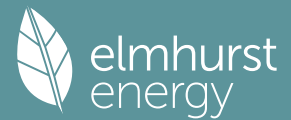


# Block Compliance



|                  |                         |                |            |
|------------------|-------------------------|----------------|------------|
| Block Reference  | Default                 | Issued on Date | 28/11/2025 |
| Block Name       |                         |                |            |
| Calculation Type | New Build (As Designed) | SAP Version    | 10.2       |

|                  |                    |             |           |
|------------------|--------------------|-------------|-----------|
| Assessor Details | Mr. Peter Yearsley | Assessor ID | R301-0001 |
| Client           |                    |             |           |

| Block Compliance Report - DER                         |                              |                                          |                                          |           |
|-------------------------------------------------------|------------------------------|------------------------------------------|------------------------------------------|-----------|
| Block Reference: Default                              | Block Name:                  |                                          |                                          |           |
| Property-Assessment Reference                         | Floor area (m <sup>2</sup> ) | DER (kgCO <sub>2</sub> /m <sup>2</sup> ) | TER (kgCO <sub>2</sub> /m <sup>2</sup> ) | % DER/TER |
| Flat 1, 85 Pell Street - Electric Panel Heaters HC    | 45.50                        | 7.59                                     | 17.39                                    | 56.35 %   |
| Flat 2, 85 Pell Street - Electric Panel Heaters HC    | 45.50                        | 7.10                                     | 16.42                                    | 56.76 %   |
| Flat 3, 85 Pell Street - Electric Panel Heaters HC    | 74.40                        | 6.50                                     | 13.47                                    | 51.74 %   |
| Flat 4, 85 Pell Street - Electric Panel Heaters HC    | 74.40                        | 6.34                                     | 13.17                                    | 51.86 %   |
| House, 85 Pell Street - Electric Panel Heaters        | 69.50                        | 7.95                                     | 13.83                                    | 42.52 %   |
| Totals:                                               | 309.30                       | 35.48                                    | 74.28                                    |           |
| Average DER = 7.04 kgCO <sub>2</sub> /m <sup>2</sup>  | % DER/TER                    | PASS                                     |                                          |           |
| Average TER = 14.49 kgCO <sub>2</sub> /m <sup>2</sup> | 51.44 %                      |                                          |                                          |           |

| Block Compliance Report - DFEE                     |                              |                               |                               |             |
|----------------------------------------------------|------------------------------|-------------------------------|-------------------------------|-------------|
| Block Reference: Default                           | Block Name:                  |                               |                               |             |
| Property-Assessment Reference                      | Floor area (m <sup>2</sup> ) | DFEE (kWh/m <sup>2</sup> /yr) | TFEE (kWh/m <sup>2</sup> /yr) | % DFEE/TFEE |
| Flat 1, 85 Pell Street - Electric Panel Heaters HC | 45.50                        | 41.77                         | 43.81                         | 4.66 %      |
| Flat 2, 85 Pell Street - Electric Panel Heaters HC | 45.50                        | 37.48                         | 39.69                         | 5.57 %      |
| Flat 3, 85 Pell Street - Electric Panel Heaters HC | 74.40                        | 36.67                         | 39.42                         | 6.98 %      |
| Flat 4, 85 Pell Street - Electric Panel Heaters HC | 74.40                        | 35.56                         | 38.00                         | 6.44 %      |
| House, 85 Pell Street - Electric Panel Heaters     | 69.50                        | 46.01                         | 46.94                         | 1.98 %      |
| Totals:                                            | 309.30                       | 197.48                        | 207.85                        |             |
| Average DFEE = 39.37 kWh/m <sup>2</sup> /yr        | % DFEE/TFEE                  | PASS                          |                               |             |
| Average TFEE = 41.45 kWh/m <sup>2</sup> /yr        | 5.03 %                       |                               |                               |             |

| Block Compliance Report - DPER                     |                              |                               |                               |             |
|----------------------------------------------------|------------------------------|-------------------------------|-------------------------------|-------------|
| Block Reference: Default                           | Block Name:                  |                               |                               |             |
| Property-Assessment Reference                      | Floor area (m <sup>2</sup> ) | DPER (kWh/m <sup>2</sup> /yr) | TPER (kWh/m <sup>2</sup> /yr) | % DPER/TPER |
| Flat 1, 85 Pell Street - Electric Panel Heaters HC | 45.50                        | 78.64                         | 92.40                         | 14.89 %     |

# Block Compliance

|                                                    |             |        |        |          |
|----------------------------------------------------|-------------|--------|--------|----------|
| Flat 2, 85 Pell Street - Electric Panel Heaters HC | 45.50       | 73.70  | 87.19  | 15.47 %  |
| Flat 3, 85 Pell Street - Electric Panel Heaters HC | 74.40       | 67.45  | 71.04  | 5.05 %   |
| Flat 4, 85 Pell Street - Electric Panel Heaters HC | 74.40       | 65.74  | 69.44  | 5.33 %   |
| House, 85 Pell Street - Electric Panel Heaters     | 69.50       | 82.12  | 72.60  | -13.11 % |
| Totals:                                            | 309.30      | 367.65 | 392.67 |          |
| Average DPER = 72.90 kWh/m <sup>2</sup> /yr        | % DPER/TPER | PASS   |        |          |
| Average TPER = 76.52 kWh/m <sup>2</sup> /yr        | 4.73 %      |        |        |          |

# Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Fri 28 Nov 2025 14:00:54

| Project Information |                |                 |                   |
|---------------------|----------------|-----------------|-------------------|
| Assessed By         | Peter Yearsley | Building Type   | Flat, End-terrace |
| OCDEA Registration  | EES/017088     | Assessment Date | 2025-11-28        |

| Dwelling Details |                                         |                  |                           |
|------------------|-----------------------------------------|------------------|---------------------------|
| Assessment Type  | As designed                             | Total Floor Area | 46 m <sup>2</sup>         |
| Site Reference   | Flat 1, 85 Pell Street                  | Plot Reference   | Electric Panel Heaters HC |
| Address          | 85 Flat 1 Pell Street, Reading, RG1 2NP |                  |                           |

| Client Details |       |
|----------------|-------|
| Name           | Array |
| Company        | Array |
| Address        |       |

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

| 1a Target emission rate and dwelling emission rate                       |                                         |  |    |
|--------------------------------------------------------------------------|-----------------------------------------|--|----|
| Fuel for main heating system                                             | Electricity                             |  |    |
| Target carbon dioxide emission rate                                      | 17.39 kgCO <sub>2</sub> /m <sup>2</sup> |  |    |
| Dwelling carbon dioxide emission rate                                    | 7.59 kgCO <sub>2</sub> /m <sup>2</sup>  |  | OK |
| 1b Target primary energy rate and dwelling primary energy                |                                         |  |    |
| Target primary energy                                                    | 92.4 kWh <sub>PE</sub> /m <sup>2</sup>  |  |    |
| Dwelling primary energy                                                  | 78.64 kWh <sub>PE</sub> /m <sup>2</sup> |  | OK |
| 1c Target fabric energy efficiency and dwelling fabric energy efficiency |                                         |  |    |
| Target fabric energy efficiency                                          | 43.8 kWh/m <sup>2</sup>                 |  |    |
| Dwelling fabric energy efficiency                                        | 41.8 kWh/m <sup>2</sup>                 |  | OK |

| 2a Fabric U-values               |                                                        |                                               |                                         |     |
|----------------------------------|--------------------------------------------------------|-----------------------------------------------|-----------------------------------------|-----|
| Element                          | Maximum permitted average U-Value [W/m <sup>2</sup> K] | Dwelling average U-Value [W/m <sup>2</sup> K] | Element with highest individual U-Value |     |
| External walls                   | 0.26                                                   | 0.15                                          | Walls (1) (0.15)                        | OK  |
| Party walls                      | 0.2                                                    | 0                                             | Party Wall (1) (0)                      | N/A |
| Curtain walls                    | 1.6                                                    | 0                                             | N/A                                     | N/A |
| Floors                           | 0.18                                                   | 0.12                                          | Heatloss Floor 1 (0.12)                 | OK  |
| Roofs                            | 0.16                                                   | 0.14                                          | Roof (1) (0.14)                         | OK  |
| Windows, doors, and roof windows | 1.6                                                    | 1.2                                           | Opening2 (1.2)                          | OK  |
| Rooflights                       | 2.2                                                    | N/A                                           | N/A                                     | N/A |

| 2b Envelope elements (better than typically expected values are flagged with a subsequent (!)) |                            |                              |  |
|------------------------------------------------------------------------------------------------|----------------------------|------------------------------|--|
| Name                                                                                           | Net area [m <sup>2</sup> ] | U-Value [W/m <sup>2</sup> K] |  |
| Exposed wall: Walls (1)                                                                        | 47.2405                    | 0.15                         |  |
| Party wall: Party Wall (1)                                                                     | 27.78                      | 0 (!)                        |  |
| Ground floor: Heatloss Floor 1, Heatloss Floor 1                                               | 45.5                       | 0.12                         |  |
| Exposed roof: Roof (1)                                                                         | 0.7                        | 0.14                         |  |

| 2c Openings (better than typically expected values are flagged with a subsequent (!)) |                        |             |              |                              |
|---------------------------------------------------------------------------------------|------------------------|-------------|--------------|------------------------------|
| Name                                                                                  | Area [m <sup>2</sup> ] | Orientation | Frame factor | U-Value [W/m <sup>2</sup> K] |
| Opening2, Windows / Glazed Doors                                                      | 1.9285                 | East        | 1.0          | 1.2                          |
| Opening3, Windows / Glazed Doors                                                      | 0.7105                 | South East  | 1.0          | 1.2                          |
| Opening4, Windows / Glazed Doors                                                      | 0.7105                 | North East  | 1.0          | 1.2                          |
| Opening5, Windows / Glazed Doors                                                      | 4.41                   | West        | 1.0          | 1.2                          |

| 2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))     |                                                   |                                              |                  |                     |
|---------------------------------------------------------------------------------------------------|---------------------------------------------------|----------------------------------------------|------------------|---------------------|
| Building part 1: Thermal bridging calculated from linear thermal transmittances for each junction |                                                   |                                              |                  |                     |
| Main element                                                                                      | Junction detail                                   | Source                                       | Psi value [W/mK] | Drawing / reference |
| External wall                                                                                     | E2: Other lintels (including other steel lintels) | Calculated by person with suitable expertise | 0.084            | R.O.I. Psi Value    |
| External wall                                                                                     | E3: Sill                                          | Calculated by person with suitable expertise | 0.034 (!)        | R.O.I. Psi Value    |
|                                                                                                   |                                                   |                                              |                  |                     |

| Main element  | Junction detail                                                   | Source                                       | Psi value [W/mK] | Drawing / reference  |
|---------------|-------------------------------------------------------------------|----------------------------------------------|------------------|----------------------|
| External wall | E4: Jamb                                                          | Calculated by person with suitable expertise | 0.043            | R.O.I. Psi Value     |
| External wall | E5: Ground floor (normal)                                         | SAP table default                            | 0.32             |                      |
| External wall | E16: Corner (normal)                                              | Calculated by person with suitable expertise | 0.03 (!)         | R.O.I. Psi Value     |
| External wall | E18: Party wall between dwellings                                 | Calculated by person with suitable expertise | 0.04             | R.O.I. Psi Value     |
| External wall | E7: Party floor between dwellings (in blocks of flats)            | Calculated by person with suitable expertise | 0.066            | R.O.I. Psi Value     |
| External wall | E10: Eaves (insulation at ceiling level)                          | Calculated by person with suitable expertise | 0.044            | R.O.I. Psi Value     |
| External wall | E17: Corner (inverted - internal area greater than external area) | Calculated by person with suitable expertise | 0.015 (!)        | R.O.I. Psi Value     |
| Party wall    | P1: Ground floor                                                  | Calculated by person with suitable expertise | 0.16             | Default Value Halved |
| Party wall    | P3: Intermediate floor between dwellings (in blocks of flats)     | SAP table default                            | 0 (!)            |                      |

### 3 Air permeability (better than typically expected values are flagged with a subsequent (!))

|                                             |                                                  |    |
|---------------------------------------------|--------------------------------------------------|----|
| Maximum permitted air permeability at 50Pa  | 8 m <sup>3</sup> /hm <sup>2</sup>                |    |
| Dwelling air permeability at 50Pa           | 4 m <sup>3</sup> /hm <sup>2</sup> , Design value | OK |
| Air permeability test certificate reference |                                                  |    |

### 4 Space heating

#### Main heating system 1: Room heaters - Electricity

|                  |                                     |
|------------------|-------------------------------------|
| Efficiency       | 100.0%                              |
| Emitter type     |                                     |
| Flow temperature |                                     |
| System type      | Panel, convector or radiant heaters |
| Manufacturer     |                                     |
| Model            |                                     |
| Commissioning    |                                     |

#### Main heating system 2: Heat pump with radiators or underfloor heating - Electricity

|                  |                         |
|------------------|-------------------------|
| Efficiency       | 0.0%                    |
| Emitter type     |                         |
| Flow temperature |                         |
| System type      | Heat Pump               |
| Manufacturer     | KERS Innovations UK Ltd |
| Model            | KERS MEV-W200SL         |
| Commissioning    |                         |

#### Secondary heating system: N/A

|               |     |
|---------------|-----|
| Fuel          | N/A |
| Efficiency    | N/A |
| Commissioning |     |

### 5 Hot water

#### Cylinder/store - type: N/A

|                            |     |
|----------------------------|-----|
| Capacity                   | N/A |
| Declared heat loss         | N/A |
| Primary pipework insulated | N/A |
| Manufacturer               |     |
| Model                      |     |
| Commissioning              |     |

#### Waste water heat recovery system 1 - type: N/A

|              |  |
|--------------|--|
| Efficiency   |  |
| Manufacturer |  |
| Model        |  |

### 6 Controls

#### Main heating 1 - type: Programmer and appliance thermostats

|                 |  |
|-----------------|--|
| Function        |  |
| Ecodesign class |  |
| Manufacturer    |  |
| Model           |  |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                   |                        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|------------------------|
| <b>Main heating 2</b> - type: Not applicable                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                   |                        |
| Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                   |                        |
| Ecodesign class                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                   |                        |
| Manufacturer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                   |                        |
| Model                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                        |
| <b>Water heating</b> - type: N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                   |                        |
| Manufacturer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                   |                        |
| Model                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                        |
| <b>7 Lighting</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                   |                        |
| Minimum permitted light source efficacy                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 75 lm/W           |                        |
| Lowest light source efficacy                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 90 lm/W           | OK                     |
| External lights control                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | N/A               |                        |
| <b>8 Mechanical ventilation</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                   |                        |
| <b>System type:</b> Centralised mechanical extract                                                                                                                                                                                                                                                                                                                                                                                                                                               |                   |                        |
| Maximum permitted specific fan power                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0.7 W/(l/s)       |                        |
| Specific fan power                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 0.51 W/(l/s)      | OK                     |
| Minimum permitted heat recovery efficiency                                                                                                                                                                                                                                                                                                                                                                                                                                                       | N/A               |                        |
| Heat recovery efficiency                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | N/A               | N/A                    |
| Manufacturer/Model                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | KERS MEV-W200SL   |                        |
| Commissioning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                   |                        |
| <b>9 Local generation</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                   |                        |
| N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                   |                        |
| <b>10 Heat networks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                   |                        |
| N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                   |                        |
| <b>11 Supporting documentary evidence</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                   |                        |
| N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                   |                        |
| <b>12 Declarations</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                   |                        |
| <b>a. Assessor Declaration</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                   |                        |
| This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report. |                   |                        |
| Signed:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>P Yearsley</b> | Assessor ID: R301-0001 |
| Name:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Peter Yearsley    | Date: 28/11/2025       |
| <b>b. Client Declaration</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                   |                        |
| N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                   |                        |

# Full SAP Calculation Printout



|                                    |                                           |               |       |                |            |
|------------------------------------|-------------------------------------------|---------------|-------|----------------|------------|
| Plot Reference                     | Flat 1, 85 Pell Street                    |               |       | Issued on Date | 28/11/2025 |
| Assessment Reference               | Electric Panel Heaters HC                 | Plot Type Ref |       |                |            |
| Plot Address                       | Flat 1, 85, Pell Street, Reading, RG1 2NP |               |       | SAP Version    | 10.2       |
|                                    |                                           |               |       |                |            |
| SAP Rating                         | 76 C                                      | DER           | 7.59  | TER            | 17.39      |
| Environmental                      | 95 A                                      | % DER < TER   |       |                | 56.35      |
| CO <sub>2</sub> Emissions (t/year) | 0.3                                       | DFEE          | 41.77 | TFEE           | 43.81      |
| Compliance Check                   | See BREL                                  | % DFEE < TFEE |       |                | 4.66       |
| % DPER < TPER                      | 14.90                                     | DPER          | 78.64 | TPER           | 92.40      |
|                                    |                                           |               |       |                |            |
| Assessor Details                   | Mr. Peter Yearsley                        |               |       | Assessor ID    | R301-0001  |
| Client                             |                                           |               |       |                |            |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m) | Volume<br>(m <sup>3</sup> )                    |
|--------------------------------------------------------|---------------------------|----------------------|------------------------------------------------|
| Main dwelling                                          | 45.5000 (1b)              | 2.7500 (2b)          | 125.1250 (1b) - (3b)                           |
| Ground floor                                           |                           |                      |                                                |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 45.5000                   |                      | 125.1250 (4)                                   |
| Dwelling volume                                        |                           |                      | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 125.1250 (5) |

## 2. Ventilation rate

|                                                    | m <sup>3</sup> per hour |
|----------------------------------------------------|-------------------------|
| Number of open chimneys                            | 0 * 80 = 0.0000 (6a)    |
| Number of open flues                               | 0 * 20 = 0.0000 (6b)    |
| Number of chimneys / flues attached to closed fire | 0 * 10 = 0.0000 (6c)    |
| Number of flues attached to solid fuel boiler      | 0 * 20 = 0.0000 (6d)    |
| Number of flues attached to other heater           | 0 * 35 = 0.0000 (6e)    |
| Number of blocked chimneys                         | 0 * 20 = 0.0000 (6f)    |
| Number of intermittent extract fans                | 0 * 10 = 0.0000 (7a)    |
| Number of passive vents                            | 0 * 10 = 0.0000 (7b)    |
| Number of flueless gas fires                       | 0 * 40 = 0.0000 (7c)    |

|                                                                                                    |                |            |
|----------------------------------------------------------------------------------------------------|----------------|------------|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 / (5) = | 0.0000 (8) |
| Pressure test                                                                                      | Yes            |            |
| Pressure Test Method                                                                               | Blower Door    |            |
| Measured/design AP50                                                                               | 4.0000         | (17)       |
| Infiltration rate                                                                                  | 0.2000         | (18)       |
| Number of sides sheltered                                                                          | 1              | (19)       |

|                                                      |                             |             |
|------------------------------------------------------|-----------------------------|-------------|
| Shelter factor                                       | (20) = 1 - [0.075 x (19)] = | 0.9250 (20) |
| Infiltration rate adjusted to include shelter factor | (21) = (18) x (20) =        | 0.1850 (21) |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate                                                                                         | 0.2359 | 0.2313 | 0.2266 | 0.2035 | 0.1989 | 0.1758 | 0.1758 | 0.1711 | 0.1850 | 0.1989 | 0.2081 | 0.2174 (22b) |
| Mechanical extract ventilation - centralised                                                            |        |        |        |        |        |        |        |        |        |        |        |              |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                                        | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K       | A x K<br>kJ/K   |
|----------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------------|-----------------|
| Main dwelling                                                  |                         |                            |                           |                               |              |                                      |                 |
| Windows / Glazed Doors                                         |                         |                            | 7.7600                    | 1.1450                        | 8.8855       |                                      | (27)            |
| Heatloss Floor 1                                               |                         |                            | 45.5000                   | 0.1200                        | 5.4600       | 75.0000                              | 3412.5000 (28a) |
| External Wall                                                  | 55.0000                 | 7.7600                     | 47.2400                   | 0.1500                        | 7.0860       | 9.0000                               | 425.1600 (29a)  |
| Bay Roof                                                       | 0.7000                  |                            | 0.7000                    | 0.1400                        | 0.0980       | 9.0000                               | 6.3000 (30)     |
| Total net area of external elements Aum(A, m <sup>2</sup> )    |                         |                            | 101.2000                  |                               |              |                                      | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                            |                         |                            |                           | (26)...(30) + (32) =          | 21.5295      |                                      | (33)            |
| Main dwelling                                                  |                         |                            |                           |                               |              |                                      |                 |
| Party Wall 1                                                   |                         |                            | 27.7800                   | 0.0000                        | 0.0000       | 45.0000                              | 1250.1000 (32)  |
| Party Ceiling 1                                                |                         |                            | 44.8000                   |                               |              | 0.0000                               | 0.0000 (32b)    |
| Internal Wall 1                                                |                         |                            | 58.8500                   |                               |              | 9.0000                               | 529.6500 (32c)  |
| Heat capacity Cm = Sum(A x k)                                  |                         |                            |                           |                               |              | (28)...(30) + (32) + (32a)...(32e) = | 5623.7100 (34)  |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K |                         |                            |                           |                               |              |                                      | 123.5980 (35)   |
| List of Thermal Bridges                                        |                         |                            |                           |                               |              |                                      |                 |
| K1 Element                                                     |                         |                            |                           | Length                        | Psi-value    | Total                                |                 |
| E2 Other lintels (including other steel lintels)               |                         |                            |                           | 4.6600                        | 0.0840       | 0.3914                               |                 |

# Full SAP Calculation Printout



|                                                                           |         |        |        |
|---------------------------------------------------------------------------|---------|--------|--------|
| E3 Sill                                                                   | 1.6500  | 0.0340 | 0.0561 |
| E4 Jamb                                                                   | 20.5800 | 0.0430 | 0.8849 |
| E5 Ground floor (normal)                                                  | 20.0000 | 0.3200 | 6.4000 |
| E16 Corner (normal)                                                       | 11.0000 | 0.0300 | 0.3300 |
| E18 Party wall between dwellings                                          | 5.5000  | 0.0400 | 0.2200 |
| E7 Party floor between dwellings (in blocks of flats)                     | 20.0000 | 0.0660 | 1.3200 |
| E10 Eaves (insulation at ceiling level)                                   | 3.2000  | 0.0440 | 0.1408 |
| E17 Corner (inverted - internal area greater than external area)          | 5.5000  | 0.0150 | 0.0825 |
| P1 Party wall - Ground floor                                              | 10.1000 | 0.1600 | 1.6160 |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | 10.1000 | 0.0000 | 0.0000 |

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.4418 (36)  
 Point Thermal bridges 0.0000  
 Total fabric heat loss (33) + (36) + (36a) = 32.9713 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)  
 (38)m Jan 20.6456 Feb 20.6456 Mar 20.6456 Apr 20.6456 May 20.6456 Jun 20.6456 Jul 20.6456 Aug 20.6456 Sep 20.6456 Oct 20.6456 Nov 20.6456 Dec 20.6456 (38)  
 Heat transfer coeff 53.6169 53.6169 53.6169 53.6169 53.6169 53.6169 53.6169 53.6169 53.6169 53.6169 53.6169 53.6169 (39)  
 Average = Sum(39)m / 12 = 53.6169

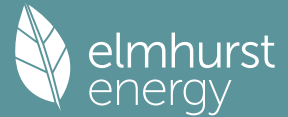
|               |        |        |        |        |        |        |        |        |        |        |        |        |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |
| HLP           | 1.1784 | 1.1784 | 1.1784 | 1.1784 | 1.1784 | 1.1784 | 1.1784 | 1.1784 | 1.1784 | 1.1784 | 1.1784 | 1.1784 |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        |        |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |

|                                                                                |          |          |          |          |          |          |          |          |          |          |          |                |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| 4. Water heating energy requirements (kWh/year)                                |          |          |          |          |          |          |          |          |          |          |          |                |
| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |          |          | 1.5590 (42)    |
| Hot water usage for mixer showers                                              | 69.2425  | 68.2019  | 66.6855  | 63.7843  | 61.6433  | 59.2556  | 57.8985  | 59.4034  | 61.0530  | 63.6166  | 66.5801  | 68.9772 (42a)  |
| Hot water usage for baths                                                      | 21.7789  | 21.4554  | 21.0000  | 20.1601  | 19.5313  | 18.8340  | 18.4573  | 18.9096  | 19.4021  | 20.1482  | 21.0054  | 21.7053 (42b)  |
| Hot water usage for other uses                                                 | 30.5954  | 29.4828  | 28.3702  | 27.2577  | 26.1451  | 25.0326  | 25.0326  | 26.1451  | 27.2577  | 28.3702  | 29.4828  | 30.5954 (42c)  |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |          |          | 111.8456 (43)  |
| Daily hot water use                                                            | 121.6167 | 119.1401 | 116.0557 | 111.2021 | 107.3197 | 103.1222 | 101.3884 | 104.4581 | 107.7127 | 112.1350 | 117.0682 | 121.2778 (44)  |
| Energy content (annual)                                                        | 192.6111 | 169.6539 | 178.3733 | 152.2302 | 144.4729 | 126.8008 | 122.6205 | 129.3410 | 132.8206 | 152.1662 | 166.7852 | 189.8917 (45)  |
| Distribution loss (46)m = 0.15 x (45)m                                         | 28.8917  | 25.4481  | 26.7560  | 22.8345  | 21.6709  | 19.0201  | 18.3931  | 19.4011  | 19.9231  | 22.8249  | 25.0178  | 28.4838 (46)   |
| Water storage loss (or HIU loss):                                              |          |          |          |          |          |          |          |          |          |          |          | 196.0000 (47)  |
| Store volume                                                                   |          |          |          |          |          |          |          |          |          |          |          | 1.3120 (48)    |
| a) If manufacturer declared loss factor is known (kWh/day):                    |          |          |          |          |          |          |          |          |          |          |          | 0.5400 (49)    |
| Temperature factor from Table 2b                                               |          |          |          |          |          |          |          |          |          |          |          | 0.7085 (55)    |
| Enter (49) or (54) in (55)                                                     |          |          |          |          |          |          |          |          |          |          |          |                |
| Total storage loss                                                             | 21.9629  | 19.8374  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629 (56)   |
| If cylinder contains dedicated solar storage                                   | 21.9629  | 19.8374  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629 (57)   |
| Primary loss                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (59)    |
| Combi loss                                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (61)    |
| Total heat required for water heating calculated for each month                | 214.5740 | 189.4914 | 200.3362 | 173.4846 | 166.4358 | 148.0552 | 144.5834 | 151.3038 | 154.0750 | 174.1291 | 188.0396 | 211.8546 (62)  |
| WWHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63a)   |
| PV diverter                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63b)   |
| Solar input                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63c)   |
| FGHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63d)   |
| Output from w/h                                                                | 214.5740 | 189.4914 | 200.3362 | 173.4846 | 166.4358 | 148.0552 | 144.5834 | 151.3038 | 154.0750 | 174.1291 | 188.0396 | 211.8546 (64)  |
| 12Total per year (kWh/year)                                                    |          |          |          |          |          |          |          |          |          |          |          | 2116.3625 (64) |
| Electric shower(s)                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (64a)   |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (64a)   |
| Heat gains from water heating, kWh/month                                       | 64.0432  | 56.4099  | 59.3091  | 50.6165  | 48.0373  | 42.1613  | 40.7713  | 43.0059  | 44.1628  | 50.5953  | 55.4561  | 63.1390 (65)   |

|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| 5. Internal gains (see Table 5 and 5a)                                              |          |          |          |          |          |          |          |          |          |          |          |               |
| Metabolic gains (Table 5), Watts                                                    |          |          |          |          |          |          |          |          |          |          |          |               |
| (66)m                                                                               | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 70.4835  | 78.0354  | 70.4835  | 72.8330  | 70.4835  | 72.8330  | 70.4835  | 70.4835  | 72.8330  | 70.4835  | 72.8330  | 70.4835 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 135.5704 | 136.9772 | 133.4321 | 125.8851 | 116.3583 | 107.4044 | 101.4227 | 100.0159 | 103.5610 | 111.1080 | 120.6348 | 129.5887 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948 (69)  |
| Pumps, fans                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (70)   |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 (71) |
| Water heating gains (Table 5)                                                       | 86.0796  | 83.9433  | 79.7166  | 70.3007  | 64.5662  | 58.5573  | 54.8001  | 57.8036  | 61.3373  | 68.0044  | 77.0223  | 84.8642 (72)  |
| Total internal gains                                                                | 338.5180 | 345.3404 | 330.0167 | 315.4033 | 297.7925 | 285.1792 | 273.0908 | 274.6875 | 284.1157 | 295.9804 | 316.8746 | 331.3209 (73) |

| 6. Solar gains |            |                                |                                   |                                    |                              |            |      |
|----------------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|------------|------|
| [Jan]          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W |      |
| Northeast      | 0.7100     | 11.2829                        | 0.7600                            | 0.0000                             | 0.7700                       | 4.6880     | (75) |
| East           | 1.9300     | 19.6403                        | 0.7600                            | 0.0000                             | 0.7700                       | 22.1824    | (76) |
| Southeast      | 0.7100     | 36.7938                        | 0.7600                            | 0.0000                             | 0.7700                       | 15.2875    | (77) |
| West           | 4.4100     | 19.6403                        | 0.7600                            | 0.0000                             | 0.7700                       | 50.6863    | (80) |

# Full SAP Calculation Printout



|             |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Solar gains | 92.8442  | 178.1294 | 287.5760 | 414.7564 | 506.9945 | 519.0809 | 494.1084 | 424.8126 | 332.5572 | 209.5854 | 115.0683 | 76.8350 (83)  |
| Total gains | 431.3622 | 523.4698 | 617.5928 | 730.1597 | 804.7870 | 804.2601 | 767.1993 | 699.5001 | 616.6729 | 505.5658 | 431.9429 | 408.1560 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 29.1352 | 29.1352 | 29.1352 | 29.1352 | 29.1352 | 29.1352 | 29.1352 | 29.1352 | 29.1352 | 29.1352 | 29.1352 | 29.1352      |
| alpha                                                                       | 2.9423  | 2.9423  | 2.9423  | 2.9423  | 2.9423  | 2.9423  | 2.9423  | 2.9423  | 2.9423  | 2.9423  | 2.9423  | 2.9423       |
| util living area                                                            | 0.9360  | 0.8951  | 0.8249  | 0.7007  | 0.5517  | 0.4060  | 0.3008  | 0.3418  | 0.5383  | 0.7817  | 0.9044  | 0.9443 (86)  |
| MIT                                                                         | 19.0869 | 19.4642 | 19.9572 | 20.4664 | 20.7873 | 20.9353 | 20.9800 | 20.9706 | 20.8522 | 20.3680 | 19.6201 | 18.9947 (87) |
| Th 2                                                                        | 19.9373 | 19.9373 | 19.9373 | 19.9373 | 19.9373 | 19.9373 | 19.9373 | 19.9373 | 19.9373 | 19.9373 | 19.9373 | 19.9373 (88) |
| util rest of house                                                          | 0.9259  | 0.8797  | 0.8007  | 0.6635  | 0.5020  | 0.3447  | 0.2308  | 0.2669  | 0.4710  | 0.7427  | 0.8875  | 0.9354 (89)  |
| MIT 2                                                                       | 17.7452 | 18.2108 | 18.8090 | 19.4015 | 19.7494 | 19.8926 | 19.9278 | 19.9224 | 19.8249 | 19.3124 | 18.4147 | 17.6305 (90) |
| Living area fraction                                                        | 18.8716 | 19.2631 | 19.7729 | 20.2955 | 20.6208 | 20.7680 | 20.8112 | 20.8024 | 20.6874 | 20.1986 | 19.4267 | 18.7758 (92) |
| MIT                                                                         | 18.8716 | 19.2631 | 19.7729 | 20.2955 | 20.6208 | 20.7680 | 20.8112 | 20.8024 | 20.6874 | 20.1986 | 19.4267 | 18.7758 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 18.8716 | 19.2631 | 19.7729 | 20.2955 | 20.6208 | 20.7680 | 20.8112 | 20.8024 | 20.6874 | 20.1986 | 19.4267 | 18.7758 (93) |

## 8. Space heating requirement

|                                                                                |          |          |          |          |          |          |          |          |          |               |          |                |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|----------|----------------|
|                                                                                | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov      | Dec            |
| Utilisation                                                                    | 0.9137   | 0.8684   | 0.7966   | 0.6766   | 0.5345   | 0.3929   | 0.2886   | 0.3282   | 0.5193   | 0.7529        | 0.8781   | 0.9234 (94)    |
| Useful gains                                                                   | 394.1330 | 454.5979 | 491.9614 | 494.0108 | 430.1382 | 316.0168 | 221.3982 | 229.5570 | 320.2579 | 380.6653      | 379.2877 | 376.9052 (95)  |
| Ext temp.                                                                      | 4.3000   | 4.9000   | 6.5000   | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000   | 4.2000 (96)    |
| Heat loss rate W                                                               | 781.2847 | 770.1041 | 711.6538 | 610.9938 | 478.3050 | 330.7089 | 225.7922 | 236.0443 | 353.1959 | 514.6471      | 660.9202 | 781.5105 (97)  |
| Space heating kWh                                                              | 288.0409 | 212.0202 | 163.4512 | 84.2278  | 35.8361  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 99.6825       | 202.7754 | 301.0264 (98a) |
| Space heating requirement - total per year (kWh/year)                          |          |          |          |          |          |          |          |          |          |               |          | 1387.0604      |
| Solar heating kWh                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000   | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |          |          |          |          |          |          |          |          |          |               |          | 0.0000         |
| Space heating kWh                                                              | 288.0409 | 212.0202 | 163.4512 | 84.2278  | 35.8361  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 99.6825       | 202.7754 | 301.0264 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |          |          |          |          |          |          |          |          |          |               |          | 1387.0604      |
| Space heating per m2                                                           |          |          |          |          |          |          |          |          |          | (98c) / (4) = |          | 30.4848 (99)   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                                                              |          |          |          |          |          |          |          |          |          |          |          |                 |
|--------------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                        |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)    |
| Fraction of space heat from main system(s)                                                                   |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)    |
| Fraction of main heating from main system 2                                                                  |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (203)    |
| Fraction of total heating from main system 1                                                                 |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (204)    |
| Fraction of total heating from main system 2                                                                 |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (205)    |
| Efficiency of main space heating system 1 (in %)                                                             |          |          |          |          |          |          |          |          |          |          |          | 100.0000 (206)  |
| Efficiency of main space heating system 2 (in %)                                                             |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
|                                                                                                              | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                                                                    | 288.0409 | 212.0202 | 163.4512 | 84.2278  | 35.8361  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 99.6825  | 202.7754 | 301.0264 (98)   |
| Space heating efficiency (main heating system 1)                                                             | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 100.0000 | 100.0000 | 100.0000 (210)  |
| Space heating fuel (main heating system)                                                                     | 288.0409 | 212.0202 | 163.4512 | 84.2278  | 35.8361  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 99.6825  | 202.7754 | 301.0264 (211)  |
| Space heating efficiency (main heating system 2)                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |
| Space heating fuel (secondary)                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Space heating fuel used, main system 2                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Water heating                                                                                                |          |          |          |          |          |          |          |          |          |          |          |                 |
| Water heating requirement                                                                                    | 214.5740 | 189.4914 | 200.3362 | 173.4846 | 166.4358 | 148.0552 | 144.5834 | 151.3038 | 154.0750 | 174.1291 | 188.0396 | 211.8546 (64)   |
| Efficiency of water heater (217)m                                                                            | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 (216)  |
| Fuel for water heating, kWh/month                                                                            | 68.4654  | 60.4621  | 63.9225  | 55.3548  | 53.1057  | 47.2408  | 46.1331  | 48.2774  | 49.1616  | 55.5604  | 59.9989  | 67.5977 (219)   |
| Space cooling fuel requirement (221)m                                                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                                                 | 8.5958   | 7.7639   | 8.5958   | 8.3185   | 8.5958   | 8.3185   | 8.5958   | 8.5958   | 8.3185   | 8.5958   | 8.3185   | 8.5958 (231)    |
| Lighting                                                                                                     | 17.0137  | 13.6490  | 12.2894  | 9.0038   | 6.9548   | 5.6821   | 6.3444   | 8.2467   | 10.7116  | 14.0542  | 15.8742  | 17.4866 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity) (233a)m                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (233a)   |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity) (233b)m                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (233b)   |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |
| Annual totals kWh/year                                                                                       |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system 1                                                                           |          |          |          |          |          |          |          |          |          |          |          | 1387.0604 (211) |
| Space heating fuel - main system 2                                                                           |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |
| Efficiency of water heater                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 313.4050        |
| Water heating fuel used                                                                                      |          |          |          |          |          |          |          |          |          |          |          | 675.2804 (219)  |

# Full SAP Calculation Printout



|                                                                                                      |           |        |
|------------------------------------------------------------------------------------------------------|-----------|--------|
| Space cooling fuel                                                                                   | 0.0000    | (221)  |
| Electricity for pumps and fans:<br>(MEV Centralised, Database: in-use factor = 1.3000, SFP = 0.6630) |           |        |
| mechanical ventilation fans (SFP = 0.6630)                                                           | 101.2086  | (230a) |
| Total electricity for the above, kWh/year                                                            | 101.2086  | (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  | 137.3105  | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |           |        |
| PV generation                                                                                        | 0.0000    | (233)  |
| Wind generation                                                                                      | 0.0000    | (234)  |
| Hydro-electric generation (Appendix N)                                                               | 0.0000    | (235a) |
| Electricity generated - Micro CHP (Appendix N)                                                       | 0.0000    | (235)  |
| Appendix Q - special features                                                                        |           |        |
| Energy saved or generated                                                                            | -0.0000   | (236)  |
| Energy used                                                                                          | 0.0000    | (237)  |
| Total delivered energy for all uses                                                                  | 2300.8598 | (238)  |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                                 | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|-------------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1                   | 1387.0604          | 0.1557                        | 215.9001 (261)           |
| Space heating - main system 2                   | 0.0000             | 0.0000                        | 0.0000 (262)             |
| Total CO2 associated with community systems     |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                      | 675.2804           | 0.1412                        | 95.3686 (264)            |
| Space and water heating                         |                    |                               | 311.2686 (265)           |
| Pumps, fans and electric keep-hot               | 101.2086           | 0.1387                        | 14.0389 (267)            |
| Energy for lighting                             | 137.3105           | 0.1443                        | 19.8181 (268)            |
| Total CO2, kg/year                              |                    |                               | 345.1256 (272)           |
| EPC Dwelling Carbon Dioxide Emission Rate (DER) |                    |                               | 7.5900 (273)             |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 1387.0604          | 1.5762                              | 2186.3307 (275)            |
| Space heating - main system 2               | 0.0000             | 0.0000                              | 0.0000 (276)               |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 675.2804           | 1.5222                              | 1027.9298 (278)            |
| Space and water heating                     |                    |                                     | 3214.2605 (279)            |
| Pumps, fans and electric keep-hot           | 101.2086           | 1.5128                              | 153.1084 (281)             |
| Energy for lighting                         | 137.3105           | 1.5338                              | 210.6114 (282)             |
| Total Primary energy kWh/year               |                    |                                     | 3577.9802 (286)            |
| Dwelling Primary energy Rate (DPER)         |                    |                                     | 78.6400 (287)              |

## SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

### CALCULATION OF TARGET EMISSIONS

#### 1. Overall dwelling characteristics

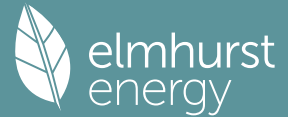
|                                                        | Area<br>(m2) | Storey height<br>(m)              | Volume<br>(m3)         |
|--------------------------------------------------------|--------------|-----------------------------------|------------------------|
| Main dwelling                                          | 45.5000 (1b) | x 2.7500 (2b)                     | = 125.1250 (1b) - (3b) |
| Ground floor                                           |              |                                   |                        |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 45.5000      |                                   | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 125.1250 (5)           |

#### 2. Ventilation rate

|                                                                                                    | m3 per hour                             |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 2 * 10 = 20.0000 (7a)                   |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 20.0000 / (5) = 0.1598 (8)              |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 5.0000 (17)                             |
| Infiltration rate                                                                                  | 0.4098 (18)                             |
| Number of sides sheltered                                                                          | 1 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.9250 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.3791 (21)        |

|                 | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed      | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor     | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate | 0.4834 | 0.4739 | 0.4644 | 0.4170 | 0.4075 | 0.3601 | 0.3601 | 0.3507 | 0.3791 | 0.4075 | 0.4265 | 0.4454 (22b) |
| Effective ac    | 0.6168 | 0.6123 | 0.6078 | 0.5869 | 0.5830 | 0.5649 | 0.5649 | 0.5615 | 0.5719 | 0.5830 | 0.5909 | 0.5992 (25)  |

# Full SAP Calculation Printout



## 3. Heat losses and heat loss parameter

| Element                                        | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2        | U-value<br>W/m2K | A x U<br>W/K | K-value<br>kJ/m2K | A x K<br>kJ/K |       |
|------------------------------------------------|-------------|----------------|----------------------|------------------|--------------|-------------------|---------------|-------|
| Main dwelling                                  |             |                |                      |                  |              |                   |               |       |
| TER Opening Type                               |             |                | 7.7600               | 1.1450           | 8.8855       |                   |               | (27)  |
| Heatloss Floor 1                               |             |                | 45.5000              | 0.1300           | 5.9150       |                   |               | (28a) |
| External Wall                                  | 55.0000     | 7.7600         | 47.2400              | 0.1800           | 8.5032       |                   |               | (29a) |
| Bay Roof                                       | 0.7000      |                | 0.7000               | 0.1100           | 0.0770       |                   |               | (30)  |
| Total net area of external elements Aum(A, m2) |             |                | 101.2000             |                  |              |                   |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)            |             |                | (26)...(30) + (32) = |                  | 23.3807      |                   |               | (33)  |
| Main dwelling                                  |             |                |                      |                  |              |                   |               |       |
| Party Wall 1                                   |             |                | 27.7800              | 0.0000           | 0.0000       |                   |               | (32)  |

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

123.5980 (35)

### List of Thermal Bridges

| K1 Element                                                                | Length  | Psi-value | Total                 |              |
|---------------------------------------------------------------------------|---------|-----------|-----------------------|--------------|
| E2 Other lintels (including other steel lintels)                          | 4.6600  | 0.0500    | 0.2330                |              |
| E3 Sill                                                                   | 1.6500  | 0.0500    | 0.0825                |              |
| E4 Jamb                                                                   | 20.5800 | 0.0500    | 1.0290                |              |
| E5 Ground floor (normal)                                                  | 20.0000 | 0.1600    | 3.2000                |              |
| E16 Corner (normal)                                                       | 11.0000 | 0.0900    | 0.9900                |              |
| E18 Party wall between dwellings                                          | 5.5000  | 0.0600    | 0.3300                |              |
| E7 Party floor between dwellings (in blocks of flats)                     | 20.0000 | 0.0700    | 1.4000                |              |
| E10 Eaves (insulation at ceiling level)                                   | 3.2000  | 0.0600    | 0.1920                |              |
| E17 Corner (inverted - internal area greater than external area)          | 5.5000  | -0.0900   | -0.4950               |              |
| P1 Party wall - Ground floor                                              | 10.1000 | 0.0800    | 0.8080                |              |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | 10.1000 | 0.0000    | 0.0000                |              |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                |         |           |                       | 7.7695 (36)  |
| Point Thermal bridges                                                     |         |           | (36a) =               | 0.0000       |
| Total fabric heat loss                                                    |         |           | (33) + (36) + (36a) = | 31.1502 (37) |

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

| (38)m                     | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |      |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| Heat transfer coeff       | 25.4691 | 25.2818 | 25.0982 | 24.2359 | 24.0745 | 23.3235 | 23.3235 | 23.1844 | 23.6128 | 24.0745 | 24.4009 | 24.7422 | (38) |
| Average = Sum(39)m / 12 = | 56.6193 | 56.4320 | 56.2484 | 55.3861 | 55.2247 | 54.4737 | 54.4737 | 54.3346 | 54.7630 | 55.2247 | 55.5511 | 55.8924 | (39) |
|                           |         |         |         |         |         |         |         |         |         |         |         | 55.3853 |      |
| HLP                       | 1.2444  | 1.2403  | 1.2362  | 1.2173  | 1.2137  | 1.1972  | 1.1972  | 1.1942  | 1.2036  | 1.2137  | 1.2209  | 1.2284  | (40) |
| HLP (average)             |         |         |         |         |         |         |         |         |         |         |         | 1.2173  |      |
| Days in mont              | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31      |      |

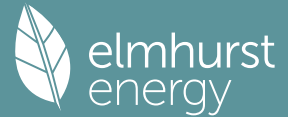
## 4. Water heating energy requirements (kWh/year)

|                                                                 |          |          |          |          |          |          |          |          |          |                                        |          |           |             |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------------------------------|----------|-----------|-------------|
| Assumed occupancy                                               |          |          |          |          |          |          |          |          |          |                                        |          |           | 1.5590 (42) |
| Hot water usage for mixer showers                               | 50.3581  | 49.6014  | 48.4986  | 46.3886  | 44.8315  | 43.0950  | 42.1080  | 43.2024  | 44.4021  | 46.2666                                | 48.4219  | 50.1652   | (42a)       |
| Hot water usage for baths                                       | 21.7789  | 21.4554  | 21.0000  | 20.1601  | 19.5313  | 18.8340  | 18.4573  | 18.9096  | 19.4021  | 20.1482                                | 21.0054  | 21.7053   | (42b)       |
| Hot water usage for other uses                                  | 30.5954  | 29.4828  | 28.3702  | 27.2577  | 26.1451  | 25.0326  | 25.0326  | 26.1451  | 27.2577  | 28.3702                                | 29.4828  | 30.5954   | (42c)       |
| Average daily hot water use (litres/day)                        |          |          |          |          |          |          |          |          |          |                                        |          | 94.4349   | (43)        |
| Daily hot water use                                             | 102.7324 | 100.5396 | 97.8688  | 93.8064  | 90.5079  | 86.9616  | 85.5979  | 88.2572  | 91.0619  | 94.7851                                | 98.9100  | 102.4658  | (44)        |
| Energy conte                                                    | 162.7030 | 143.1670 | 150.4207 | 128.4163 | 121.8410 | 106.9294 | 103.5232 | 109.2808 | 112.2885 | 128.6224                               | 140.9155 | 160.4367  | (45)        |
| Energy content (annual)                                         |          |          |          |          |          |          |          |          |          | Total = Sum(45)m =                     |          | 1568.5445 |             |
| Distribution loss (46)m = 0.15 x (45)m                          | 24.4054  | 21.4751  | 22.5631  | 19.2624  | 18.2762  | 16.0394  | 15.5285  | 16.3921  | 16.8433  | 19.2934                                | 21.1373  | 24.0655   | (46)        |
| Water storage loss (or HIU loss):                               |          |          |          |          |          |          |          |          |          |                                        |          | 150.0000  | (47)        |
| Store volume                                                    |          |          |          |          |          |          |          |          |          |                                        |          | 1.3938    | (48)        |
| a) If manufacturer declared loss factor is known (kWh/day):     |          |          |          |          |          |          |          |          |          |                                        |          | 0.5400    | (49)        |
| Temperature factor from Table 2b                                |          |          |          |          |          |          |          |          |          |                                        |          | 0.7527    | (55)        |
| Enter (49) or (54) in (55)                                      |          |          |          |          |          |          |          |          |          |                                        |          |           |             |
| Total storage loss                                              | 23.3325  | 21.0745  | 23.3325  | 22.5798  | 23.3325  | 22.5798  | 23.3325  | 23.3325  | 22.5798  | 23.3325                                | 22.5798  | 23.3325   | (56)        |
| If cylinder contains dedicated solar storage                    | 23.3325  | 21.0745  | 23.3325  | 22.5798  | 23.3325  | 22.5798  | 23.3325  | 23.3325  | 22.5798  | 23.3325                                | 22.5798  | 23.3325   | (57)        |
| Primary loss                                                    | 23.2624  | 21.0112  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624  | 23.2624  | 22.5120  | 23.2624                                | 22.5120  | 23.2624   | (59)        |
| Combi loss                                                      | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000    | (61)        |
| Total heat required for water heating calculated for each month | 209.2979 | 185.2528 | 197.0156 | 173.5081 | 168.4359 | 152.0212 | 150.1181 | 155.8757 | 157.3803 | 175.2173                               | 186.0073 | 207.0316  | (62)        |
| WWHRS                                                           | -23.0216 | -20.3605 | -21.3204 | -17.6541 | -16.4530 | -14.0789 | -13.1968 | -14.0334 | -14.5666 | -17.1724                               | -19.4543 | -22.5953  | (63a)       |
| PV diverter                                                     | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000                                | -0.0000  | -0.0000   | (63b)       |
| Solar input                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000    | (63c)       |
| FGHRS                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000    | (63d)       |
| Output from w/h                                                 | 186.2762 | 164.8922 | 175.6952 | 155.8540 | 151.9829 | 137.9423 | 136.9214 | 141.8423 | 142.8137 | 158.0449                               | 166.5530 | 184.4363  | (64)        |
| 12Total per year (kWh/year)                                     |          |          |          |          |          |          |          |          |          | Total per year (kWh/year) = Sum(64)m = |          | 1903.2544 | (64)        |
| Electric shower(s)                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000    | (64a)       |
|                                                                 |          |          |          |          |          |          |          |          |          |                                        |          | 0.0000    | (64a)       |
| Heat gains from water heating, kWh/month                        | 91.3747  | 81.2716  | 87.2908  | 78.7719  | 77.7881  | 71.6275  | 71.6974  | 73.6118  | 73.4094  | 80.0429                                | 82.9279  | 90.6211   | (65)        |

## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |          |      |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| Metabolic gains (Table 5), Watts                                                    |          |          |          |          |          |          |          |          |          |          |          |          |      |
| (66)m                                                                               | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 70.4835  | 78.0354  | 70.4835  | 72.8330  | 70.4835  | 72.8330  | 70.4835  | 70.4835  | 72.8330  | 70.4835  | 72.8330  | 70.4835  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 135.5704 | 136.9772 | 133.4321 | 125.8851 | 116.3583 | 107.4044 | 101.4227 | 100.0159 | 103.5610 | 111.1080 | 120.6348 | 129.5887 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | (69) |
| Pumps, fans                                                                         | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 3.0000   | 3.0000   | 3.0000   | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 |          |          |          |          |          |          |          |          |          |          |          |          |      |

# Full SAP Calculation Printout



|                               |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
|                               | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 (71) |
| Water heating gains (Table 5) | 122.8154 | 120.9399 | 117.3263 | 109.4054 | 104.5538 | 99.4826  | 96.3675  | 98.9406  | 101.9575 | 107.5845 | 115.1776 | 121.8026 (72) |
| Total internal gains          | 378.2538 | 385.3369 | 370.6265 | 357.5079 | 340.7801 | 326.1045 | 314.6582 | 315.8245 | 324.7359 | 338.5606 | 358.0299 | 371.2593 (73) |

## 6. Solar gains

| [Jan]       |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W   |          |          |               |
|-------------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|----------|----------|---------------|
| Northeast   |          |          |          | 0.7100     | 11.2829                        | 0.6300                            | 0.7000                             | 0.7700                       | 2.4482 (75)  |          |          |               |
| East        |          |          |          | 1.9300     | 19.6403                        | 0.6300                            | 0.7000                             | 0.7700                       | 11.5845 (76) |          |          |               |
| Southeast   |          |          |          | 0.7100     | 36.7938                        | 0.6300                            | 0.7000                             | 0.7700                       | 7.9837 (77)  |          |          |               |
| West        |          |          |          | 4.4100     | 19.6403                        | 0.6300                            | 0.7000                             | 0.7700                       | 26.4702 (80) |          |          |               |
| Solar gains | 48.4867  | 93.0258  | 150.1828 | 216.6011   | 264.7712                       | 271.0832                          | 258.0416                           | 221.8528                     | 173.6736     | 109.4532 | 60.0929  | 40.1261 (83)  |
| Total gains | 426.7405 | 478.3627 | 520.8093 | 574.1090   | 605.5513                       | 597.1877                          | 572.6998                           | 537.6773                     | 498.4095     | 448.0138 | 418.1228 | 411.3854 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 27.5903 | 27.6818 | 27.7722 | 28.2046 | 28.2870 | 28.6770 | 28.6770 | 28.7504 | 28.5255 | 28.2870 | 28.1208 | 27.9491      |
| alpha                                                                       | 2.8394  | 2.8455  | 2.8515  | 2.8803  | 2.8858  | 2.9118  | 2.9118  | 2.9167  | 2.9017  | 2.8858  | 2.8747  | 2.8633       |
| util living area                                                            | 0.9398  | 0.9166  | 0.8777  | 0.7966  | 0.6788  | 0.5261  | 0.3986  | 0.4368  | 0.6338  | 0.8265  | 0.9133  | 0.9448 (86)  |
| MIT                                                                         | 18.9226 | 19.2043 | 19.6288 | 20.1814 | 20.6051 | 20.8666 | 20.9558 | 20.9416 | 20.7607 | 20.2144 | 19.5006 | 18.8904 (87) |
| Th 2                                                                        | 20.3778 | 20.3799 | 20.3819 | 20.3914 | 20.3931 | 20.4014 | 20.4014 | 20.4029 | 20.3982 | 20.3931 | 20.3895 | 20.3858 (88) |
| util rest of house                                                          | 0.9346  | 0.9095  | 0.8671  | 0.7792  | 0.6514  | 0.4866  | 0.3494  | 0.3868  | 0.5959  | 0.8079  | 0.9049  | 0.9400 (89)  |
| MIT 2                                                                       | 18.4263 | 18.7049 | 19.1227 | 19.6640 | 20.0634 | 20.3030 | 20.3744 | 20.3661 | 20.2133 | 19.7044 | 19.0068 | 18.4003 (90) |
| Living area fraction                                                        | 18.8430 | 19.1241 | 19.5476 | 20.0984 | 20.5182 | 20.7762 | 20.8626 | 20.8493 | 20.6729 | 20.1326 | 19.4213 | 18.8118 (92) |
| MIT                                                                         | 18.8430 | 19.1241 | 19.5476 | 20.0984 | 20.5182 | 20.7762 | 20.8626 | 20.8493 | 20.6729 | 20.1326 | 19.4213 | 18.8118 (93) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 18.8430 | 19.1241 | 19.5476 | 20.0984 | 20.5182 | 20.7762 | 20.8626 | 20.8493 | 20.6729 | 20.1326 | 19.4213 | 18.8118 (93) |

## 8. Space heating requirement

|                                                                                |          |          |          |          |          |          |          |          |          |               |          |                |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|----------|----------------|
|                                                                                | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov      | Dec            |
| Utilisation                                                                    | 0.9190   | 0.8927   | 0.8511   | 0.7702   | 0.6572   | 0.5116   | 0.3875   | 0.4245   | 0.6137   | 0.7992        | 0.8892   | 0.9250 (94)    |
| Useful gains                                                                   | 392.1650 | 427.0338 | 443.2452 | 442.2003 | 397.9714 | 305.5345 | 221.9336 | 228.2332 | 305.8707 | 358.0395      | 371.8111 | 380.5451 (95)  |
| Ext temp.                                                                      | 4.3000   | 4.9000   | 6.5000   | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000   | 4.2000 (96)    |
| Heat loss rate W                                                               | 823.4138 | 802.6966 | 733.9095 | 620.2375 | 486.9814 | 336.4398 | 232.1977 | 241.7503 | 359.9514 | 526.4331      | 684.4647 | 816.6867 (97)  |
| Space heating kWh                                                              | 320.8491 | 252.4455 | 216.2543 | 128.1868 | 66.2234  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 125.2848      | 225.1105 | 324.4894 (98a) |
| Space heating requirement - total per year (kWh/year)                          |          |          |          |          |          |          |          |          |          |               |          | 1658.8438      |
| Solar heating kWh                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000   | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |          |          |          |          |          |          |          |          |          |               |          | 0.0000         |
| Space heating kWh                                                              | 320.8491 | 252.4455 | 216.2543 | 128.1868 | 66.2234  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 125.2848      | 225.1105 | 324.4894 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |          |          |          |          |          |          |          |          |          |               |          | 1658.8438      |
| Space heating per m2                                                           |          |          |          |          |          |          |          |          |          | (98c) / (4) = |          | 36.4581 (99)   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |                 |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)    |
| Fraction of space heat from main system(s)                                          |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                                    |          |          |          |          |          |          |          |          |          |          |          | 92.3000 (206)   |
| Efficiency of main space heating system 2 (in %)                                    |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                             |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
|                                                                                     | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                                           | 320.8491 | 252.4455 | 216.2543 | 128.1868 | 66.2234  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 125.2848 | 225.1105 | 324.4894 (98)   |
| Space heating efficiency (main heating system 1)                                    | 92.3000  | 92.3000  | 92.3000  | 92.3000  | 92.3000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 92.3000  | 92.3000  | 92.3000 (210)   |
| Space heating fuel (main heating system)                                            | 347.6155 | 273.5054 | 234.2950 | 138.8806 | 71.7480  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 135.7365 | 243.8901 | 351.5594 (211)  |
| Space heating efficiency (main heating system 2)                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |
| Space heating fuel (secondary)                                                      | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Water heating                                                                       |          |          |          |          |          |          |          |          |          |          |          |                 |
| Water heating requirement                                                           | 186.2762 | 164.8922 | 175.6952 | 155.8540 | 151.9829 | 137.9423 | 136.9214 | 141.8423 | 142.8137 | 158.0449 | 166.5530 | 184.4363 (64)   |
| Efficiency of water heater (217)m                                                   | 85.2676  | 85.0118  | 84.5267  | 83.6250  | 82.3325  | 79.8000  | 79.8000  | 79.8000  | 79.8000  | 83.5441  | 84.7361  | 79.8000 (216)   |
| Fuel for water heating, kWh/month                                                   | 218.4607 | 193.9639 | 207.8576 | 186.3726 | 184.5966 | 172.8600 | 171.5807 | 177.7472 | 178.9645 | 189.1753 | 196.5551 | 216.1877 (219)  |
| Space cooling fuel requirement (221)m                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                        | 7.3041   | 6.5973   | 7.3041   | 7.0685   | 7.3041   | 7.0685   | 7.3041   | 7.3041   | 7.0685   | 7.3041   | 7.0685   | 7.3041 (231)    |
| Lighting                                                                            | 14.6451  | 11.7488  | 10.5785  | 7.7503   | 5.9865   | 4.8911   | 5.4611   | 7.0986   | 9.2203   | 12.0976  | 13.6642  | 15.0521 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity) (233a)m               | -15.7289 | -23.0244 | -34.3617 | -40.1851 | -44.7155 | -42.2821 | -41.8036 | -38.7997 | -33.7025 | -27.0492 | -17.6050 | -13.5040 (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) |          |          |          |          |          |          |          |          |          |          |          |                 |

# Full SAP Calculation Printout



|                                                                                                      |         |          |          |          |          |          |          |          |          |          |         |           |        |
|------------------------------------------------------------------------------------------------------|---------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------|-----------|--------|
| (235a)m                                                                                              | 0.0000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000  | 0.0000    | (235a) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |         |          |          |          |          |          |          |          |          |          |         |           |        |
| (235c)m                                                                                              | 0.0000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000  | 0.0000    | (235c) |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |         |          |          |          |          |          |          |          |          |          |         |           |        |
| (233b)m                                                                                              | -6.4781 | -13.8465 | -27.9186 | -42.5040 | -56.7396 | -57.1708 | -56.4595 | -47.5256 | -34.4957 | -19.9474 | -8.6994 | -5.1037   | (233b) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |         |          |          |          |          |          |          |          |          |          |         |           |        |
| (234b)m                                                                                              | 0.0000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000  | 0.0000    | (234b) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |         |          |          |          |          |          |          |          |          |          |         |           |        |
| (235b)m                                                                                              | 0.0000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000  | 0.0000    | (235b) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |         |          |          |          |          |          |          |          |          |          |         |           |        |
| (235d)m                                                                                              | 0.0000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000  | 0.0000    | (235d) |
| Annual totals kWh/year                                                                               |         |          |          |          |          |          |          |          |          |          |         |           |        |
| Space heating fuel - main system 1                                                                   |         |          |          |          |          |          |          |          |          |          |         | 1797.2306 | (211)  |
| Space heating fuel - main system 2                                                                   |         |          |          |          |          |          |          |          |          |          |         | 0.0000    | (213)  |
| Space heating fuel - secondary                                                                       |         |          |          |          |          |          |          |          |          |          |         | 0.0000    | (215)  |
| Efficiency of water heater                                                                           |         |          |          |          |          |          |          |          |          |          |         | 79.8000   |        |
| Water heating fuel used                                                                              |         |          |          |          |          |          |          |          |          |          |         | 2294.3218 | (219)  |
| Space cooling fuel                                                                                   |         |          |          |          |          |          |          |          |          |          |         | 0.0000    | (221)  |
| Electricity for pumps and fans:                                                                      |         |          |          |          |          |          |          |          |          |          |         |           |        |
| Total electricity for the above, kWh/year                                                            |         |          |          |          |          |          |          |          |          |          |         | 86.0000   | (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |         |          |          |          |          |          |          |          |          |          |         | 118.1943  | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |         |          |          |          |          |          |          |          |          |          |         |           |        |
| PV generation                                                                                        |         |          |          |          |          |          |          |          |          |          |         | -749.6505 | (233)  |
| Wind generation                                                                                      |         |          |          |          |          |          |          |          |          |          |         | 0.0000    | (234)  |
| Hydro-electric generation (Appendix N)                                                               |         |          |          |          |          |          |          |          |          |          |         | 0.0000    | (235a) |
| Electricity generated - Micro CHP (Appendix N)                                                       |         |          |          |          |          |          |          |          |          |          |         | 0.0000    | (235)  |
| Appendix Q - special features                                                                        |         |          |          |          |          |          |          |          |          |          |         |           |        |
| Energy saved or generated                                                                            |         |          |          |          |          |          |          |          |          |          |         | -0.0000   | (236)  |
| Energy used                                                                                          |         |          |          |          |          |          |          |          |          |          |         | 0.0000    | (237)  |
| Total delivered energy for all uses                                                                  |         |          |          |          |          |          |          |          |          |          |         | 3546.0961 | (238)  |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                               | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |       |
|-----------------------------------------------|--------------------|-------------------------------|--------------------------|-------|
| Space heating - main system 1                 | 1797.2306          | 0.2100                        | 377.4184                 | (261) |
| Total CO2 associated with community systems   |                    |                               | 0.0000                   | (373) |
| Water heating (other fuel)                    | 2294.3218          | 0.2100                        | 481.8076                 | (264) |
| Space and water heating                       |                    |                               | 859.2260                 | (265) |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293                  | (267) |
| Energy for lighting                           | 118.1943           | 0.1443                        | 17.0591                  | (268) |
| Energy saving/generation technologies         |                    |                               |                          |       |
| PV Unit electricity used in dwelling          | -372.7616          | 0.1338                        | -49.8635                 |       |
| PV Unit electricity exported                  | -376.8889          | 0.1255                        | -47.3060                 |       |
| Total                                         |                    |                               | -97.1694                 | (269) |
| Total CO2, kg/year                            |                    |                               | 791.0449                 | (272) |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 17.3900                  | (273) |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |       |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|-------|
| Space heating - main system 1               | 1797.2306          | 1.1300                              | 2030.8705                  | (275) |
| Total CO2 associated with community systems |                    |                                     | 0.0000                     | (473) |
| Water heating (other fuel)                  | 2294.3218          | 1.1300                              | 2592.5836                  | (278) |
| Space and water heating                     |                    |                                     | 4623.4542                  | (279) |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008                   | (281) |
| Energy for lighting                         | 118.1943           | 1.5338                              | 181.2903                   | (282) |
| Energy saving/generation technologies       |                    |                                     |                            |       |
| PV Unit electricity used in dwelling        | -372.7616          | 1.4943                              | -557.0312                  |       |
| PV Unit electricity exported                | -376.8889          | 0.4607                              | -173.6393                  |       |
| Total                                       |                    |                                     | -730.6705                  | (283) |
| Total Primary energy kWh/year               |                    |                                     | 4204.1748                  | (286) |
| Target Primary Energy Rate (TPER)           |                    |                                     | 92.4000                    | (287) |

## SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF FABRIC ENERGY EFFICIENCY

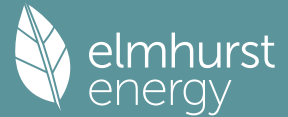
### 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m) | Volume<br>(m3) |             |
|--------------------------------------------------------|--------------|----------------------|----------------|-------------|
| Main dwelling                                          | 45.5000      | 2.7500               | 125.1250       | (1b) - (3b) |
| Ground floor                                           |              |                      |                | (4)         |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 45.5000      |                      |                |             |
| Dwelling volume                                        |              |                      | 125.1250       | (5)         |

### 2. Ventilation rate

|                                                    | m3 per hour |             |
|----------------------------------------------------|-------------|-------------|
| Number of open chimneys                            | 0 * 80 =    | 0.0000 (6a) |
| Number of open flues                               | 0 * 20 =    | 0.0000 (6b) |
| Number of chimneys / flues attached to closed fire | 0 * 10 =    | 0.0000 (6c) |
| Number of flues attached to solid fuel boiler      | 0 * 20 =    | 0.0000 (6d) |
| Number of flues attached to other heater           | 0 * 35 =    | 0.0000 (6e) |
| Number of blocked chimneys                         | 0 * 20 =    | 0.0000 (6f) |

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Number of intermittent extract fans  
Number of passive vents  
Number of flueless gas fires

2 \* 10 = 20.0000 (7a)  
0 \* 10 = 0.0000 (7b)  
0 \* 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 20.0000 / (5) = 0.1598 (8)  
Pressure test Yes  
Pressure Test Method Blower Door  
Measured/design AP50 4.0000 (17)  
Infiltration rate 0.3598 (18)  
Number of sides sheltered 1 (19)  
Shelter factor (20) = 1 - [0.075 x (19)] = 0.9250 (20)  
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3329 (21)

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |       |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 | (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 | (22a) |
| Adj infilt rate                                                                                         | 0.4244 | 0.4161 | 0.4077 | 0.3661 | 0.3578 | 0.3162 | 0.3162 | 0.3079 | 0.3329 | 0.3578 | 0.3745 | 0.3911 | (22b) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.0000 | (23b) |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =            |        |        |        |        |        |        |        |        |        |        |        | 0.0000 | (23c) |
| Effective ac                                                                                            | 0.5901 | 0.5866 | 0.5831 | 0.5670 | 0.5640 | 0.5500 | 0.5500 | 0.5474 | 0.5554 | 0.5640 | 0.5701 | 0.5765 | (25)  |

## 3. Heat losses and heat loss parameter

| Element                                                                   | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K     | A x U<br>W/K | K-value<br>kJ/m2K                    | A x K<br>kJ/K |       |
|---------------------------------------------------------------------------|-------------|----------------|---------------|----------------------|--------------|--------------------------------------|---------------|-------|
| Main dwelling                                                             |             |                |               |                      |              |                                      |               |       |
| Windows / Glazed Doors                                                    |             |                | 7.7600        | 1.1450               | 8.8855       |                                      |               | (27)  |
| Heatloss Floor 1                                                          |             |                | 45.5000       | 0.1200               | 5.4600       | 75.0000                              | 3412.5000     | (28a) |
| External Wall                                                             | 55.0000     | 7.7600         | 47.2400       | 0.1500               | 7.0860       | 9.0000                               | 425.1600      | (29a) |
| Bay Roof                                                                  | 0.7000      |                | 0.7000        | 0.1400               | 0.0980       | 9.0000                               | 6.3000        | (30)  |
| Total net area of external elements Aum(A, m2)                            |             |                | 101.2000      |                      |              |                                      |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)                                       |             |                |               | (26)...(30) + (32) = | 21.5295      |                                      |               | (33)  |
| Main dwelling                                                             |             |                |               |                      |              |                                      |               |       |
| Party Wall 1                                                              |             |                | 27.7800       | 0.0000               | 0.0000       | 45.0000                              | 1250.1000     | (32)  |
| Party Ceiling 1                                                           |             |                | 44.8000       |                      |              | 0.0000                               | 0.0000        | (32b) |
| Internal Wall 1                                                           |             |                | 58.8500       |                      |              | 9.0000                               | 529.6500      | (32c) |
| Heat capacity Cm = Sum(A x k)                                             |             |                |               |                      |              | (28)...(30) + (32) + (32a)...(32e) = | 5623.7100     | (34)  |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K                         |             |                |               |                      |              |                                      | 123.5980      | (35)  |
| List of Thermal Bridges                                                   |             |                |               |                      |              |                                      |               |       |
| K1 Element                                                                |             |                |               | Length               | Psi-value    | Total                                |               |       |
| E2 Other lintels (including other steel lintels)                          |             |                |               | 4.6600               | 0.0840       | 0.3914                               |               |       |
| E3 Sill                                                                   |             |                |               | 1.6500               | 0.0340       | 0.0561                               |               |       |
| E4 Jamb                                                                   |             |                |               | 20.5800              | 0.0430       | 0.8849                               |               |       |
| E5 Ground floor (normal)                                                  |             |                |               | 20.0000              | 0.3200       | 6.4000                               |               |       |
| E6 Corner (normal)                                                        |             |                |               | 11.0000              | 0.0300       | 0.3300                               |               |       |
| E8 Party wall between dwellings                                           |             |                |               | 5.5000               | 0.0400       | 0.2200                               |               |       |
| E7 Party floor between dwellings (in blocks of flats)                     |             |                |               | 20.0000              | 0.0660       | 1.3200                               |               |       |
| E10 Eaves (insulation at ceiling level)                                   |             |                |               | 3.2000               | 0.0440       | 0.1408                               |               |       |
| E17 Corner (inverted - internal area greater than external area)          |             |                |               | 5.5000               | 0.0150       | 0.0825                               |               |       |
| P1 Party wall - Ground floor                                              |             |                |               | 10.1000              | 0.1600       | 1.6160                               |               |       |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) |             |                |               | 10.1000              | 0.0000       | 0.0000                               |               |       |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                |             |                |               |                      |              |                                      | 11.4418       | (36)  |
| Point Thermal bridges                                                     |             |                |               |                      |              |                                      | 0.0000        | (36a) |
| Total fabric heat loss                                                    |             |                |               |                      |              | (33) + (36) + (36a) =                | 32.9713       | (37)  |

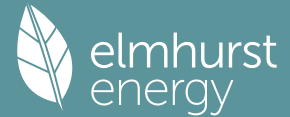
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

|                           | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |      |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| (38)m                     | 24.3640 | 24.2196 | 24.0781 | 23.4133 | 23.2889 | 22.7099 | 22.7099 | 22.6027 | 22.9330 | 23.2889 | 23.5405 | 23.8036 | (38) |
| Heat transfer coeff       | 57.3353 | 57.1909 | 57.0493 | 56.3846 | 56.2602 | 55.6812 | 55.6812 | 55.5740 | 55.9042 | 56.2602 | 56.5118 | 56.7749 | (39) |
| Average = Sum(39)m / 12 = |         |         |         |         |         |         |         |         |         |         |         | 56.3840 |      |
| HLP                       | 1.2601  | 1.2569  | 1.2538  | 1.2392  | 1.2365  | 1.2238  | 1.2238  | 1.2214  | 1.2287  | 1.2365  | 1.2420  | 1.2478  | (40) |
| HLP (average)             |         |         |         |         |         |         |         |         |         |         |         | 1.2392  |      |
| Days in mont              | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31      |      |

## 4. Water heating energy requirements (kWh/year)

|                                                                                                              |  |  |  |  |  |  |  |  |  |  |  |  |              |
|--------------------------------------------------------------------------------------------------------------|--|--|--|--|--|--|--|--|--|--|--|--|--------------|
| Assumed occupancy                                                                                            |  |  |  |  |  |  |  |  |  |  |  |  | 1.5590 (42)  |
| Hot water usage for mixer showers                                                                            |  |  |  |  |  |  |  |  |  |  |  |  |              |
| 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000                          |  |  |  |  |  |  |  |  |  |  |  |  | (42a)        |
| Hot water usage for baths                                                                                    |  |  |  |  |  |  |  |  |  |  |  |  |              |
| 21.7789 21.4554 21.0000 20.1601 19.5313 18.8340 18.4573 18.9096 19.4021 20.1482 21.0054 21.7053              |  |  |  |  |  |  |  |  |  |  |  |  | (42b)        |
| Hot water usage for other uses                                                                               |  |  |  |  |  |  |  |  |  |  |  |  |              |
| 30.5954 29.4828 28.3702 27.2577 26.1451 25.0326 25.0326 26.1451 27.2577 28.3702 29.4828 30.5954              |  |  |  |  |  |  |  |  |  |  |  |  | (42c)        |
| Average daily hot water use (litres/day)                                                                     |  |  |  |  |  |  |  |  |  |  |  |  | 48.0064 (43) |
| Daily hot water use                                                                                          |  |  |  |  |  |  |  |  |  |  |  |  |              |
| 52.3742 50.9382 49.3702 47.4178 45.6764 43.8665 43.4899 45.0548 46.6598 48.5185 50.4881 52.3006              |  |  |  |  |  |  |  |  |  |  |  |  | (44)         |
| Energy conte 82.9480 72.5354 75.8801 64.9126 61.4892 53.9390 52.5973 55.7872 57.5362 65.8391 71.9296 81.8901 |  |  |  |  |  |  |  |  |  |  |  |  | (45)         |
| Energy content (annual)                                                                                      |  |  |  |  |  |  |  |  |  |  |  |  | 797.2838     |
| Distribution loss (46)m = 0.15 x (45)m                                                                       |  |  |  |  |  |  |  |  |  |  |  |  |              |
| 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000                          |  |  |  |  |  |  |  |  |  |  |  |  | (46)         |
| Water storage loss (or HIU loss):                                                                            |  |  |  |  |  |  |  |  |  |  |  |  |              |
| Total storage loss                                                                                           |  |  |  |  |  |  |  |  |  |  |  |  |              |
| 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000                          |  |  |  |  |  |  |  |  |  |  |  |  | (56)         |
| If cylinder contains dedicated solar storage                                                                 |  |  |  |  |  |  |  |  |  |  |  |  |              |
| 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000                          |  |  |  |  |  |  |  |  |  |  |  |  | (57)         |
| Primary loss                                                                                                 |  |  |  |  |  |  |  |  |  |  |  |  |              |
| 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000                          |  |  |  |  |  |  |  |  |  |  |  |  | (59)         |
| Combi loss                                                                                                   |  |  |  |  |  |  |  |  |  |  |  |  |              |
| 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000                          |  |  |  |  |  |  |  |  |  |  |  |  | (61)         |
| Total heat required for water heating calculated for each month                                              |  |  |  |  |  |  |  |  |  |  |  |  |              |
| 70.5058 61.6551 64.4981 55.1757 52.2658 45.8482 44.7077 47.4191 48.9057 55.9632 61.1402 69.6066              |  |  |  |  |  |  |  |  |  |  |  |  | (62)         |
| WWHRS                                                                                                        |  |  |  |  |  |  |  |  |  |  |  |  |              |
| 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000                          |  |  |  |  |  |  |  |  |  |  |  |  | (63a)        |
| PV diverter                                                                                                  |  |  |  |  |  |  |  |  |  |  |  |  |              |
| 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000                          |  |  |  |  |  |  |  |  |  |  |  |  | (63b)        |
| Solar input                                                                                                  |  |  |  |  |  |  |  |  |  |  |  |  |              |
| 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000                          |  |  |  |  |  |  |  |  |  |  |  |  | (63c)        |
| FGHRS                                                                                                        |  |  |  |  |  |  |  |  |  |  |  |  |              |
| 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000                          |  |  |  |  |  |  |  |  |  |  |  |  | (63d)        |
| Output from w/h                                                                                              |  |  |  |  |  |  |  |  |  |  |  |  |              |
| 70.5058 61.6551 64.4981 55.1757 52.2658 45.8482 44.7077 47.4191 48.9057 55.9632 61.1402 69.6066              |  |  |  |  |  |  |  |  |  |  |  |  | (64)         |

# Full SAP Calculation Printout



|                                                                                |                                        |         |         |         |         |         |         |         |         |         |                |
|--------------------------------------------------------------------------------|----------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------------|
| 12Total per year (kWh/year)                                                    | Total per year (kWh/year) = Sum(64)m = |         |         |         |         |         |         |         |         |         | 677.6912 (64)  |
| Electric shower(s)                                                             |                                        |         |         |         |         |         |         |         |         |         | 678 (64)       |
| 40.3285                                                                        | 35.9330                                | 39.2375 | 37.4438 | 38.1465 | 36.3880 | 37.6010 | 38.1465 | 37.4438 | 39.2375 | 38.4997 | 40.3285 (64a)  |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |                                        |         |         |         |         |         |         |         |         |         | 458.7342 (64a) |
| Heat gains from water heating, kWh/month                                       |                                        |         |         |         |         |         |         |         |         |         |                |
| 27.7086                                                                        | 24.3970                                | 25.9339 | 23.1549 | 22.6031 | 20.5590 | 20.5772 | 21.3914 | 21.5874 | 23.8002 | 24.9100 | 27.4838 (65)   |

## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |          |      |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| Metabolic gains (Table 5), Watts                                                    | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |      |
| (66)m                                                                               | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 70.4835  | 78.0354  | 70.4835  | 72.8330  | 70.4835  | 72.8330  | 70.4835  | 70.4835  | 72.8330  | 70.4835  | 72.8330  | 70.4835  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 135.5704 | 136.9772 | 133.4321 | 125.8851 | 116.3583 | 107.4044 | 101.4227 | 100.0159 | 103.5610 | 111.1080 | 120.6348 | 129.5887 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | (69) |
| Pumps, fans                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | (71) |
| Water heating gains (Table 5)                                                       | 37.2427  | 36.3051  | 34.8574  | 32.1596  | 30.3805  | 28.5542  | 27.6575  | 28.7519  | 29.9825  | 31.9895  | 34.5972  | 36.9406  | (72) |
| Total internal gains                                                                | 289.6811 | 297.7021 | 285.1575 | 277.2621 | 263.6068 | 255.1761 | 245.9482 | 245.6358 | 252.7609 | 259.9655 | 274.4495 | 283.3973 | (73) |

## 6. Solar gains

| [Jan]       |          |          |          |          |            |                                |                              |                                   |                                    |                              |              |               |
|-------------|----------|----------|----------|----------|------------|--------------------------------|------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|---------------|
|             |          |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | Specific data<br>or Table 6b | g<br>Specific data<br>or Table 6c | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W   |               |
| Northeast   |          |          |          |          | 0.7100     | 11.2829                        | 0.7600                       |                                   | 0.0000                             | 0.7700                       | 4.6880 (75)  |               |
| East        |          |          |          |          | 1.9300     | 19.6403                        | 0.7600                       |                                   | 0.0000                             | 0.7700                       | 22.1824 (76) |               |
| Southeast   |          |          |          |          | 0.7100     | 36.7938                        | 0.7600                       |                                   | 0.0000                             | 0.7700                       | 15.2875 (77) |               |
| West        |          |          |          |          | 4.4100     | 19.6403                        | 0.7600                       |                                   | 0.0000                             | 0.7700                       | 50.6863 (80) |               |
|             |          |          |          |          |            |                                |                              |                                   |                                    |                              |              |               |
| Solar gains | 92.8442  | 178.1294 | 287.5760 | 414.7564 | 506.9945   | 519.0809                       | 494.1084                     | 424.8126                          | 332.5572                           | 209.5854                     | 115.0683     | 76.8350 (83)  |
| Total gains | 382.5253 | 475.8316 | 572.7336 | 692.0186 | 770.6012   | 774.2571                       | 740.0566                     | 670.4484                          | 585.3181                           | 469.5509                     | 389.5178     | 360.2323 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |                           |         |         |         |         |         |         |         |         |         |         |              |             |
|-----------------------------------------------------------------------------|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|-------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |                           |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |             |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |                           |         |         |         |         |         |         |         |         |         |         |              |             |
|                                                                             | Jan                       | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |             |
| tau                                                                         | 27.2457                   | 27.3145 | 27.3823 | 27.7051 | 27.7664 | 28.0551 | 28.0551 | 28.1092 | 27.9432 | 27.7664 | 27.6427 | 27.5147      |             |
| alpha                                                                       | 2.8164                    | 2.8210  | 2.8255  | 2.8470  | 2.8511  | 2.8703  | 2.8703  | 2.8739  | 2.8629  | 2.8511  | 2.8428  | 2.8343       |             |
| util living area                                                            | 0.9533                    | 0.9184  | 0.8558  | 0.7348  | 0.5857  | 0.4321  | 0.3216  | 0.3662  | 0.5739  | 0.8154  | 0.9264  | 0.9596 (86)  |             |
| MIT                                                                         | 18.7485                   | 19.1610 | 19.7175 | 20.3360 | 20.7251 | 20.9162 | 20.9733 | 20.9610 | 20.8091 | 20.2266 | 19.3786 | 18.6821 (87) |             |
| Th 2                                                                        | 19.8722                   | 19.8747 | 19.8772 | 19.8888 | 19.8909 | 19.9010 | 19.9010 | 19.9029 | 19.8971 | 19.8909 | 19.8865 | 19.8820 (88) |             |
| util rest of house                                                          | 0.9453                    | 0.9053  | 0.8336  | 0.6979  | 0.5336  | 0.3661  | 0.2449  | 0.2844  | 0.5030  | 0.7786  | 0.9123  | 0.9527 (89)  |             |
| MIT 2                                                                       | 17.8547                   | 18.2567 | 18.7901 | 19.3666 | 19.7012 | 19.8559 | 19.8913 | 19.8876 | 19.7835 | 19.2901 | 18.4844 | 17.7965 (90) |             |
| Living area fraction                                                        | fLA = Living area / (4) = |         |         |         |         |         |         |         |         |         |         |              | 0.8396 (91) |
| MIT                                                                         | 18.6051                   | 19.0159 | 19.5687 | 20.1804 | 20.5608 | 20.7461 | 20.7997 | 20.7888 | 20.6445 | 20.0764 | 19.2351 | 18.5400 (92) |             |
| Temperature adjustment                                                      |                           |         |         |         |         |         |         |         |         |         |         |              | 0.0000      |
| adjusted MIT                                                                | 18.6051                   | 19.0159 | 19.5687 | 20.1804 | 20.5608 | 20.7461 | 20.7997 | 20.7888 | 20.6445 | 20.0764 | 19.2351 | 18.5400 (93) |             |

## 8. Space heating requirement

|                                                                                | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov      | Dec            |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|----------|----------------|
| Utilisation                                                                    | 0.9341   | 0.8934   | 0.8268   | 0.7081   | 0.5658   | 0.4173   | 0.3080   | 0.3509   | 0.5522   | 0.7853        | 0.9024   | 0.9422 (94)    |
| Useful gains                                                                   | 357.3336 | 425.1288 | 473.5459 | 490.0124 | 435.9798 | 323.0800 | 227.9157 | 235.2451 | 323.1866 | 368.7568      | 351.4900 | 339.4044 (95)  |
| Ext temp.                                                                      | 4.3000   | 4.9000   | 6.5000   | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000   | 4.2000 (96)    |
| Heat loss rate W                                                               |          |          |          |          |          |          |          |          |          |               |          |                |
| Space heating kWh                                                              | 820.1862 | 807.3021 | 745.5614 | 636.0429 | 498.5121 | 342.2234 | 233.8436 | 243.9040 | 365.8667 | 533.1431      | 685.7777 | 814.1513 (97)  |
| Space heating requirement - total per year (kWh/year)                          | 344.3623 | 256.8205 | 202.3796 | 105.1420 | 46.5240  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 122.3034      | 240.6872 | 353.2117 (98a) |
| Solar heating kWh                                                              |          |          |          |          |          |          |          |          |          |               |          | 1671.4307      |
| Space heating contribution - total per year (kWh/year)                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000   | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |          |          |          |          |          |          |          |          |          |               |          | 0.0000         |
| Space heating kWh                                                              | 344.3623 | 256.8205 | 202.3796 | 105.1420 | 46.5240  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 122.3034      | 240.6872 | 353.2117 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |          |          |          |          |          |          |          |          |          |               |          | 1671.4307      |
| Space heating per m2                                                           |          |          |          |          |          |          |          |          |          | (98c) / (4) = |          | 36.7347 (99)   |

## 8c. Space cooling requirement

|                                                     |                          |        |        |        |         |          |          |          |         |         |        |              |
|-----------------------------------------------------|--------------------------|--------|--------|--------|---------|----------|----------|----------|---------|---------|--------|--------------|
| Calculated for June, July and August. See Table 10b |                          |        |        |        |         |          |          |          |         |         |        |              |
|                                                     | Jan                      | Feb    | Mar    | Apr    | May     | Jun      | Jul      | Aug      | Sep     | Oct     | Nov    | Dec          |
| Ext. temp.                                          | 4.3000                   | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000  | 16.6000  | 16.4000  | 14.1000 | 10.6000 | 7.1000 | 4.2000       |
| Heat loss rate W                                    |                          |        |        |        |         |          |          |          |         |         |        |              |
|                                                     | 0.0000                   | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 523.4035 | 412.0411 | 422.3625 | 0.0000  | 0.0000  | 0.0000 | 0.0000 (100) |
| Utilisation                                         | 0.0000                   | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.8944   | 0.9296   | 0.9086   | 0.0000  | 0.0000  | 0.0000 | 0.0000 (101) |
| Useful loss                                         | 0.0000                   | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 468.1430 | 383.0484 | 383.7441 | 0.0000  | 0.0000  | 0.0000 | 0.0000 (102) |
| Total gains                                         | 0.0000                   | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 878.8364 | 840.3197 | 760.3173 | 0.0000  | 0.0000  | 0.0000 | 0.0000 (103) |
| Space cooling kWh                                   |                          |        |        |        |         |          |          |          |         |         |        |              |
|                                                     | 0.0000                   | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 295.6992 | 340.2098 | 280.1704 | 0.0000  | 0.0000  | 0.0000 | 0.0000 (104) |
| Cooled fraction                                     | fc = cooled area / (4) = |        |        |        |         |          |          |          |         |         |        | 1.0000 (105) |
| Intermittency factor (Table 10b)                    |                          |        |        |        |         |          |          |          |         |         |        |              |

# Full SAP Calculation Printout



|                                 |        |        |        |        |        |         |         |         |        |        |        |                |
|---------------------------------|--------|--------|--------|--------|--------|---------|---------|---------|--------|--------|--------|----------------|
| Space cooling kWh               | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500  | 0.2500  | 0.2500  | 0.2500 | 0.2500 | 0.2500 | 0.2500 (106)   |
| Space cooling requirement       | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 73.9248 | 85.0525 | 70.0426 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (107)   |
| Energy for space heating        |        |        |        |        |        |         |         |         |        |        |        | 229.0199 (107) |
| Energy for space cooling        |        |        |        |        |        |         |         |         |        |        |        | 36.7347 (99)   |
| Total                           |        |        |        |        |        |         |         |         |        |        |        | 5.0334 (108)   |
| Fabric Energy Efficiency (DFEE) |        |        |        |        |        |         |         |         |        |        |        | 41.7681 (109)  |
|                                 |        |        |        |        |        |         |         |         |        |        |        | 41.8 (109)     |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

## 1. Overall dwelling characteristics

| Main dwelling                                          | Area (m2)    | Storey height (m)               | Volume (m3)            |
|--------------------------------------------------------|--------------|---------------------------------|------------------------|
| Ground floor                                           | 45.5000 (1b) | x 2.7500 (2b)                   | = 125.1250 (1b) - (3b) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 45.5000      |                                 | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 125.1250 (5)         |

## 2. Ventilation rate

|                                                    | m3 per hour           |
|----------------------------------------------------|-----------------------|
| Number of open chimneys                            | 0 * 80 = 0.0000 (6a)  |
| Number of open flues                               | 0 * 20 = 0.0000 (6b)  |
| Number of chimneys / flues attached to closed fire | 0 * 10 = 0.0000 (6c)  |
| Number of flues attached to solid fuel boiler      | 0 * 20 = 0.0000 (6d)  |
| Number of flues attached to other heater           | 0 * 35 = 0.0000 (6e)  |
| Number of blocked chimneys                         | 0 * 20 = 0.0000 (6f)  |
| Number of intermittent extract fans                | 2 * 10 = 20.0000 (7a) |
| Number of passive vents                            | 0 * 10 = 0.0000 (7b)  |
| Number of flueless gas fires                       | 0 * 40 = 0.0000 (7c)  |

|                                                      |                                                       |                 |            |
|------------------------------------------------------|-------------------------------------------------------|-----------------|------------|
| Infiltration due to chimneys, flues and fans         | = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 20.0000 / (5) = | 0.1598 (8) |
| Pressure test                                        |                                                       | Yes             |            |
| Pressure Test Method                                 |                                                       | Blower Door     |            |
| Measured/design AP50                                 |                                                       | 5.0000          | (17)       |
| Infiltration rate                                    |                                                       | 0.4098          | (18)       |
| Number of sides sheltered                            |                                                       | 1               | (19)       |
| Shelter factor                                       | (20) = 1 - [0.075 x (19)] =                           | 0.9250          | (20)       |
| Infiltration rate adjusted to include shelter factor | (21) = (18) x (20) =                                  | 0.3791          | (21)       |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate                                                                                         | 0.4834 | 0.4739 | 0.4644 | 0.4170 | 0.4075 | 0.3601 | 0.3601 | 0.3507 | 0.3791 | 0.4075 | 0.4265 | 0.4454 (22b) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.0000 (23b) |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =            |        |        |        |        |        |        |        |        |        |        |        | 0.0000 (23c) |
| Effective ac                                                                                            | 0.6168 | 0.6123 | 0.6078 | 0.5869 | 0.5830 | 0.5649 | 0.5649 | 0.5615 | 0.5719 | 0.5830 | 0.5909 | 0.5992 (25)  |

## 3. Heat losses and heat loss parameter

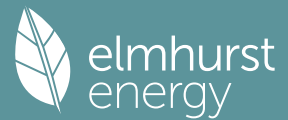
| Element                                        | Gross m2 | Openings m2 | NetArea m2 | U-value W/m2K        | A x U W/K | K-value kJ/m2K | A x K kJ/K |
|------------------------------------------------|----------|-------------|------------|----------------------|-----------|----------------|------------|
| Main dwelling                                  |          |             |            |                      |           |                |            |
| TER Opening Type                               |          |             | 7.7600     | 1.1450               | 8.8855    |                | (27)       |
| Heatloss Floor 1                               |          |             | 45.5000    | 0.1300               | 5.9150    |                | (28a)      |
| External Wall                                  | 55.0000  | 7.7600      | 47.2400    | 0.1800               | 8.5032    |                | (29a)      |
| Bay Roof                                       | 0.7000   |             | 0.7000     | 0.1100               | 0.0770    |                | (30)       |
| Total net area of external elements Aum(A, m2) |          |             | 101.2000   |                      |           |                | (31)       |
| Fabric heat loss, W/K = Sum (A x U)            |          |             |            | (26)...(30) + (32) = | 23.3807   |                | (33)       |
| Main dwelling                                  |          |             |            |                      |           |                |            |
| Party Wall 1                                   |          |             | 27.7800    | 0.0000               | 0.0000    |                | (32)       |

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 123.5980 (35)

| List of Thermal Bridges                                                   | Length  | Psi-value | Total                              |
|---------------------------------------------------------------------------|---------|-----------|------------------------------------|
| K1 Element                                                                | 4.6600  | 0.0500    | 0.2330                             |
| E2 Other lintels (including other steel lintels)                          | 1.6500  | 0.0500    | 0.0825                             |
| E3 Sill                                                                   | 20.5800 | 0.0500    | 1.0290                             |
| E4 Jamb                                                                   | 20.0000 | 0.1600    | 3.2000                             |
| E5 Ground floor (normal)                                                  | 11.0000 | 0.0900    | 0.9900                             |
| E16 Corner (normal)                                                       | 5.5000  | 0.0600    | 0.3300                             |
| E18 Party wall between dwellings                                          | 20.0000 | 0.0700    | 1.4000                             |
| E7 Party floor between dwellings (in blocks of flats)                     | 3.2000  | 0.0600    | 0.1920                             |
| E10 Eaves (insulation at ceiling level)                                   | 5.5000  | -0.0900   | -0.4950                            |
| E17 Corner (inverted - internal area greater than external area)          | 10.1000 | 0.0800    | 0.8080                             |
| P1 Party wall - Ground floor                                              | 10.1000 | 0.0000    | 0.0000                             |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) |         |           |                                    |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                |         |           | 7.7695 (36)                        |
| Point Thermal Bridges                                                     |         |           | (36a) = 0.0000                     |
| Total fabric heat loss                                                    |         |           | (33) + (36) + (36a) = 31.1502 (37) |

| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
|---------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| (38)m                                                               | 25.4691 | 25.2818 | 25.0982 | 24.2359 | 24.0745 | 23.3235 | 23.3235 | 23.1844 | 23.6128 | 24.0745 | 24.4009 | 24.7422 (38) |
| Heat transfer coeff                                                 | 56.6193 | 56.4320 | 56.2484 | 55.3861 | 55.2247 | 54.4737 | 54.4737 | 54.3346 | 54.7630 | 55.2247 | 55.5511 | 55.8924 (39) |
| Average = Sum(39)m / 12 =                                           |         |         |         |         |         |         |         |         |         |         |         | 55.3853      |

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|               |        |        |        |        |        |        |        |        |        |        |        |             |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
| HLP           | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec         |
| HLP (average) | 1.2444 | 1.2403 | 1.2362 | 1.2173 | 1.2137 | 1.1972 | 1.1972 | 1.1942 | 1.2036 | 1.2137 | 1.2209 | 1.2284 (40) |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31          |

## 4. Water heating energy requirements (kWh/year)

|                                                                                |         |         |         |         |         |         |         |         |         |         |         |                |
|--------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------------|
| Assumed occupancy                                                              |         |         |         |         |         |         |         |         |         |         |         | 1.5590 (42)    |
| Hot water usage for mixer showers                                              | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (42a)   |
| Hot water usage for baths                                                      | 21.7789 | 21.4554 | 21.0000 | 20.1601 | 19.5313 | 18.8340 | 18.4573 | 18.9096 | 19.4021 | 20.1482 | 21.0054 | 21.7053 (42b)  |
| Hot water usage for other uses                                                 | 30.5954 | 29.4828 | 28.3702 | 27.2577 | 26.1451 | 25.0326 | 25.0326 | 26.1451 | 27.2577 | 28.3702 | 29.4828 | 30.5954 (42c)  |
| Average daily hot water use (litres/day)                                       |         |         |         |         |         |         |         |         |         |         |         | 48.0064 (43)   |
| Daily hot water use                                                            | 52.3742 | 50.9382 | 49.3702 | 47.4178 | 45.6764 | 43.8665 | 43.4899 | 45.0548 | 46.6598 | 48.5185 | 50.4881 | 52.3006 (44)   |
| Energy content (annual)                                                        | 82.9480 | 72.5354 | 75.8801 | 64.9126 | 61.4892 | 53.9390 | 52.5973 | 55.7872 | 57.5362 | 65.8391 | 71.9296 | 81.8901 (45)   |
| Distribution loss (46)m = 0.15 x (45)m                                         | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (46)    |
| Water storage loss (or HIU loss):                                              | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (56)    |
| Total storage loss                                                             | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (57)    |
| If cylinder contains dedicated solar storage                                   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (59)    |
| Primary loss                                                                   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (61)    |
| Combi loss                                                                     | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (62)    |
| Total heat required for water heating calculated for each month                | 70.5058 | 61.6551 | 64.4981 | 55.1757 | 52.2658 | 45.8482 | 44.7077 | 47.4191 | 48.9057 | 55.9632 | 61.1402 | 69.6066 (63a)  |
| WWHRS                                                                          | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (63b)   |
| PV diverter                                                                    | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (63c)   |
| Solar input                                                                    | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (63d)   |
| FGHRS                                                                          | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (64)    |
| Output from w/h                                                                | 70.5058 | 61.6551 | 64.4981 | 55.1757 | 52.2658 | 45.8482 | 44.7077 | 47.4191 | 48.9057 | 55.9632 | 61.1402 | 69.6066 (64)   |
| 12Total per year (kWh/year)                                                    |         |         |         |         |         |         |         |         |         |         |         | 677.6912 (64)  |
| Electric shower(s)                                                             | 40.3285 | 35.9330 | 39.2375 | 37.4438 | 38.1465 | 36.3880 | 37.6010 | 38.1465 | 37.4438 | 39.2375 | 38.4997 | 40.3285 (64a)  |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |         |         |         |         |         |         |         |         |         |         |         | 458.7342 (64a) |
| Heat gains from water heating, kWh/month                                       | 27.7086 | 24.3970 | 25.9339 | 23.1549 | 22.6031 | 20.5590 | 20.5772 | 21.3914 | 21.5874 | 23.8002 | 24.9100 | 27.4838 (65)   |

## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Metabolic gains (Table 5), Watts                                                    | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
| (66)m                                                                               | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 70.4835  | 78.0354  | 70.4835  | 72.8330  | 70.4835  | 72.8330  | 70.4835  | 70.4835  | 72.8330  | 70.4835  | 72.8330  | 70.4835 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 135.5704 | 136.9772 | 133.4321 | 125.8851 | 116.3583 | 107.4044 | 101.4227 | 100.0159 | 103.5610 | 111.1080 | 120.6348 | 129.5887 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948 (69)  |
| Pumps, fans                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (70)   |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 (71) |
| Water heating gains (Table 5)                                                       | 37.2427  | 36.3051  | 34.8574  | 32.1596  | 30.3805  | 28.5542  | 27.6575  | 28.7519  | 29.9825  | 31.9895  | 34.5972  | 36.9406 (72)  |
| Total internal gains                                                                | 289.6811 | 297.7021 | 285.1575 | 277.2621 | 263.6068 | 255.1761 | 245.9482 | 245.6358 | 252.7609 | 259.9655 | 274.4495 | 283.3973 (73) |

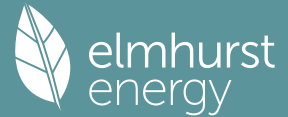
## 6. Solar gains

| [Jan]       |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W   |          |          |               |
|-------------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|----------|----------|---------------|
| Northeast   |          |          |          | 0.7100     | 11.2829                        | 0.6300                            | 0.7000                             | 0.7700                       | 2.4482 (75)  |          |          |               |
| East        |          |          |          | 1.9300     | 19.6403                        | 0.6300                            | 0.7000                             | 0.7700                       | 11.5845 (76) |          |          |               |
| Southeast   |          |          |          | 0.7100     | 36.7938                        | 0.6300                            | 0.7000                             | 0.7700                       | 7.9837 (77)  |          |          |               |
| West        |          |          |          | 4.4100     | 19.6403                        | 0.6300                            | 0.7000                             | 0.7700                       | 26.4702 (80) |          |          |               |
| Solar gains | 48.4867  | 93.0258  | 150.1828 | 216.6011   | 264.7712                       | 271.0832                          | 258.0416                           | 221.8528                     | 173.6736     | 109.4532 | 60.0929  | 40.1261 (83)  |
| Total gains | 338.1678 | 390.7279 | 435.3403 | 493.8632   | 528.3780                       | 526.2593                          | 503.9898                           | 467.4886                     | 426.4345     | 369.4187 | 334.5424 | 323.5234 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 27.5903 | 27.6818 | 27.7722 | 28.2046 | 28.2870 | 28.6770 | 28.6770 | 28.7504 | 28.5255 | 28.2870 | 28.1208 | 27.9491      |
| alpha                                                                       | 2.8394  | 2.8455  | 2.8515  | 2.8803  | 2.8858  | 2.9118  | 2.9118  | 2.9167  | 2.9017  | 2.8858  | 2.8747  | 2.8633       |
| util living area                                                            | 0.9647  | 0.9463  | 0.9146  | 0.8427  | 0.7320  | 0.5782  | 0.4453  | 0.4908  | 0.6972  | 0.8782  | 0.9467  | 0.9685 (86)  |
| MIT                                                                         | 18.6370 | 18.9417 | 19.4034 | 20.0231 | 20.5118 | 20.8285 | 20.9409 | 20.9206 | 20.6889 | 20.0378 | 19.2502 | 18.6015 (87) |
| Th 2                                                                        | 19.8847 | 19.8879 | 19.8911 | 19.9062 | 19.9090 | 19.9222 | 19.9222 | 19.9247 | 19.9171 | 19.9090 | 19.9033 | 19.8973 (88) |
| util rest of house                                                          | 0.9585  | 0.9370  | 0.8994  | 0.8145  | 0.6834  | 0.5026  | 0.3472  | 0.3912  | 0.6277  | 0.8500  | 0.9360  | 0.9629 (89)  |
| MIT 2                                                                       | 17.7546 | 18.0555 | 18.5079 | 19.1088 | 19.5538 | 19.8239 | 19.8991 | 19.8912 | 19.7206 | 19.1387 | 18.3737 | 17.7282 (90) |
| Living area fraction                                                        |         |         |         |         |         |         |         |         |         |         |         | 0.8396 (91)  |
| MIT                                                                         | 18.4954 | 18.7995 | 19.2597 | 19.8764 | 20.3581 | 20.6673 | 20.7738 | 20.7555 | 20.5335 | 19.8936 | 19.1096 | 18.4614 (92) |

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|                        |         |         |         |         |         |         |         |         |         |         |         |              |
|------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature adjustment |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT           | 18.4954 | 18.7995 | 19.2597 | 19.8764 | 20.3581 | 20.6673 | 20.7738 | 20.7555 | 20.5335 | 19.8936 | 19.1096 | 18.4614 (93) |

## 8. Space heating requirement

|                                                                                | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov      | Dec       |       |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|----------|-----------|-------|
| Utilisation                                                                    | 0.9486   | 0.9258   | 0.8893   | 0.8137   | 0.7045   | 0.5561   | 0.4256   | 0.4693   | 0.6691   | 0.8496        | 0.9264   | 0.9536    | (94)  |
| Useful gains                                                                   | 320.7742 | 361.7455 | 387.1430 | 401.8522 | 372.2329 | 292.6417 | 214.4985 | 219.4116 | 285.3235 | 313.8534      | 309.9145 | 308.5251  | (95)  |
| Ext temp.                                                                      | 4.3000   | 4.9000   | 6.5000   | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000   | 4.2000    | (96)  |
| Heat loss rate W                                                               | 803.7355 | 784.3753 | 717.7130 | 607.9386 | 478.1398 | 330.5080 | 227.3601 | 236.6535 | 352.3194 | 513.2346      | 667.1454 | 797.1032  | (97)  |
| Space heating kWh                                                              | 359.3232 | 284.0073 | 245.9441 | 148.3823 | 78.7947  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 148.3396      | 257.2062 | 363.5021  | (98a) |
| Space heating requirement - total per year (kWh/year)                          |          |          |          |          |          |          |          |          |          |               |          | 1885.4995 |       |
| Solar heating kWh                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000   | 0.0000    | (98b) |
| Solar heating contribution - total per year (kWh/year)                         |          |          |          |          |          |          |          |          |          |               |          | 0.0000    |       |
| Space heating kWh                                                              | 359.3232 | 284.0073 | 245.9441 | 148.3823 | 78.7947  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 148.3396      | 257.2062 | 363.5021  | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |          |          |          |          |          |          |          |          |          |               |          | 1885.4995 |       |
| Space heating per m2                                                           |          |          |          |          |          |          |          |          |          | (98c) / (4) = |          | 41.4395   | (99)  |

## 8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

|                                  | Jan    | Feb    | Mar    | Apr    | May     | Jun      | Jul      | Aug      | Sep                      | Oct     | Nov    | Dec      |       |
|----------------------------------|--------|--------|--------|--------|---------|----------|----------|----------|--------------------------|---------|--------|----------|-------|
| Ext. temp.                       | 4.3000 | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000  | 16.6000  | 16.4000  | 14.1000                  | 10.6000 | 7.1000 | 4.2000   |       |
| Heat loss rate W                 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 512.0526 | 403.1052 | 412.9429 | 0.0000                   | 0.0000  | 0.0000 | 0.0000   | (100) |
| Utilisation                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.7939   | 0.8535   | 0.8250   | 0.0000                   | 0.0000  | 0.0000 | 0.0000   | (101) |
| Useful loss                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 406.5176 | 344.0360 | 340.6964 | 0.0000                   | 0.0000  | 0.0000 | 0.0000   | (102) |
| Total gains                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 588.9689 | 564.3974 | 523.0915 | 0.0000                   | 0.0000  | 0.0000 | 0.0000   | (103) |
| Space cooling kWh                | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 131.3649 | 163.9489 | 135.7020 | 0.0000                   | 0.0000  | 0.0000 | 0.0000   | (104) |
| Cooled fraction                  |        |        |        |        |         |          |          |          | fc = cooled area / (4) = |         |        |          | (105) |
| Intermittency factor (Table 10b) | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500  | 0.2500   | 0.2500   | 0.2500   | 0.2500                   | 0.2500  | 0.2500 | 0.2500   | (106) |
| Space cooling kWh                | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 32.8412  | 40.9872  | 33.9255  | 0.0000                   | 0.0000  | 0.0000 | 0.0000   | (107) |
| Space cooling requirement        |        |        |        |        |         |          |          |          |                          |         |        | 107.7539 | (107) |
| Energy for space heating         |        |        |        |        |         |          |          |          |                          |         |        | 41.4395  | (99)  |
| Energy for space cooling         |        |        |        |        |         |          |          |          |                          |         |        | 2.3682   | (108) |
| Total                            |        |        |        |        |         |          |          |          |                          |         |        | 43.8078  | (109) |
| Fabric Energy Efficiency (TFEE)  |        |        |        |        |         |          |          |          |                          |         |        | 43.8     | (109) |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

## CALCULATION OF ENERGY RATING

### 1. Overall dwelling characteristics

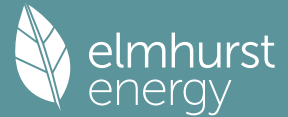
|                                                        | Area (m2)    | Storey height (m)                 | Volume (m3)            |  |
|--------------------------------------------------------|--------------|-----------------------------------|------------------------|--|
| Main dwelling                                          | 45.5000 (1b) | x 2.7500 (2b)                     | = 125.1250 (1b) - (3b) |  |
| Ground floor                                           |              |                                   |                        |  |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 45.5000      |                                   | (4)                    |  |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 125.1250 (5)           |  |

### 2. Ventilation rate

|                                                                                                    | m3 per hour                 |             |
|----------------------------------------------------------------------------------------------------|-----------------------------|-------------|
| Number of open chimneys                                                                            | 0 * 80 =                    | 0.0000 (6a) |
| Number of open flues                                                                               | 0 * 20 =                    | 0.0000 (6b) |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 =                    | 0.0000 (6c) |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 =                    | 0.0000 (6d) |
| Number of flues attached to other heater                                                           | 0 * 35 =                    | 0.0000 (6e) |
| Number of blocked chimneys                                                                         | 0 * 20 =                    | 0.0000 (6f) |
| Number of intermittent extract fans                                                                | 0 * 10 =                    | 0.0000 (7a) |
| Number of passive vents                                                                            | 0 * 10 =                    | 0.0000 (7b) |
| Number of flueless gas fires                                                                       | 0 * 40 =                    | 0.0000 (7c) |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 / (5) =              | 0.0000 (8)  |
| Pressure test                                                                                      |                             | Yes         |
| Pressure Test Method                                                                               |                             | Blower Door |
| Measured/design AP50                                                                               |                             | 4.0000 (17) |
| Infiltration rate                                                                                  |                             | 0.2000 (18) |
| Number of sides sheltered                                                                          |                             | 1 (19)      |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = | 0.9250 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) =        | 0.1850 (21) |

|                                              | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |       |
|----------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| Wind speed                                   | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 | (22)  |
| Wind factor                                  | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 | (22a) |
| Adj infilt rate                              | 0.2359 | 0.2313 | 0.2266 | 0.2035 | 0.1989 | 0.1758 | 0.1758 | 0.1711 | 0.1850 | 0.1989 | 0.2081 | 0.2174 | (22b) |
| Mechanical extract ventilation - centralised |        |        |        |        |        |        |        |        |        |        |        |        |       |
| If mechanical ventilation                    |        |        |        |        |        |        |        |        |        |        |        | 0.5000 | (23a) |

# Full SAP Calculation Printout



If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)  
Effective ac 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 (25)

## 3. Heat losses and heat loss parameter

|                                                                           |             |                |                        |                  |              |                                          |               |         |         |         |         |         |      |
|---------------------------------------------------------------------------|-------------|----------------|------------------------|------------------|--------------|------------------------------------------|---------------|---------|---------|---------|---------|---------|------|
| Element                                                                   | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2          | U-value<br>W/m2K | A x U<br>W/K | K-value<br>kJ/m2K                        | A x K<br>kJ/K |         |         |         |         |         |      |
| Main dwelling                                                             |             |                |                        |                  |              |                                          |               |         |         |         |         |         |      |
| Windows / Glazed Doors                                                    |             |                | 7.7600                 | 1.1450           | 8.8855       |                                          |               | (27)    |         |         |         |         |      |
| Heatloss Floor 1                                                          |             |                | 45.5000                | 0.1200           | 5.4600       | 75.0000                                  | 3412.5000     | (28a)   |         |         |         |         |      |
| External Wall                                                             | 55.0000     | 7.7600         | 47.2400                | 0.1500           | 7.0860       | 9.0000                                   | 425.1600      | (29a)   |         |         |         |         |      |
| Bay Roof                                                                  | 0.7000      |                | 0.7000                 | 0.1400           | 0.0980       | 9.0000                                   | 6.3000        | (30)    |         |         |         |         |      |
| Total net area of external elements Aum(A, m2)                            |             |                | 101.2000               |                  |              |                                          |               | (31)    |         |         |         |         |      |
| Fabric heat loss, W/K = Sum (A x U)                                       |             |                | (26) ... (30) + (32) = |                  | 21.5295      |                                          |               | (33)    |         |         |         |         |      |
| Main dwelling                                                             |             |                |                        |                  |              |                                          |               |         |         |         |         |         |      |
| Party Wall 1                                                              |             |                | 27.7800                | 0.0000           | 0.0000       | 45.0000                                  | 1250.1000     | (32)    |         |         |         |         |      |
| Party Ceiling 1                                                           |             |                | 44.8000                |                  |              | 0.0000                                   | 0.0000        | (32b)   |         |         |         |         |      |
| Internal Wall 1                                                           |             |                | 58.8500                |                  |              | 9.0000                                   | 529.6500      | (32c)   |         |         |         |         |      |
| Heat capacity Cm = Sum(A x k)                                             |             |                |                        |                  |              | (28) ... (30) + (32) + (32a) ... (32e) = | 5623.7100     | (34)    |         |         |         |         |      |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K                         |             |                |                        |                  |              |                                          | 123.5980      | (35)    |         |         |         |         |      |
| List of Thermal Bridges                                                   |             |                |                        |                  |              |                                          |               |         |         |         |         |         |      |
| K1 Element                                                                |             |                |                        | Length           | Psi-value    |                                          | Total         |         |         |         |         |         |      |
| E2 Other lintels (including other steel lintels)                          |             |                |                        | 4.6600           | 0.0840       |                                          | 0.3914        |         |         |         |         |         |      |
| E3 Sill                                                                   |             |                |                        | 1.6500           | 0.0340       |                                          | 0.0561        |         |         |         |         |         |      |
| E4 Jamb                                                                   |             |                |                        | 20.5800          | 0.0430       |                                          | 0.8849        |         |         |         |         |         |      |
| E5 Ground floor (normal)                                                  |             |                |                        | 20.0000          | 0.3200       |                                          | 6.4000        |         |         |         |         |         |      |
| E16 Corner (normal)                                                       |             |                |                        | 11.0000          | 0.0300       |                                          | 0.3300        |         |         |         |         |         |      |
| E18 Party wall between dwellings                                          |             |                |                        | 5.5000           | 0.0400       |                                          | 0.2200        |         |         |         |         |         |      |
| E7 Party floor between dwellings (in blocks of flats)                     |             |                |                        | 20.0000          | 0.0660       |                                          | 1.3200        |         |         |         |         |         |      |
| E10 Eaves (insulation at ceiling level)                                   |             |                |                        | 3.2000           | 0.0440       |                                          | 0.1408        |         |         |         |         |         |      |
| E17 Corner (inverted - internal area greater than external area)          |             |                |                        | 5.5000           | 0.0150       |                                          | 0.0825        |         |         |         |         |         |      |
| P1 Party wall - Ground floor                                              |             |                |                        | 10.1000          | 0.1600       |                                          | 1.6160        |         |         |         |         |         |      |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) |             |                |                        | 10.1000          | 0.0000       |                                          | 0.0000        |         |         |         |         |         |      |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                |             |                |                        |                  |              |                                          | 11.4418       | (36)    |         |         |         |         |      |
| Point Thermal bridges                                                     |             |                |                        |                  |              |                                          | (36a) =       | 0.0000  |         |         |         |         |      |
| Total fabric heat loss                                                    |             |                |                        |                  |              | (33) + (36) + (36a) =                    | 32.9713       | (37)    |         |         |         |         |      |
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)       |             |                |                        |                  |              |                                          |               |         |         |         |         |         |      |
| (38)m                                                                     | Jan         | Feb            | Mar                    | Apr              | May          | Jun                                      | Jul           | Aug     | Sep     | Oct     | Nov     | Dec     |      |
| Heat transfer coeff                                                       | 20.6456     | 20.6456        | 20.6456                | 20.6456          | 20.6456      | 20.6456                                  | 20.6456       | 20.6456 | 20.6456 | 20.6456 | 20.6456 | 20.6456 | (38) |
| Average = Sum(39)m / 12 =                                                 | 53.6169     | 53.6169        | 53.6169                | 53.6169          | 53.6169      | 53.6169                                  | 53.6169       | 53.6169 | 53.6169 | 53.6169 | 53.6169 | 53.6169 | (39) |
|                                                                           | 53.6169     | 53.6169        | 53.6169                | 53.6169          | 53.6169      | 53.6169                                  | 53.6169       | 53.6169 | 53.6169 | 53.6169 | 53.6169 | 53.6169 | (39) |

|               |        |        |        |        |        |        |        |        |        |        |        |        |      |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| HLP           | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |      |
| HLP (average) | 1.1784 | 1.1784 | 1.1784 | 1.1784 | 1.1784 | 1.1784 | 1.1784 | 1.1784 | 1.1784 | 1.1784 | 1.1784 | 1.1784 | (40) |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |      |

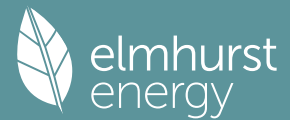
## 4. Water heating energy requirements (kWh/year)

|                                                                 |          |          |          |          |          |          |          |          |          |                    |          |               |                                                       |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------------|----------|---------------|-------------------------------------------------------|
| Assumed occupancy                                               |          |          |          |          |          |          |          |          |          |                    |          |               | 1.5590 (42)                                           |
| Hot water usage for mixer showers                               |          |          |          |          |          |          |          |          |          |                    |          |               |                                                       |
| 69.2425                                                         | 68.2019  | 66.6855  | 63.7843  | 61.6433  | 59.2556  | 57.8985  | 59.4034  | 61.0530  | 63.6166  | 66.5801            | 68.9772  | (42a)         |                                                       |
| Hot water usage for baths                                       |          |          |          |          |          |          |          |          |          |                    |          |               |                                                       |
| 21.7789                                                         | 21.4554  | 21.0000  | 20.1601  | 19.5313  | 18.8340  | 18.4573  | 18.9096  | 19.4021  | 20.1482  | 21.0054            | 21.7053  | (42b)         |                                                       |
| Hot water usage for other uses                                  |          |          |          |          |          |          |          |          |          |                    |          |               |                                                       |
| 30.5954                                                         | 29.4828  | 28.3702  | 27.2577  | 26.1451  | 25.0326  | 25.0326  | 26.1451  | 27.2577  | 28.3702  | 29.4828            | 30.5954  | (42c)         |                                                       |
| Average daily hot water use (litres/day)                        |          |          |          |          |          |          |          |          |          |                    |          |               | 111.8456 (43)                                         |
| Daily hot water use                                             | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct                | Nov      | Dec           |                                                       |
| 121.6167                                                        | 119.1401 | 116.0557 | 111.2021 | 107.3197 | 103.1222 | 101.3884 | 104.4581 | 107.7127 | 112.1350 | 117.0682           | 121.2778 | (44)          |                                                       |
| Energy content (annual)                                         | 192.6111 | 169.6539 | 178.3733 | 152.2302 | 144.4729 | 126.8008 | 122.6205 | 129.3410 | 132.8206 | 152.1662           | 166.7852 | 189.8917      | (45)                                                  |
| Distribution loss (46)m = 0.15 x (45)m                          |          |          |          |          |          |          |          |          |          | Total = Sum(45)m = |          | 1857.7673     |                                                       |
| 28.8917                                                         | 25.4481  | 26.7560  | 22.8345  | 21.6709  | 19.0201  | 18.3931  | 19.4011  | 19.9231  | 22.8249  | 25.0178            | 28.4838  | (46)          |                                                       |
| Water storage loss (or HIU loss):                               |          |          |          |          |          |          |          |          |          |                    |          |               |                                                       |
| Store volume                                                    |          |          |          |          |          |          |          |          |          |                    |          |               | 196.0000 (47)                                         |
| a) If manufacturer declared loss factor is known (kWh/day):     |          |          |          |          |          |          |          |          |          |                    |          |               | 1.3120 (48)                                           |
| Temperature factor from Table 2b                                |          |          |          |          |          |          |          |          |          |                    |          |               | 0.5400 (49)                                           |
| Enter (49) or (54) in (55)                                      |          |          |          |          |          |          |          |          |          |                    |          |               | 0.7085 (55)                                           |
| Total storage loss                                              |          |          |          |          |          |          |          |          |          |                    |          |               |                                                       |
| 21.9629                                                         | 19.8374  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  | 21.9629  | 21.2544  | 21.9629  | 21.2544            | 21.9629  | (56)          |                                                       |
| If cylinder contains dedicated solar storage                    |          |          |          |          |          |          |          |          |          |                    |          |               |                                                       |
| 21.9629                                                         | 19.8374  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  | 21.9629  | 21.2544  | 21.9629  | 21.2544            | 21.9629  | (57)          |                                                       |
| Primary loss                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000 (59)   |                                                       |
| Combi loss                                                      | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000 (61)   |                                                       |
| Total heat required for water heating calculated for each month |          |          |          |          |          |          |          |          |          |                    |          |               |                                                       |
| 214.5740                                                        | 189.4914 | 200.3362 | 173.4846 | 166.4358 | 148.0552 | 144.5834 | 151.3038 | 154.0750 | 174.1291 | 188.0396           | 211.8546 | (62)          |                                                       |
| WWHRS                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000 (63a)  |                                                       |
| PV diverter                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000 (63b)  |                                                       |
| Solar input                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000 (63c)  |                                                       |
| FGHRS                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000 (63d)  |                                                       |
| Output from w/h                                                 | 214.5740 | 189.4914 | 200.3362 | 173.4846 | 166.4358 | 148.0552 | 144.5834 | 151.3038 | 154.0750 | 174.1291           | 188.0396 | 211.8546 (64) |                                                       |
| Electric shower(s)                                              |          |          |          |          |          |          |          |          |          |                    |          |               | Total per year (kWh/year) = Sum(64)m = 2116.3625 (64) |
| 0.0000                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000 (64a)  |                                                       |
| Heat gains from water heating, kWh/month                        | 64.0432  | 56.4099  | 59.3091  | 50.6165  | 48.0373  | 42.1613  | 40.7713  | 43.0059  | 44.1628  | 50.5953            | 55.4561  | 63.1390 (65)  |                                                       |

## 5. Internal gains (see Table 5 and 5a)

|                                  |                                                                 |         |         |         |         |         |         |         |         |         |         |              |
|----------------------------------|-----------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Metabolic gains (Table 5), Watts |                                                                 |         |         |         |         |         |         |         |         |         |         |              |
|                                  | Jan                                                             | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| (66)m                            | 93.5378                                                         | 93.5378 | 93.5378 | 93.5378 | 93.5378 | 93.5378 | 93.5378 | 93.5378 | 93.5378 | 93.5378 | 93.5378 | 93.5378 (66) |
| Lighting gains                   | calculated in Appendix L, equation L9 or L9a), also see Table 5 |         |         |         |         |         |         |         |         |         |         |              |
|                                  | 19.4377                                                         | 17.2644 | 14.0404 | 10.6295 | 7.9456  | 6.7080  | 7.2483  | 9.4216  | 12.6456 | 16.0565 | 18.7404 | 19.9780 (67) |

# Full SAP Calculation Printout



|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 202.3439 | 204.4436 | 199.1525 | 187.8882 | 173.6691 | 160.3051 | 151.3771 | 149.2775 | 154.5686 | 165.8329 | 180.0520 | 193.4160 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127 (69)  |
| Pumps, fans                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (70)   |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 (71) |
| Water heating gains (Table 5)                                                       | 86.0796  | 83.9433  | 79.7166  | 70.3007  | 64.5662  | 58.5573  | 54.8001  | 57.8036  | 61.3373  | 68.0044  | 77.0223  | 84.8642 (72)  |
| Total internal gains                                                                | 384.9532 | 382.7434 | 370.0014 | 345.9104 | 323.2729 | 302.6625 | 290.5176 | 293.5947 | 305.6436 | 326.9858 | 352.9067 | 375.3502 (73) |

## 6. Solar gains

| [Jan]       |          |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c |          |          | Access<br>factor<br>Table 6d | Gains<br>W    |  |
|-------------|----------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|----------|----------|------------------------------|---------------|--|
| -----       |          |          |          |          |            |                                |                                   |                                    |          |          |                              |               |  |
| Northeast   |          |          |          |          | 0.7100     | 11.2829                        | 0.7600                            | 0.0000                             |          |          | 0.7700                       | 4.6880 (75)   |  |
| East        |          |          |          |          | 1.9300     | 19.6403                        | 0.7600                            | 0.0000                             |          |          | 0.7700                       | 22.1824 (76)  |  |
| Southeast   |          |          |          |          | 0.7100     | 36.7938                        | 0.7600                            | 0.0000                             |          |          | 0.7700                       | 15.2875 (77)  |  |
| West        |          |          |          |          | 4.4100     | 19.6403                        | 0.7600                            | 0.0000                             |          |          | 0.7700                       | 50.6863 (80)  |  |
| -----       |          |          |          |          |            |                                |                                   |                                    |          |          |                              |               |  |
| Solar gains | 92.8442  | 178.1294 | 287.5760 | 414.7564 | 506.9945   | 519.0809                       | 494.1084                          | 424.8126                           | 332.5572 | 209.5854 | 115.0683                     | 76.8350 (83)  |  |
| Total gains | 477.7974 | 560.8728 | 657.5774 | 760.6668 | 830.2674   | 821.7434                       | 784.6260                          | 718.4073                           | 638.2007 | 536.5712 | 467.9750                     | 452.1852 (84) |  |

## 7. Mean internal temperature (heating season)

|                                                                             |              |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|--------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) | 21.0000 (85) |         |         |         |         |         |         |         |         |         |         |              |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          | Jan          | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 29.1352      | 29.1352 | 29.1352 | 29.1352 | 29.1352 | 29.1352 | 29.1352 | 29.1352 | 29.1352 | 29.1352 | 29.1352 | 29.1352      |
| alpha                                                                       | 2.9423       | 2.9423  | 2.9423  | 2.9423  | 2.9423  | 2.9423  | 2.9423  | 2.9423  | 2.9423  | 2.9423  | 2.9423  | 2.9423       |
| util living area                                                            | 0.9198       | 0.8795  | 0.8051  | 0.6843  | 0.5388  | 0.3983  | 0.2945  | 0.3335  | 0.5242  | 0.7605  | 0.8874  | 0.9298 (86)  |
| MIT                                                                         | 19.2259      | 19.5605 | 20.0348 | 20.5010 | 20.8004 | 20.9385 | 20.9811 | 20.9725 | 20.8623 | 20.4181 | 19.7159 | 19.1310 (87) |
| Th 2                                                                        | 19.9373      | 19.9373 | 19.9373 | 19.9373 | 19.9373 | 19.9373 | 19.9373 | 19.9373 | 19.9373 | 19.9373 | 19.9373 | 19.9373 (88) |
| util rest of house                                                          | 0.9077       | 0.8625  | 0.7794  | 0.6467  | 0.4896  | 0.3379  | 0.2258  | 0.2601  | 0.4577  | 0.7199  | 0.8684  | 0.9190 (89)  |
| MIT 2                                                                       | 17.9165      | 18.3270 | 18.8989 | 19.4385 | 19.7616 | 19.8949 | 19.9284 | 19.9234 | 19.8332 | 19.3664 | 18.5297 | 17.7992 (90) |
| Living area fraction                                                        | 19.0158      | 19.3626 | 19.8525 | 20.3305 | 20.6337 | 20.7710 | 20.8122 | 20.8042 | 20.6972 | 20.2494 | 19.5256 | 18.9173 (92) |
| MIT                                                                         | 19.0158      | 19.3626 | 19.8525 | 20.3305 | 20.6337 | 20.7710 | 20.8122 | 20.8042 | 20.6972 | 20.2494 | 19.5256 | 18.9173 (93) |
| Temperature adjustment                                                      |              |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 19.0158      | 19.3626 | 19.8525 | 20.3305 | 20.6337 | 20.7710 | 20.8122 | 20.8042 | 20.6972 | 20.2494 | 19.5256 | 18.9173 (93) |

## 8. Space heating requirement

|                                                                                |          |          |          |          |          |          |          |          |          |               |          |                |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|----------|----------------|
| Utilisation                                                                    | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov      | Dec            |
| Useful gains                                                                   | 427.7987 | 477.9037 | 511.0297 | 502.8745 | 433.6441 | 316.8880 | 221.6950 | 230.0593 | 322.9427 | 393.0860      | 402.4341 | 409.9701 (95)  |
| Ext temp.                                                                      | 4.3000   | 4.9000   | 6.5000   | 8.9000   | 11.7000  | 16.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000   | 4.2000 (96)    |
| Heat loss rate W                                                               | 789.0163 | 775.4382 | 715.9209 | 612.8698 | 478.9977 | 330.8722 | 225.8468 | 236.1373 | 353.7221 | 517.3689      | 666.2224 | 789.0977 (97)  |
| Space heating kWh                                                              | 268.7459 | 199.9432 | 152.4390 | 79.1966  | 33.7431  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 92.4665       | 189.9276 | 282.0710 (98a) |
| Space heating requirement - total per year (kWh/year)                          |          |          |          |          |          |          |          |          |          |               |          | 1298.5328      |
| Solar heating kWh                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000   | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |          |          |          |          |          |          |          |          |          |               |          | 0.0000         |
| Space heating kWh                                                              | 268.7459 | 199.9432 | 152.4390 | 79.1966  | 33.7431  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 92.4665       | 189.9276 | 282.0710 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |          |          |          |          |          |          |          |          |          |               |          | 1298.5328      |
| Space heating per m2                                                           |          |          |          |          |          |          |          |          |          | (98c) / (4) = |          | 28.5392 (99)   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                       |                |          |          |          |          |          |          |          |          |          |          |                |
|-----------------------------------------------------------------------|----------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Fraction of space heat from secondary/supplementary system (Table 11) | 0.0000 (201)   |          |          |          |          |          |          |          |          |          |          |                |
| Fraction of space heat from main system(s)                            | 1.0000 (202)   |          |          |          |          |          |          |          |          |          |          |                |
| Fraction of main heating from main system 2                           | 0.0000 (203)   |          |          |          |          |          |          |          |          |          |          |                |
| Fraction of total heating from main system 1                          | 1.0000 (204)   |          |          |          |          |          |          |          |          |          |          |                |
| Fraction of total heating from main system 2                          | 0.0000 (205)   |          |          |          |          |          |          |          |          |          |          |                |
| Efficiency of main space heating system 1 (in %)                      | 100.0000 (206) |          |          |          |          |          |          |          |          |          |          |                |
| Efficiency of main space heating system 2 (in %)                      | 0.0000 (207)   |          |          |          |          |          |          |          |          |          |          |                |
| Efficiency of secondary/supplementary heating system, %               | 0.0000 (208)   |          |          |          |          |          |          |          |          |          |          |                |
| Space heating requirement                                             | Jan            | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec            |
| 268.7459                                                              | 199.9432       | 152.4390 | 79.1966  | 33.7431  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 92.4665  | 189.9276 | 282.0710 (98)  |
| Space heating efficiency (main heating system 1)                      | 100.0000       | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 100.0000 | 100.0000 | 100.0000 (210) |
| Space heating fuel (main heating system)                              | 268.7459       | 199.9432 | 152.4390 | 79.1966  | 33.7431  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 92.4665  | 189.9276 | 282.0710 (211) |
| Space heating efficiency (main heating system 2)                      | 0.0000         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)   |
| Space heating fuel (main heating system 2)                            | 0.0000         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)   |
| Space heating fuel (secondary)                                        | 0.0000         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)   |
| Space heating fuel used, main system 2                                |                |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)   |
| Water heating requirement                                             | 214.5740       | 189.4914 | 200.3362 | 173.4846 | 166.4358 | 148.0552 | 144.5834 | 151.3038 | 154.0750 | 174.1291 | 188.0396 | 211.8546 (64)  |
| Efficiency of water heater                                            | 313.4050       | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 (216) |
| (217)m                                                                | 313.4050       | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 (217) |
| Fuel for water heating, kWh/month                                     |                |          |          |          |          |          |          |          |          |          |          |                |

# Full SAP Calculation Printout



|                                                                                                      |         |         |         |         |         |         |         |         |         |         |         |           |        |
|------------------------------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|-----------|--------|
| Space cooling fuel requirement (221)m                                                                | 68.4654 | 60.4621 | 63.9225 | 55.3548 | 53.1057 | 47.2408 | 46.1331 | 48.2774 | 49.1616 | 55.5604 | 59.9989 | 67.5977   | (219)  |
| Pumps and Fa                                                                                         | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000    | (221)  |
| Lighting                                                                                             | 8.5958  | 7.7639  | 8.5958  | 8.3185  | 8.5958  | 8.3185  | 8.5958  | 8.3185  | 8.5958  | 8.3185  | 8.5958  | 8.3185    | (231)  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | 17.0137 | 13.6490 | 12.2894 | 9.0038  | 6.9548  | 5.6821  | 6.3444  | 8.2467  | 10.7116 | 14.0542 | 15.8742 | 17.4866   | (232)  |
| (233a)m                                                                                              | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000    | (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000    | (234a) |
| (234a)m                                                                                              | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000    | (234a) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000    | (235a) |
| (235a)m                                                                                              | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000    | (235a) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000    | (235c) |
| (235c)m                                                                                              | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000    | (235c) |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000    | (233b) |
| (233b)m                                                                                              | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000    | (233b) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000    | (234b) |
| (234b)m                                                                                              | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000    | (234b) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000    | (235b) |
| (235b)m                                                                                              | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000    | (235b) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000    | (235d) |
| (235d)m                                                                                              | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000    | (235d) |
| Annual totals kWh/year                                                                               |         |         |         |         |         |         |         |         |         |         |         |           |        |
| Space heating fuel - main system 1                                                                   |         |         |         |         |         |         |         |         |         |         |         | 1298.5328 | (211)  |
| Space heating fuel - main system 2                                                                   |         |         |         |         |         |         |         |         |         |         |         | 0.0000    | (213)  |
| Space heating fuel - secondary                                                                       |         |         |         |         |         |         |         |         |         |         |         | 0.0000    | (215)  |
| Efficiency of water heater                                                                           |         |         |         |         |         |         |         |         |         |         |         | 313.4050  |        |
| Water heating fuel used                                                                              |         |         |         |         |         |         |         |         |         |         |         | 675.2804  | (219)  |
| Space cooling fuel                                                                                   |         |         |         |         |         |         |         |         |         |         |         | 0.0000    | (221)  |
| Electricity for pumps and fans:                                                                      |         |         |         |         |         |         |         |         |         |         |         |           |        |
| (MEVCentralised, Database: in-use factor = 1.3000, SFP = 0.6630)                                     |         |         |         |         |         |         |         |         |         |         |         |           |        |
| mechanical ventilation fans (SFP = 0.6630)                                                           |         |         |         |         |         |         |         |         |         |         |         | 101.2086  | (230a) |
| Total electricity for the above, kWh/year                                                            |         |         |         |         |         |         |         |         |         |         |         | 101.2086  | (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |         |         |         |         |         |         |         |         |         |         |         | 137.3105  | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |         |         |         |         |         |         |         |         |         |         |         |           |        |
| PV generation                                                                                        |         |         |         |         |         |         |         |         |         |         |         | 0.0000    | (233)  |
| Wind generation                                                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000    | (234)  |
| Hydro-electric generation (Appendix N)                                                               |         |         |         |         |         |         |         |         |         |         |         | 0.0000    | (235a) |
| Electricity generated - Micro CHP (Appendix N)                                                       |         |         |         |         |         |         |         |         |         |         |         | 0.0000    | (235)  |
| Appendix Q - special features                                                                        |         |         |         |         |         |         |         |         |         |         |         |           |        |
| Energy saved or generated                                                                            |         |         |         |         |         |         |         |         |         |         |         | -0.0000   | (236)  |
| Energy used                                                                                          |         |         |         |         |         |         |         |         |         |         |         | 0.0000    | (237)  |
| Total delivered energy for all uses                                                                  |         |         |         |         |         |         |         |         |         |         |         | 2212.3322 | (238)  |

## 10a. Fuel costs - using Table 12 prices

|                                             | Fuel kWh/year | Fuel price p/kWh | Fuel cost £/year |
|---------------------------------------------|---------------|------------------|------------------|
| Space heating - main system 1               | 1298.5328     | 16.4900          | 214.1281 (240)   |
| Space heating - main system 2               | 0.0000        | 16.4900          | 0.0000 (241)     |
| Total CO2 associated with community systems |               |                  | 0.0000 (473)     |
| Water heating (other fuel)                  | 675.2804      | 16.4900          | 111.3537 (247)   |
| Energy for instantaneous electric shower(s) | 0.0000        | 16.4900          | 0.0000 (247a)    |
| Pumps, fans and electric keep-hot           | 101.2086      | 16.4900          | 16.6893 (249)    |
| Energy for lighting                         | 137.3105      | 16.4900          | 22.6425 (250)    |
| Additional standing charges                 |               |                  | 0.0000 (251)     |
| Total energy cost                           |               |                  | 364.8136 (255)   |

## 11a. SAP rating - Individual heating systems

|                                  |              |
|----------------------------------|--------------|
| Energy cost deflator (Table 12): | 0.3600 (256) |
| Energy cost factor (ECF)         | 1.4512 (257) |
| SAP value                        | 76.4762      |
| SAP rating (Section 12)          | 76 (258)     |
| SAP band                         | C            |

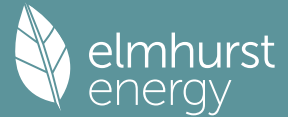
## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                             | Energy kWh/year | Emission factor kg CO2/kWh | Emissions kg CO2/year |
|---------------------------------------------|-----------------|----------------------------|-----------------------|
| Space heating - main system 1               | 1298.5328       | 0.1557                     | 202.1309 (261)        |
| Space heating - main system 2               | 0.0000          | 0.0000                     | 0.0000 (262)          |
| Total CO2 associated with community systems |                 |                            | 0.0000 (373)          |
| Water heating (other fuel)                  | 675.2804        | 0.1412                     | 95.3686 (264)         |
| Space and water heating                     |                 |                            | 297.4995 (265)        |
| Pumps, fans and electric keep-hot           | 101.2086        | 0.1387                     | 14.0389 (267)         |
| Energy for lighting                         | 137.3105        | 0.1443                     | 19.8181 (268)         |
| Total CO2, kg/year                          |                 |                            | 331.3565 (272)        |
| CO2 emissions per m2                        |                 |                            | 7.2800 (273)          |
| EI value                                    |                 |                            | 95.0937               |
| EI rating                                   |                 |                            | 95 (274)              |
| EI band                                     |                 |                            | A                     |

## 1. Overall dwelling characteristics

Area Storey height Volume

# Full SAP Calculation Printout



Main dwelling  
Ground floor  
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 45.5000  
Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 125.1250

## 2. Ventilation rate

Number of open chimneys 0 \* 80 = 0.0000 (6a)  
Number of open flues 0 \* 20 = 0.0000 (6b)  
Number of chimneys / flues attached to closed fire 0 \* 10 = 0.0000 (6c)  
Number of flues attached to solid fuel boiler 0 \* 20 = 0.0000 (6d)  
Number of flues attached to other heater 0 \* 35 = 0.0000 (6e)  
Number of blocked chimneys 0 \* 20 = 0.0000 (6f)  
Number of intermittent extract fans 0 \* 10 = 0.0000 (7a)  
Number of passive vents 0 \* 10 = 0.0000 (7b)  
Number of flueless gas fires 0 \* 40 = 0.0000 (7c)  
Air changes per hour 0.0000 / (5) = 0.0000 (8)  
Pressure test Yes  
Pressure Test Method Blower Door  
Measured/design AP50 4.0000 (17)  
Infiltration rate 0.2000 (18)  
Number of sides sheltered 1 (19)  
Shelter factor (20) = 1 - [0.075 x (19)] = 0.9250 (20)  
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1850 (21)

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |       |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| Wind speed                                                                                              | 4.3000 | 4.1000 | 4.1000 | 3.8000 | 3.9000 | 3.4000 | 3.4000 | 3.3000 | 3.4000 | 3.8000 | 3.7000 | 4.0000 | (22)  |
| Wind factor                                                                                             | 1.0750 | 1.0250 | 1.0250 | 0.9500 | 0.9750 | 0.8500 | 0.8500 | 0.8250 | 0.8500 | 0.9500 | 0.9250 | 1.0000 | (22a) |
| Adj infilt rate                                                                                         | 0.1989 | 0.1896 | 0.1896 | 0.1758 | 0.1804 | 0.1573 | 0.1573 | 0.1526 | 0.1573 | 0.1758 | 0.1711 | 0.1850 | (22b) |
| Mechanical extract ventilation - centralised                                                            |        |        |        |        |        |        |        |        |        |        |        |        |       |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 | (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.5000 | (23b) |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | (25)  |

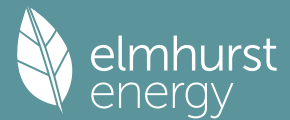
## 3. Heat losses and heat loss parameter

| Element                                                                   | Gross m2 | Openings m2 | NetArea m2 | U-value W/m2K        | A x U W/K | K-value kJ/m2K | A x K kJ/K            |              |
|---------------------------------------------------------------------------|----------|-------------|------------|----------------------|-----------|----------------|-----------------------|--------------|
| Main dwelling                                                             |          |             |            |                      |           |                |                       |              |
| Windows / Glazed Doors                                                    |          |             | 7.7600     | 1.1450               | 8.8855    |                |                       | (27)         |
| Heatloss Floor 1                                                          |          |             | 45.5000    | 0.1200               | 5.4600    | 75.0000        | 3412.5000             | (28a)        |
| External Wall                                                             | 55.0000  | 7.7600      | 47.2400    | 0.1500               | 7.0860    | 9.0000         | 425.1600              | (29a)        |
| Bay Roof                                                                  | 0.7000   |             | 0.7000     | 0.1400               | 0.0980    | 9.0000         | 6.3000                | (30)         |
| Total net area of external elements Aum(A, m2)                            |          |             | 101.2000   |                      |           |                |                       | (31)         |
| Fabric heat loss, W/K = Sum (A x U)                                       |          |             |            | (26)...(30) + (32) = | 21.5295   |                |                       | (33)         |
| Main dwelling                                                             |          |             |            |                      |           |                |                       |              |
| Party Wall 1                                                              |          |             | 27.7800    | 0.0000               | 0.0000    | 45.0000        | 1250.1000             | (32)         |
| Party Ceiling 1                                                           |          |             | 44.8000    |                      |           | 0.0000         | 0.0000                | (32b)        |
| Internal Wall 1                                                           |          |             | 58.8500    |                      |           | 9.0000         | 529.6500              | (32c)        |
| Heat capacity Cm = Sum(A x k)                                             |          |             |            |                      |           |                |                       |              |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K                         |          |             |            |                      |           |                |                       |              |
| List of Thermal Bridges                                                   |          |             |            |                      |           |                |                       |              |
| K1 Element                                                                |          |             |            | Length               | Psi-value | Total          |                       |              |
| E2 Other lintels (including other steel lintels)                          |          |             |            | 4.6600               | 0.0840    | 0.3914         |                       |              |
| E3 Sill                                                                   |          |             |            | 1.6500               | 0.0340    | 0.0561         |                       |              |
| E4 Jamb                                                                   |          |             |            | 20.5800              | 0.0430    | 0.8849         |                       |              |
| E5 Ground floor (normal)                                                  |          |             |            | 20.0000              | 0.3200    | 6.4000         |                       |              |
| E16 Corner (normal)                                                       |          |             |            | 11.0000              | 0.0300    | 0.3300         |                       |              |
| E18 Party wall between dwellings                                          |          |             |            | 5.5000               | 0.0400    | 0.2200         |                       |              |
| E7 Party floor between dwellings (in blocks of flats)                     |          |             |            | 20.0000              | 0.0660    | 1.3200         |                       |              |
| E10 Eaves (insulation at ceiling level)                                   |          |             |            | 3.2000               | 0.0440    | 0.1408         |                       |              |
| E17 Corner (inverted - internal area greater than external area)          |          |             |            | 5.5000               | 0.0150    | 0.0825         |                       |              |
| P1 Party wall - Ground floor                                              |          |             |            | 10.1000              | 0.1600    | 1.6160         |                       |              |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) |          |             |            | 10.1000              | 0.0000    | 0.0000         |                       |              |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                |          |             |            |                      |           |                | 11.4418               | (36)         |
| Point Thermal bridges                                                     |          |             |            |                      |           |                | 0.0000                |              |
| Total fabric heat loss                                                    |          |             |            |                      |           |                | (33) + (36) + (36a) = | 32.9713 (37) |
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)       |          |             |            |                      |           |                |                       |              |
| (38)m                                                                     | 20.6456  | 20.6456     | 20.6456    | 20.6456              | 20.6456   | 20.6456        | 20.6456               | 20.6456 (38) |
| Heat transfer coeff                                                       | 53.6169  | 53.6169     | 53.6169    | 53.6169              | 53.6169   | 53.6169        | 53.6169               | 53.6169 (39) |
| Average = Sum(39)m / 12 =                                                 |          |             |            |                      |           |                |                       | 53.6169      |
| HLP                                                                       | 1.1784   | 1.1784      | 1.1784     | 1.1784               | 1.1784    | 1.1784         | 1.1784                | 1.1784 (40)  |
| HLP (average)                                                             |          |             |            |                      |           |                |                       | 1.1784       |
| Days in mont                                                              | 31       | 28          | 31         | 30                   | 31        | 30             | 31                    | 31           |

## 4. Water heating energy requirements (kWh/year)

|                                          | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec           |               |
|------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------------|---------------|
| Assumed occupancy                        |         |         |         |         |         |         |         |         |         |         |         |               | 1.5590 (42)   |
| Hot water usage for mixer showers        |         |         |         |         |         |         |         |         |         |         |         |               |               |
| 69.2425                                  | 68.2019 | 66.6855 | 63.7843 | 61.6433 | 59.2556 | 57.8985 | 59.4034 | 61.0530 | 63.6166 | 66.5801 | 68.9772 | 68.9772 (42a) |               |
| Hot water usage for baths                |         |         |         |         |         |         |         |         |         |         |         |               |               |
| 21.7789                                  | 21.4554 | 21.0000 | 20.1601 | 19.5313 | 18.8340 | 18.4573 | 18.9096 | 19.4021 | 20.1482 | 21.0054 | 21.7053 | 21.7053 (42b) |               |
| Hot water usage for other uses           |         |         |         |         |         |         |         |         |         |         |         |               |               |
| 30.5954                                  | 29.4828 | 28.3702 | 27.2577 | 26.1451 | 25.0326 | 25.0326 | 26.1451 | 27.2577 | 28.3702 | 29.4828 | 30.5954 | 30.5954 (42c) |               |
| Average daily hot water use (litres/day) |         |         |         |         |         |         |         |         |         |         |         |               | 111.8456 (43) |
|                                          | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec           |               |

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|                                                                                |          |          |          |          |          |          |          |          |          |          |          |               |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Daily hot water use                                                            | 121.6167 | 119.1401 | 116.0557 | 111.2021 | 107.3197 | 103.1222 | 101.3884 | 104.4581 | 107.7127 | 112.1350 | 117.0682 | 121.2778 (44) |
| Energy conte                                                                   | 192.6111 | 169.6539 | 178.3733 | 152.2302 | 144.4729 | 126.8008 | 122.6205 | 129.3410 | 132.8206 | 152.1662 | 166.7852 | 189.8917 (45) |
| Energy content (annual)                                                        | 28.8917  | 25.4481  | 26.7560  | 22.8345  | 21.6709  | 19.0201  | 18.3931  | 19.4011  | 19.9231  | 22.8249  | 25.0178  | 28.4838 (46)  |
| Distribution loss (46)m = 0.15 x (45)m                                         |          |          |          |          |          |          |          |          |          |          |          |               |
| Water storage loss (or HIU loss):                                              |          |          |          |          |          |          |          |          |          |          |          |               |
| Store volume                                                                   |          |          |          |          |          |          |          |          |          |          |          | 196.0000 (47) |
| a) If manufacturer declared loss factor is known (kWh/day):                    |          |          |          |          |          |          |          |          |          |          |          | 1.3120 (48)   |
| Temperature factor from Table 2b                                               |          |          |          |          |          |          |          |          |          |          |          | 0.5400 (49)   |
| Enter (49) or (54) in (55)                                                     |          |          |          |          |          |          |          |          |          |          |          | 0.7085 (55)   |
| Total storage loss                                                             |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                | 21.9629  | 19.8374  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629 (56)  |
| If cylinder contains dedicated solar storage                                   |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                | 21.9629  | 19.8374  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629 (57)  |
| Primary loss                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (59)   |
| Combi loss                                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (61)   |
| Total heat required for water heating calculated for each month                |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                | 214.5740 | 189.4914 | 200.3362 | 173.4846 | 166.4358 | 148.0552 | 144.5834 | 151.3038 | 154.0750 | 174.1291 | 188.0396 | 211.8546 (62) |
| WWHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63a)  |
| PV diverter                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63b)  |
| Solar input                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63c)  |
| FGHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63d)  |
| Output from w/h                                                                |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                | 214.5740 | 189.4914 | 200.3362 | 173.4846 | 166.4358 | 148.0552 | 144.5834 | 151.3038 | 154.0750 | 174.1291 | 188.0396 | 211.8546 (64) |
| Electric shower(s)                                                             |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (64a)  |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (64a)  |
| Heat gains from water heating, kWh/month                                       |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                | 64.0432  | 56.4099  | 59.3091  | 50.6165  | 48.0373  | 42.1613  | 40.7713  | 43.0059  | 44.1628  | 50.5953  | 55.4561  | 63.1390 (65)  |

## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |          |      |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| Metabolic gains (Table 5), Watts                                                    | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |      |
| (66)m                                                                               | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 19.4377  | 17.2644  | 14.0404  | 10.6295  | 7.9456   | 6.7080   | 7.2483   | 9.4216   | 12.6456  | 16.0565  | 18.7404  | 19.9780  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 202.3439 | 204.4436 | 199.1525 | 187.8882 | 173.6691 | 160.3051 | 151.3771 | 149.2775 | 154.5686 | 165.8329 | 180.0520 | 193.4160 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | (69) |
| Pumps, fans                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | (71) |
| Water heating gains (Table 5)                                                       | 86.0796  | 83.9433  | 79.7166  | 70.3007  | 64.5662  | 58.5573  | 54.8001  | 57.8036  | 61.3373  | 68.0044  | 77.0223  | 84.8642  | (72) |
| Total internal gains                                                                | 384.9532 | 382.7434 | 370.0014 | 345.9104 | 323.2729 | 302.6625 | 290.5176 | 293.5947 | 305.6436 | 326.9858 | 352.9067 | 375.3502 | (73) |

## 6. Solar gains

| [Jan]       |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | Specific data<br>or Table 6b | g        | FF       | Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W   |               |
|-------------|----------|----------|----------|------------|--------------------------------|------------------------------|----------|----------|------------------------------|------------------------------|--------------|---------------|
| Northeast   |          |          |          | 0.7100     | 13.7804                        |                              | 0.7600   | 0.0000   |                              | 0.7700                       | 5.7257 (75)  |               |
| East        |          |          |          | 1.9300     | 23.8018                        |                              | 0.7600   | 0.0000   |                              | 0.7700                       | 26.8826 (76) |               |
| Southeast   |          |          |          | 0.7100     | 43.0593                        |                              | 0.7600   | 0.0000   |                              | 0.7700                       | 17.8908 (77) |               |
| West        |          |          |          | 4.4100     | 23.8018                        |                              | 0.7600   | 0.0000   |                              | 0.7700                       | 61.4260 (80) |               |
|             |          |          |          |            |                                |                              |          |          |                              |                              |              |               |
| Solar gains | 111.9250 | 187.7506 | 300.8610 | 440.1107   | 523.7043                       | 566.9794                     | 534.4573 | 471.4426 | 370.7634                     | 237.1121                     | 136.6813     | 93.1365 (83)  |
| Total gains | 496.8782 | 570.4940 | 670.8624 | 786.0211   | 846.9773                       | 869.6418                     | 824.9749 | 765.0373 | 676.4069                     | 564.0979                     | 489.5881     | 468.4867 (84) |

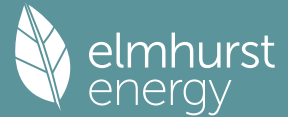
## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 29.1352 | 29.1352 | 29.1352 | 29.1352 | 29.1352 | 29.1352 | 29.1352 | 29.1352 | 29.1352 | 29.1352 | 29.1352 | 29.1352      |
| alpha                                                                       | 2.9423  | 2.9423  | 2.9423  | 2.9423  | 2.9423  | 2.9423  | 2.9423  | 2.9423  | 2.9423  | 2.9423  | 2.9423  | 2.9423       |
| util living area                                                            | 0.9033  | 0.8626  | 0.7766  | 0.6354  | 0.4750  | 0.3128  | 0.2127  | 0.2356  | 0.4460  | 0.7071  | 0.8600  | 0.9146 (86)  |
| MIT                                                                         | 19.4292 | 19.7227 | 20.1898 | 20.6276 | 20.8757 | 20.9738 | 20.9942 | 20.9920 | 20.9221 | 20.5701 | 19.9261 | 19.3499 (87) |
| Th 2                                                                        | 19.9373 | 19.9373 | 19.9373 | 19.9373 | 19.9373 | 19.9373 | 19.9373 | 19.9373 | 19.9373 | 19.9373 | 19.9373 | 19.9373 (88) |
| util rest of house                                                          | 0.8886  | 0.8429  | 0.7471  | 0.5933  | 0.4216  | 0.2517  | 0.1450  | 0.1631  | 0.3759  | 0.6592  | 0.8362  | 0.9012 (89)  |
| MIT 2                                                                       | 18.1697 | 18.5269 | 19.0834 | 19.5788 | 19.8364 | 19.9224 | 19.9356 | 19.9348 | 19.8851 | 19.5352 | 18.7857 | 18.0732 (90) |
| Living area fraction                                                        |         |         |         |         |         |         |         |         |         |         |         |              |
| MIT                                                                         | 19.2271 | 19.5309 | 20.0123 | 20.4593 | 20.7090 | 20.8051 | 20.8243 | 20.8224 | 20.7558 | 20.4040 | 19.7431 | 19.1451 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 19.2271 | 19.5309 | 20.0123 | 20.4593 | 20.7090 | 20.8051 | 20.8243 | 20.8224 | 20.7558 | 20.4040 | 19.7431 | 19.1451 (93) |

## 8. Space heating requirement

|                                                       | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec            |
|-------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Utilisation                                           | 0.8772   | 0.8345   | 0.7493   | 0.6146   | 0.4608   | 0.3018   | 0.2016   | 0.2236   | 0.4304   | 0.6812   | 0.8313   | 0.8895 (94)    |
| Useful gains                                          | 435.8633 | 476.0885 | 502.6845 | 483.0527 | 390.2900 | 262.4659 | 166.2885 | 171.0919 | 291.1397 | 384.2478 | 407.0158 | 416.7077 (95)  |
| Ext temp.                                             | 5.1000   | 5.7000   | 7.4000   | 9.9000   | 12.9000  | 15.8000  | 17.7000  | 17.6000  | 15.0000  | 11.5000  | 8.0000   | 5.1000 (96)    |
| Heat loss rate W                                      | 757.4521 | 741.5688 | 676.2311 | 566.1567 | 418.6921 | 268.3576 | 167.5161 | 172.7754 | 308.6057 | 477.4067 | 629.6285 | 753.0548 (97)  |
| Space heating kWh                                     | 239.2621 | 178.4027 | 129.1186 | 59.8349  | 21.1312  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 69.3103  | 160.2811 | 250.2422 (98a) |
| Space heating requirement - total per year (kWh/year) |          |          |          |          |          |          |          |          |          |          |          | 1107.5831      |
| Solar heating kWh                                     |          |          |          |          |          |          |          |          |          |          |          |                |

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|                                                                                |          |          |          |         |         |        |        |        |        |               |          |                |
|--------------------------------------------------------------------------------|----------|----------|----------|---------|---------|--------|--------|--------|--------|---------------|----------|----------------|
| Solar heating contribution - total per year (kWh/year)                         | 0.0000   | 0.0000   | 0.0000   | 0.0000  | 0.0000  | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000        | 0.0000   | 0.0000 (98b)   |
| Space heating kWh                                                              | 239.2621 | 178.4027 | 129.1186 | 59.8349 | 21.1312 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 69.3103       | 160.2811 | 250.2422 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |          |          |          |         |         |        |        |        |        |               |          | 1107.5831      |
| Space heating per m2                                                           |          |          |          |         |         |        |        |        |        | (98c) / (4) = |          | 24.3425 (99)   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |                 |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)    |
| Fraction of space heat from main system(s)                                                           |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)    |
| Fraction of main heating from main system 2                                                          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (203)    |
| Fraction of total heating from main system 1                                                         |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (204)    |
| Fraction of total heating from main system 2                                                         |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (205)    |
| Efficiency of main space heating system 1 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 100.0000 (206)  |
| Efficiency of main space heating system 2 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                              |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
| Space heating requirement                                                                            | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| 239.2621                                                                                             | 178.4027 | 129.1186 | 59.8349  | 21.1312  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 69.3103  | 160.2811 | 250.2422 (98)   |
| Space heating efficiency (main heating system 1)                                                     | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 100.0000 | 100.0000 | 100.0000 (210)  |
| Space heating fuel (main heating system)                                                             | 239.2621 | 178.4027 | 129.1186 | 59.8349  | 21.1312  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 69.3103  | 160.2811 | 250.2422 (211)  |
| Space heating efficiency (main heating system 2)                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |
| Space heating fuel (secondary)                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Space heating fuel used, main system 2                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Water heating requirement                                                                            | 214.5740 | 189.4914 | 200.3362 | 173.4846 | 166.4358 | 148.0552 | 144.5834 | 151.3038 | 154.0750 | 174.1291 | 188.0396 | 211.8546 (64)   |
| Efficiency of water heater                                                                           | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 (216)  |
| Fuel for water heating, kWh/month                                                                    | 68.4654  | 60.4621  | 63.9225  | 55.3548  | 53.1057  | 47.2408  | 46.1331  | 48.2774  | 49.1616  | 55.5604  | 59.9989  | 67.5977 (219)   |
| Space cooling fuel requirement                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                                         | 8.5958   | 7.7639   | 8.5958   | 8.3185   | 8.5958   | 8.3185   | 8.5958   | 8.5958   | 8.3185   | 8.5958   | 8.3185   | 8.5958 (231)    |
| Lighting                                                                                             | 17.0137  | 13.6490  | 12.2894  | 9.0038   | 6.9548   | 5.6821   | 6.3444   | 8.2467   | 10.7116  | 14.0542  | 15.8742  | 17.4866 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (233a)   |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (233b)   |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 1107.5831 (211) |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 313.4050        |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          | 675.2804 (219)  |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (221)    |
| Electricity for pumps and fans:                                                                      |          |          |          |          |          |          |          |          |          |          |          |                 |
| (MEVCentralised, Database: in-use factor = 1.3000, SFP = 0.6630)                                     |          |          |          |          |          |          |          |          |          |          |          |                 |
| mechanical ventilation fans (SFP = 0.6630)                                                           |          |          |          |          |          |          |          |          |          |          |          | 101.2086 (230a) |
| Total electricity for the above, kWh/year                                                            |          |          |          |          |          |          |          |          |          |          |          | 101.2086 (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |          |          |          |          |          |          |          |          | 137.3105 (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| PV generation                                                                                        |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (233)    |
| Wind generation                                                                                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (234)    |
| Hydro-electric generation (Appendix N)                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (235a)   |
| Electricity generated - Micro CHP (Appendix N)                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (235)    |
| Appendix Q - special features                                                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| Energy saved or generated                                                                            |          |          |          |          |          |          |          |          |          |          |          | -0.0000 (236)   |
| Energy used                                                                                          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (237)    |
| Total delivered energy for all uses                                                                  |          |          |          |          |          |          |          |          |          |          |          | 2021.3826 (238) |

## 10a. Fuel costs - using BEDF prices (585)

|                                             |           |            |                |
|---------------------------------------------|-----------|------------|----------------|
|                                             | Fuel      | Fuel price | Fuel cost      |
|                                             | kWh/year  | p/kWh      | £/year         |
| Space heating - main system 1               | 1107.5831 | 28.4300    | 314.8859 (240) |
| Space heating - main system 2               | 0.0000    | 28.4300    | 0.0000 (241)   |
| Total CO2 associated with community systems |           |            | 0.0000 (473)   |
| Water heating (other fuel)                  | 675.2804  | 28.4300    | 191.9822 (247) |
| Energy for instantaneous electric shower(s) | 0.0000    | 28.4300    | 0.0000 (247a)  |
| Pumps, fans and electric keep-hot           | 101.2086  | 28.4300    | 28.7736 (249)  |
| Energy for lighting                         | 137.3105  | 28.4300    | 39.0374 (250)  |
| Additional standing charges                 |           |            | 0.0000 (251)   |
| Total energy cost                           |           |            | 574.6791 (255) |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|  |          |                 |             |
|--|----------|-----------------|-------------|
|  | Energy   | Emission factor | Emissions   |
|  | kWh/year | kg CO2/kWh      | kg CO2/year |

# Full SAP Calculation Printout



|                                             |           |        |                |
|---------------------------------------------|-----------|--------|----------------|
| Space heating - main system 1               | 1107.5831 | 0.1563 | 173.0631 (261) |
| Space heating - main system 2               | 0.0000    | 0.0000 | 0.0000 (262)   |
| Total CO2 associated with community systems |           |        | 0.0000 (373)   |
| Water heating (other fuel)                  | 675.2804  | 0.1412 | 95.3686 (264)  |
| Space and water heating                     |           |        | 268.4317 (265) |
| Pumps, fans and electric keep-hot           | 101.2086  | 0.1387 | 14.0389 (267)  |
| Energy for lighting                         | 137.3105  | 0.1443 | 19.8181 (268)  |
| Total CO2, kg/year                          |           |        | 302.2887 (272) |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy kWh/year | Primary energy factor kg CO2/kWh | Primary energy kWh/year |
|---------------------------------------------|-----------------|----------------------------------|-------------------------|
| Space heating - main system 1               | 1107.5831       | 1.5785                           | 1748.2700 (275)         |
| Space heating - main system 2               | 0.0000          | 0.0000                           | 0.0000 (276)            |
| Total CO2 associated with community systems |                 |                                  | 0.0000 (473)            |
| Water heating (other fuel)                  | 675.2804        | 1.5222                           | 1027.9298 (278)         |
| Space and water heating                     |                 |                                  | 2776.1998 (279)         |
| Pumps, fans and electric keep-hot           | 101.2086        | 1.5128                           | 153.1084 (281)          |
| Energy for lighting                         | 137.3105        | 1.5338                           | 210.6114 (282)          |
| Total Primary energy kWh/year               |                 |                                  | 3139.9196 (286)         |

## SAP 10 EPC IMPROVEMENTS

### Electric Panel Heaters HC

|                                      |      |
|--------------------------------------|------|
| Current energy efficiency rating:    | C 76 |
| Current environmental impact rating: | A 95 |

|                             |                |
|-----------------------------|----------------|
| N Solar water heating       | Not applicable |
| U Solar photovoltaic panels | Not applicable |
| V2 Wind turbine             | Not applicable |

| Recommended measures: | SAP change | Cost change | CO2 change |
|-----------------------|------------|-------------|------------|
| (none)                |            |             |            |

| Recommended measures | Typical annual savings | Energy efficiency | Environmental impact |
|----------------------|------------------------|-------------------|----------------------|
| (none)               |                        |                   |                      |
| Total Savings        | £0                     | 0.00 kg/m²        |                      |

|                                        |      |
|----------------------------------------|------|
| Potential energy efficiency rating:    | C 76 |
| Potential environmental impact rating: | A 95 |

Fuel prices for cost data on this page from database revision number 585 TEST (31 Oct 2025)  
Recommendation texts revision number 6.1 (11 Jun 2019)

### Typical heating and lighting costs of this home (per year, Thames Valley):

|                          | Current £575 | Potential £575 | Saving £0  |
|--------------------------|--------------|----------------|------------|
| Electricity              |              |                |            |
| Space heating            | £344         | £344           | £0         |
| Water heating            | £192         | £192           | £0         |
| Lighting                 | £39          | £39            | £0         |
| Total cost of fuels      | £575         | £575           | £0         |
| Total cost of uses       | £575         | £575           | £0         |
| Delivered energy         | 44 kWh/m²    | 44 kWh/m²      | 0 kWh/m²   |
| Carbon dioxide emissions | 0.3 tonnes   | 0.3 tonnes     | 0.0 tonnes |
| CO2 emissions per m²     | 7 kg/m²      | 7 kg/m²        | 0 kg/m²    |
| Primary energy           | 69 kWh/m²    | 69 kWh/m²      | 0 kWh/m²   |

## SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

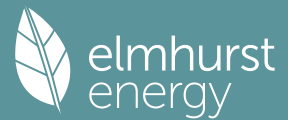
### 1. Overall dwelling characteristics

|                                                         | Area (m2)    | Storey height (m)                | Volume (m3)            |
|---------------------------------------------------------|--------------|----------------------------------|------------------------|
| Main dwelling                                           | 45.5000 (1b) | x 2.7500 (2b)                    | = 125.1250 (1b) - (3b) |
| Ground floor                                            |              |                                  |                        |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n) | 45.5000      |                                  | (4)                    |
| Dwelling volume                                         |              | (3a)+(3b)+(3c)+(3d)+(3e)... (3n) | = 125.1250 (5)         |

### 2. Ventilation rate

|                                                    | m3 per hour          |
|----------------------------------------------------|----------------------|
| Number of open chimneys                            | 0 * 80 = 0.0000 (6a) |
| Number of open flues                               | 0 * 20 = 0.0000 (6b) |
| Number of chimneys / flues attached to closed fire | 0 * 10 = 0.0000 (6c) |
| Number of flues attached to solid fuel boiler      | 0 * 20 = 0.0000 (6d) |
| Number of flues attached to other heater           | 0 * 35 = 0.0000 (6e) |
| Number of blocked chimneys                         | 0 * 20 = 0.0000 (6f) |

# Full SAP Calculation Printout



Number of intermittent extract fans 0 \* 10 = 0.0000 (7a)  
Number of passive vents 0 \* 10 = 0.0000 (7b)  
Number of flueless gas fires 0 \* 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)  
Pressure test Yes  
Pressure Test Method Blower Door  
Measured/design AP50 4.0000 (17)  
Infiltration rate 0.2000 (18)  
Number of sides sheltered 1 (19)  
Shelter factor (20) = 1 - [0.075 x (19)] = 0.9250 (20)  
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1850 (21)

|                                                                                                         |        |        |        |        |        |        |        |        |        |        |        |              |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate                                                                                         | 0.2359 | 0.2313 | 0.2266 | 0.2035 | 0.1989 | 0.1758 | 0.1758 | 0.1711 | 0.1850 | 0.1989 | 0.2081 | 0.2174 (22b) |
| Mechanical extract ventilation - centralised                                                            |        |        |        |        |        |        |        |        |        |        |        |              |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

### 3. Heat losses and heat loss parameter

| Element                                                                   | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K     | A x U<br>W/K | K-value<br>kJ/m2K | A x K<br>kJ/K                                       |
|---------------------------------------------------------------------------|-------------|----------------|---------------|----------------------|--------------|-------------------|-----------------------------------------------------|
| Main dwelling                                                             |             |                |               |                      |              |                   |                                                     |
| Windows / Glazed Doors                                                    |             |                | 7.7600        | 1.1450               | 8.8855       |                   |                                                     |
| Heatloss Floor 1                                                          |             |                | 45.5000       | 0.1200               | 5.4600       | 75.0000           | 3412.5000 (28a)                                     |
| External Wall                                                             | 55.0000     | 7.7600         | 47.2400       | 0.1500               | 7.0860       | 9.0000            | 425.1600 (29a)                                      |
| Bay Roof                                                                  | 0.7000      |                | 0.7000        | 0.1400               | 0.0980       | 9.0000            | 6.3000 (30)                                         |
| Total net area of external elements Aum(A, m2)                            |             |                | 101.2000      |                      |              |                   |                                                     |
| Fabric heat loss, W/K = Sum (A x U)                                       |             |                |               | (26)...(30) + (32) = | 21.5295      |                   |                                                     |
| Main dwelling                                                             |             |                |               |                      |              |                   |                                                     |
| Party Wall 1                                                              |             |                | 27.7800       | 0.0000               | 0.0000       | 45.0000           | 1250.1000 (32)                                      |
| Party Ceiling 1                                                           |             |                | 44.8000       |                      |              | 0.0000            | 0.0000 (32b)                                        |
| Internal Wall 1                                                           |             |                | 58.8500       |                      |              | 9.0000            | 529.6500 (32c)                                      |
| Heat capacity Cm = Sum(A x k)                                             |             |                |               |                      |              |                   | (28)...(30) + (32) + (32a)...(32e) = 5623.7100 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K                         |             |                |               |                      |              |                   | 123.5980 (35)                                       |
| List of Thermal Bridges                                                   |             |                |               |                      |              |                   |                                                     |
| K1 Element                                                                |             |                |               | Length               | Psi-value    | Total             |                                                     |
| E2 Other lintels (including other steel lintels)                          |             |                |               | 4.6600               | 0.0840       | 0.3914            |                                                     |
| E3 Sill                                                                   |             |                |               | 1.6500               | 0.0340       | 0.0561            |                                                     |
| E4 Jamb                                                                   |             |                |               | 20.5800              | 0.0430       | 0.8849            |                                                     |
| E5 Ground floor (normal)                                                  |             |                |               | 20.0000              | 0.3200       | 6.4000            |                                                     |
| E16 Corner (normal)                                                       |             |                |               | 11.0000              | 0.0300       | 0.3300            |                                                     |
| E18 Party wall between dwellings                                          |             |                |               | 5.5000               | 0.0400       | 0.2200            |                                                     |
| E7 Party floor between dwellings (in blocks of flats)                     |             |                |               | 20.0000              | 0.0660       | 1.3200            |                                                     |
| E10 Eaves (insulation at ceiling level)                                   |             |                |               | 3.2000               | 0.0440       | 0.1408            |                                                     |
| E17 Corner (inverted - internal area greater than external area)          |             |                |               | 5.5000               | 0.0150       | 0.0825            |                                                     |
| P1 Party wall - Ground floor                                              |             |                |               | 10.1000              | 0.1600       | 1.6160            |                                                     |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) |             |                |               | 10.1000              | 0.0000       | 0.0000            |                                                     |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                |             |                |               |                      |              |                   | 11.4418 (36)                                        |
| Point Thermal bridges                                                     |             |                |               |                      |              |                   | (36a) = 0.0000                                      |
| Total fabric heat loss                                                    |             |                |               |                      |              |                   | (33) + (36) + (36a) = 32.9713 (37)                  |

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

|                           |         |         |         |         |         |         |         |         |         |         |         |              |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
|                           | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| (38)m                     | 20.6456 | 20.6456 | 20.6456 | 20.6456 | 20.6456 | 20.6456 | 20.6456 | 20.6456 | 20.6456 | 20.6456 | 20.6456 | 20.6456 (38) |
| Heat transfer coeff       | 53.6169 | 53.6169 | 53.6169 | 53.6169 | 53.6169 | 53.6169 | 53.6169 | 53.6169 | 53.6169 | 53.6169 | 53.6169 | 53.6169 (39) |
| Average = Sum(39)m / 12 = |         |         |         |         |         |         |         |         |         |         |         | 53.6169      |

|               |        |        |        |        |        |        |        |        |        |        |        |             |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec         |
| HLP           | 1.1784 | 1.1784 | 1.1784 | 1.1784 | 1.1784 | 1.1784 | 1.1784 | 1.1784 | 1.1784 | 1.1784 | 1.1784 | 1.1784 (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 1.1784      |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31          |

### 4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.5590 (42)

Hot water usage for mixer showers

|         |         |         |         |         |         |         |         |         |         |         |               |     |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------------|-----|
|         | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov           | Dec |
| 69.2425 | 68.2019 | 66.6855 | 63.7843 | 61.6433 | 59.2556 | 57.8985 | 59.4034 | 61.0530 | 63.6166 | 66.5801 | 68.9772 (42a) |     |

Hot water usage for baths

|         |         |         |         |         |         |         |         |         |         |         |               |     |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------------|-----|
|         | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov           | Dec |
| 21.7789 | 21.4554 | 21.0000 | 20.1601 | 19.5313 | 18.8340 | 18.4573 | 18.9096 | 19.4021 | 20.1482 | 21.0054 | 21.7053 (42b) |     |

Hot water usage for other uses

|         |         |         |         |         |         |         |         |         |         |         |               |     |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------------|-----|
|         | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov           | Dec |
| 30.5954 | 29.4828 | 28.3702 | 27.2577 | 26.1451 | 25.0326 | 25.0326 | 26.1451 | 27.2577 | 28.3702 | 29.4828 | 30.5954 (42c) |     |

Average daily hot water use (litres/day)

|          |          |          |          |          |          |          |          |          |          |          |               |     |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|-----|
|          | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov           | Dec |
| 121.6167 | 119.1401 | 116.0557 | 111.2021 | 107.3197 | 103.1222 | 101.3884 | 104.4581 | 107.7127 | 112.1350 | 117.0682 | 121.2778 (44) |     |

Energy conte 192.6111 169.6539 178.3733 152.2302 144.4729 126.8008 122.6205 129.3410 132.8206 152.1662 166.7852 189.8917 (45)

Energy content (annual)

Distribution loss (46)m = 0.15 x (45)m

|         |         |         |         |         |         |         |         |         |         |         |              |     |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|-----|
|         | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov          | Dec |
| 28.8917 | 25.4481 | 26.7560 | 22.8345 | 21.6709 | 19.0201 | 18.3931 | 19.4011 | 19.9231 | 22.8249 | 25.0178 | 28.4838 (46) |     |

Water storage loss (or HIU loss):

Store volume 196.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day):

Temperature factor from Table 2b 1.3120 (48)

Enter (49) or (54) in (55) 0.5400 (49)

Total storage loss 0.7085 (55)

21.9629 19.8374 21.9629 21.2544 21.9629 21.2544 21.9629 21.9629 21.2544 21.9629 21.2544 21.9629 (56)

If cylinder contains dedicated solar storage

|         |         |         |         |         |         |         |         |         |         |         |              |     |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|-----|
|         | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov          | Dec |
| 21.9629 | 19.8374 | 21.9629 | 21.2544 | 21.9629 | 21.2544 | 21.9629 | 21.9629 | 21.2544 | 21.9629 | 21.2544 | 21.9629 (57) |     |

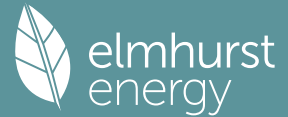
Primary loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (59)

Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)

Total heat required for water heating calculated for each month

|          |          |          |          |          |          |          |          |          |          |          |               |     |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|-----|
|          | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov           | Dec |
| 214.5740 | 189.4914 | 200.3362 | 173.4846 | 166.4358 | 148.0552 | 144.5834 | 151.3038 | 154.0750 | 174.1291 | 188.0396 | 211.8546 (62) |     |

# Full SAP Calculation Printout



|                                                                                |          |          |          |          |          |          |          |          |          |          |          |          |                |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| WWHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63a)   |
| PV diverter                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63b)   |
| Solar input                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63c)   |
| FGHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63d)   |
| Output from w/h                                                                | 214.5740 | 189.4914 | 200.3362 | 173.4846 | 166.4358 | 148.0552 | 144.5834 | 151.3038 | 154.0750 | 174.1291 | 188.0396 | 211.8546 | (64)           |
| Total per year (kWh/year) = Sum(64)m =                                         |          |          |          |          |          |          |          |          |          |          |          |          | 2116.3625 (64) |
| Electric shower(s)                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (64a)   |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (64a)   |
| Heat gains from water heating, kWh/month                                       | 64.0432  | 56.4099  | 59.3091  | 50.6165  | 48.0373  | 42.1613  | 40.7713  | 43.0059  | 44.1628  | 50.5953  | 55.4561  | 63.1390  | (65)           |

## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |          |      |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| Metabolic gains (Table 5), Watts                                                    | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |      |
| (66)m                                                                               | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 19.4377  | 17.2644  | 14.0404  | 10.6295  | 7.9456   | 6.7080   | 7.2483   | 9.4216   | 12.6456  | 16.0565  | 18.7404  | 19.9780  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 202.3439 | 204.4436 | 199.1525 | 187.8882 | 173.6691 | 160.3051 | 151.3771 | 149.2775 | 154.5686 | 165.8329 | 180.0520 | 193.4160 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | (69) |
| Pumps, fans                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | (71) |
| Water heating gains (Table 5)                                                       | 86.0796  | 83.9433  | 79.7166  | 70.3007  | 64.5662  | 58.5573  | 54.8001  | 57.8036  | 61.3373  | 68.0044  | 77.0223  | 84.8642  | (72) |
| Total internal gains                                                                | 384.9532 | 382.7434 | 370.0014 | 345.9104 | 323.2729 | 302.6625 | 290.5176 | 293.5947 | 305.6436 | 326.9858 | 352.9067 | 375.3502 | (73) |

## 6. Solar gains

| [Jan]       |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 |          | g<br>Specific data<br>or Table 6b |          | FF<br>Specific data<br>or Table 6c |          | Access<br>factor<br>Table 6d |  | Gains<br>W    |
|-------------|----------|----------|----------|------------|--------------------------------|----------|-----------------------------------|----------|------------------------------------|----------|------------------------------|--|---------------|
|             |          |          |          |            |                                |          |                                   |          |                                    |          |                              |  |               |
| Northeast   |          |          |          | 0.7100     | 11.2829                        |          | 0.7600                            |          | 0.0000                             |          | 0.7700                       |  | 4.6880 (75)   |
| East        |          |          |          | 1.9300     | 19.6403                        |          | 0.7600                            |          | 0.0000                             |          | 0.7700                       |  | 22.1824 (76)  |
| Southeast   |          |          |          | 0.7100     | 36.7938                        |          | 0.7600                            |          | 0.0000                             |          | 0.7700                       |  | 15.2875 (77)  |
| West        |          |          |          | 4.4100     | 19.6403                        |          | 0.7600                            |          | 0.0000                             |          | 0.7700                       |  | 50.6863 (80)  |
|             |          |          |          |            |                                |          |                                   |          |                                    |          |                              |  |               |
| Solar gains | 92.8442  | 178.1294 | 287.5760 | 414.7564   | 506.9945                       | 519.0809 | 494.1084                          | 424.8126 | 332.5572                           | 209.5854 | 115.0683                     |  | 76.8350 (83)  |
| Total gains | 477.7974 | 560.8728 | 657.5774 | 760.6668   | 830.2674                       | 821.7434 | 784.6260                          | 718.4073 | 638.2007                           | 536.5712 | 467.9750                     |  | 452.1852 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |              |
| tau                                                                         | 29.1352 | 29.1352 | 29.1352 | 29.1352 | 29.1352 | 29.1352 | 29.1352 | 29.1352 | 29.1352 | 29.1352 | 29.1352 | 29.1352 |              |
| alpha                                                                       | 2.9423  | 2.9423  | 2.9423  | 2.9423  | 2.9423  | 2.9423  | 2.9423  | 2.9423  | 2.9423  | 2.9423  | 2.9423  | 2.9423  |              |
| util living area                                                            | 0.9198  | 0.8795  | 0.8051  | 0.6843  | 0.5388  | 0.3983  | 0.2945  | 0.3335  | 0.5242  | 0.7605  | 0.8874  | 0.9298  | (86)         |
| MIT                                                                         | 19.2259 | 19.5605 | 20.0348 | 20.5010 | 20.8004 | 20.9385 | 20.9811 | 20.9725 | 20.8623 | 20.4181 | 19.7159 | 19.1310 | (87)         |
| Th 2                                                                        | 19.9373 | 19.9373 | 19.9373 | 19.9373 | 19.9373 | 19.9373 | 19.9373 | 19.9373 | 19.9373 | 19.9373 | 19.9373 | 19.9373 | (88)         |
| util rest of house                                                          | 0.9077  | 0.8625  | 0.7794  | 0.6467  | 0.4896  | 0.3379  | 0.2258  | 0.2601  | 0.4577  | 0.7199  | 0.8684  | 0.9190  | (89)         |
| MIT 2                                                                       | 17.9165 | 18.3270 | 18.8989 | 19.4385 | 19.7616 | 19.8949 | 19.9284 | 19.9234 | 19.8332 | 19.3664 | 18.5297 | 17.7992 | (90)         |
| Living area fraction                                                        | 19.0158 | 19.3626 | 19.8525 | 20.3305 | 20.6337 | 20.7710 | 20.8122 | 20.8042 | 20.6972 | 20.2494 | 19.5256 | 18.9173 | (92)         |
| MIT                                                                         | 19.0158 | 19.3626 | 19.8525 | 20.3305 | 20.6337 | 20.7710 | 20.8122 | 20.8042 | 20.6972 | 20.2494 | 19.5256 | 18.9173 | (92)         |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000  |              |
| adjusted MIT                                                                | 19.0158 | 19.3626 | 19.8525 | 20.3305 | 20.6337 | 20.7710 | 20.8122 | 20.8042 | 20.6972 | 20.2494 | 19.5256 | 18.9173 | (93)         |

## 8. Space heating requirement

|                                                                                |          |          |          |          |          |          |          |          |          |          |          |          |                            |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------------------|
| Utilisation                                                                    | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |                            |
|                                                                                | 0.8954   | 0.8521   | 0.7771   | 0.6611   | 0.5223   | 0.3856   | 0.2825   | 0.3202   | 0.5060   | 0.7326   | 0.8599   | 0.9066   | (94)                       |
| Useful gains                                                                   | 427.7987 | 477.9037 | 511.0297 | 502.8745 | 433.6441 | 316.8880 | 221.6950 | 230.0593 | 322.9427 | 393.0860 | 402.4341 | 409.9701 | (95)                       |
| Ext temp.                                                                      | 4.3000   | 4.9000   | 6.5000   | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000  | 7.1000   | 4.2000   | (96)                       |
| Heat loss rate W                                                               | 789.0163 | 775.4382 | 715.9209 | 612.8698 | 478.9977 | 330.8722 | 225.8468 | 236.1373 | 353.7221 | 517.3689 | 666.2224 | 789.0977 | (97)                       |
| Space heating kWh                                                              | 268.7459 | 199.9432 | 152.4390 | 79.1966  | 33.7431  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 92.4665  | 189.9276 | 282.0710 | (98a)                      |
| Space heating requirement - total per year (kWh/year)                          |          |          |          |          |          |          |          |          |          |          |          |          | 1298.5328                  |
| Solar heating kWh                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (98b)                      |
| Solar heating contribution - total per year (kWh/year)                         |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000                     |
| Space heating kWh                                                              | 268.7459 | 199.9432 | 152.4390 | 79.1966  | 33.7431  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 92.4665  | 189.9276 | 282.0710 | (98c)                      |
| Space heating requirement after solar contribution - total per year (kWh/year) |          |          |          |          |          |          |          |          |          |          |          |          | 1298.5328                  |
| Space heating per m <sup>2</sup>                                               |          |          |          |          |          |          |          |          |          |          |          |          | (98c) / (4) = 28.5392 (99) |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                       |          |       |
|-----------------------------------------------------------------------|----------|-------|
| Fraction of space heat from secondary/supplementary system (Table 11) | 0.0000   | (201) |
| Fraction of space heat from main system(s)                            | 1.0000   | (202) |
| Fraction of main heating from main system 2                           | 0.0000   | (203) |
| Fraction of total heating from main system 1                          | 1.0000   | (204) |
| Fraction of total heating from main system 2                          | 0.0000   | (205) |
| Efficiency of main space heating system 1 (in %)                      | 100.0000 | (206) |
| Efficiency of main space heating system 2 (in %)                      | 0.0000   | (207) |

# Full SAP Calculation Printout



|                                                                                                              |          |          |          |          |          |          |          |          |          |          |          |                 |
|--------------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Efficiency of secondary/supplementary heating system, %                                                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
|                                                                                                              | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                                                                    | 268.7459 | 199.9432 | 152.4390 | 79.1966  | 33.7431  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 92.4665  | 189.9276 | 282.0710 (98)   |
| Space heating efficiency (main heating system 1)                                                             | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 100.0000 | 100.0000 | 100.0000 (210)  |
| Space heating fuel (main heating system)                                                                     | 268.7459 | 199.9432 | 152.4390 | 79.1966  | 33.7431  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 92.4665  | 189.9276 | 282.0710 (211)  |
| Space heating efficiency (main heating system 2)                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |
| Space heating fuel (secondary)                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Space heating fuel used, main system 2                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Water heating requirement                                                                                    | 214.5740 | 189.4914 | 200.3362 | 173.4846 | 166.4358 | 148.0552 | 144.5834 | 151.3038 | 154.0750 | 174.1291 | 188.0396 | 211.8546 (64)   |
| Efficiency of water heater (217)m                                                                            | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 (216)  |
| Fuel for water heating, kWh/month                                                                            | 68.4654  | 60.4621  | 63.9225  | 55.3548  | 53.1057  | 47.2408  | 46.1331  | 48.2774  | 49.1616  | 55.5604  | 59.9989  | 67.5977 (219)   |
| Space cooling fuel requirement (221)m                                                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                                                 | 8.5958   | 7.7639   | 8.5958   | 8.3185   | 8.5958   | 8.3185   | 8.5958   | 8.5958   | 8.3185   | 8.5958   | 8.3185   | 8.5958 (231)    |
| Lighting                                                                                                     | 17.0137  | 13.6490  | 12.2894  | 9.0038   | 6.9548   | 5.6821   | 6.3444   | 8.2467   | 10.7116  | 14.0542  | 15.8742  | 17.4866 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity) (233a)m                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (233a)   |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity) (233b)m                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (233b)   |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |
| Annual totals kWh/year                                                                                       |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system 1                                                                           |          |          |          |          |          |          |          |          |          |          |          | 1298.5328 (211) |
| Space heating fuel - main system 2                                                                           |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |
| Efficiency of water heater                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 313.4050        |
| Water heating fuel used                                                                                      |          |          |          |          |          |          |          |          |          |          |          | 675.2804 (219)  |
| Space cooling fuel                                                                                           |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (221)    |
| Electricity for pumps and fans:                                                                              |          |          |          |          |          |          |          |          |          |          |          |                 |
| (MEVCentralised, Database: in-use factor = 1.3000, SFP = 0.6630)                                             |          |          |          |          |          |          |          |          |          |          |          |                 |
| mechanical ventilation fans (SFP = 0.6630)                                                                   |          |          |          |          |          |          |          |          |          |          |          | 101.2086 (230a) |
| Total electricity for the above, kWh/year                                                                    |          |          |          |          |          |          |          |          |          |          |          | 101.2086 (231)  |
| Electricity for lighting (calculated in Appendix L)                                                          |          |          |          |          |          |          |          |          |          |          |          | 137.3105 (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                                |          |          |          |          |          |          |          |          |          |          |          |                 |
| PV generation                                                                                                |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (233)    |
| Wind generation                                                                                              |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (234)    |
| Hydro-electric generation (Appendix N)                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (235a)   |
| Electricity generated - Micro CHP (Appendix N)                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (235)    |
| Appendix Q - special features                                                                                |          |          |          |          |          |          |          |          |          |          |          |                 |
| Energy saved or generated                                                                                    |          |          |          |          |          |          |          |          |          |          |          | -0.0000 (236)   |
| Energy used                                                                                                  |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (237)    |
| Total delivered energy for all uses                                                                          |          |          |          |          |          |          |          |          |          |          |          | 2212.3322 (238) |

## 10a. Fuel costs - using Table 12 prices

|                                             | Fuel<br>kWh/year | Fuel price<br>p/kWh | Fuel cost<br>£/year |
|---------------------------------------------|------------------|---------------------|---------------------|
| Space heating - main system 1               | 1298.5328        | 16.4900             | 214.1281 (240)      |
| Space heating - main system 2               | 0.0000           | 16.4900             | 0.0000 (241)        |
| Total CO2 associated with community systems |                  |                     | 0.0000 (473)        |
| Water heating (other fuel)                  | 675.2804         | 16.4900             | 111.3537 (247)      |
| Energy for instantaneous electric shower(s) | 0.0000           | 16.4900             | 0.0000 (247a)       |
| Pumps, fans and electric keep-hot           | 101.2086         | 16.4900             | 16.6893 (249)       |
| Energy for lighting                         | 137.3105         | 16.4900             | 22.6425 (250)       |
| Additional standing charges                 |                  |                     | 0.0000 (251)        |
| Total energy cost                           |                  |                     | 364.8136 (255)      |

## 11a. SAP rating - Individual heating systems

|                                  |                                  |              |
|----------------------------------|----------------------------------|--------------|
| Energy cost deflator (Table 12): |                                  | 0.3600 (256) |
| Energy cost factor (ECF)         | [(255) x (256)] / [(4) + 45.0] = | 1.4512 (257) |
| SAP value                        |                                  | 76.4762      |
| SAP rating (Section 12)          |                                  | 76 (258)     |
| SAP band                         |                                  | C            |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|---------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1               | 1298.5328          | 0.1557                        | 202.1309 (261)           |
| Space heating - main system 2               | 0.0000             | 0.0000                        | 0.0000 (262)             |
| Total CO2 associated with community systems |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                  | 675.2804           | 0.1412                        | 95.3686 (264)            |
| Space and water heating                     |                    |                               | 297.4995 (265)           |
| Pumps, fans and electric keep-hot           | 101.2086           | 0.1387                        | 14.0389 (267)            |
| Energy for lighting                         | 137.3105           | 0.1443                        | 19.8181 (268)            |
| Total CO2, kg/year                          |                    |                               | 331.3565 (272)           |

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CO2 emissions per m2 7.2800 (273)  
 EI value 95.0937  
 EI rating 95 (274)  
 EI band A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
 CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

## 1. Overall dwelling characteristics

|                                                        |              |                                 |                      |
|--------------------------------------------------------|--------------|---------------------------------|----------------------|
| Main dwelling                                          | Area (m2)    | Storey height (m)               | Volume (m3)          |
| Ground floor                                           | 45.5000 (1b) | 2.7500 (2b)                     | 125.1250 (1b) - (3b) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 45.5000      |                                 | (4)                  |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | 125.1250 (5)         |

## 2. Ventilation rate

|                                                    |          |             |
|----------------------------------------------------|----------|-------------|
| Number of open chimneys                            | 0 * 80 = | 0.0000 (6a) |
| Number of open flues                               | 0 * 20 = | 0.0000 (6b) |
| Number of chimneys / flues attached to closed fire | 0 * 10 = | 0.0000 (6c) |
| Number of flues attached to solid fuel boiler      | 0 * 20 = | 0.0000 (6d) |
| Number of flues attached to other heater           | 0 * 35 = | 0.0000 (6e) |
| Number of blocked chimneys                         | 0 * 20 = | 0.0000 (6f) |
| Number of intermittent extract fans                | 0 * 10 = | 0.0000 (7a) |
| Number of passive vents                            | 0 * 10 = | 0.0000 (7b) |
| Number of flueless gas fires                       | 0 * 40 = | 0.0000 (7c) |

Air changes per hour  
 Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)  
 Pressure test Yes  
 Pressure Test Method Blower Door  
 Measured/design AP50 4.0000 (17)  
 Infiltration rate 0.2000 (18)  
 Number of sides sheltered 1 (19)  
 Shelter factor (20) = 1 - [0.075 x (19)] = 0.9250 (20)  
 Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1850 (21)

|                                                                                                         |        |        |        |        |        |        |        |        |        |        |        |              |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
| Wind factor                                                                                             | 4.3000 | 4.1000 | 4.1000 | 3.8000 | 3.9000 | 3.4000 | 3.4000 | 3.3000 | 3.4000 | 3.8000 | 3.7000 | 4.0000 (22)  |
| Adj infilt rate                                                                                         | 1.0750 | 1.0250 | 1.0250 | 0.9500 | 0.9750 | 0.8500 | 0.8500 | 0.8250 | 0.8500 | 0.9500 | 0.9250 | 1.0000 (22a) |
|                                                                                                         | 0.1989 | 0.1896 | 0.1896 | 0.1758 | 0.1804 | 0.1573 | 0.1573 | 0.1526 | 0.1573 | 0.1758 | 0.1711 | 0.1850 (22b) |
| Mechanical extract ventilation - centralised                                                            |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        |              |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

## 3. Heat losses and heat loss parameter

|                                                |          |             |            |                      |           |                |                 |
|------------------------------------------------|----------|-------------|------------|----------------------|-----------|----------------|-----------------|
| Element                                        | Gross m2 | Openings m2 | NetArea m2 | U-value W/m2K        | A x U W/K | K-value kJ/m2K | A x K kJ/K      |
| Main dwelling                                  |          |             |            |                      |           |                |                 |
| Windows / Glazed Doors                         |          |             | 7.7600     | 1.1450               | 8.8855    |                | (27)            |
| Heatloss Floor 1                               |          |             | 45.5000    | 0.1200               | 5.4600    | 75.0000        | 3412.5000 (28a) |
| External Wall                                  | 55.0000  | 7.7600      | 47.2400    | 0.1500               | 7.0860    | 9.0000         | 425.1600 (29a)  |
| Bay Roof                                       | 0.7000   |             | 0.7000     | 0.1400               | 0.0980    | 9.0000         | 6.3000 (30)     |
| Total net area of external elements Aum(A, m2) |          |             | 101.2000   |                      |           |                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)            |          |             |            | (26)...(30) + (32) = | 21.5295   |                | (33)            |
| Main dwelling                                  |          |             |            |                      |           |                |                 |
| Party Wall 1                                   |          |             | 27.7800    | 0.0000               | 0.0000    | 45.0000        | 1250.1000 (32)  |
| Party Ceiling 1                                |          |             | 44.8000    |                      |           | 0.0000         | 0.0000 (32b)    |
| Internal Wall 1                                |          |             | 58.8500    |                      |           | 9.0000         | 529.6500 (32c)  |

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 5623.7100 (34)  
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 123.5980 (35)

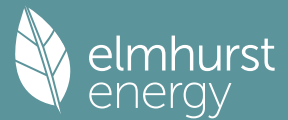
List of Thermal Bridges

|                                                                           |         |           |                                    |
|---------------------------------------------------------------------------|---------|-----------|------------------------------------|
| K1 Element                                                                | Length  | Psi-value | Total                              |
| E2 Other lintels (including other steel lintels)                          | 4.6600  | 0.0840    | 0.3914                             |
| E3 Sill                                                                   | 1.6500  | 0.0340    | 0.0561                             |
| E4 Jamb                                                                   | 20.5800 | 0.0430    | 0.8849                             |
| E5 Ground floor (normal)                                                  | 20.0000 | 0.3200    | 6.4000                             |
| E16 Corner (normal)                                                       | 11.0000 | 0.0300    | 0.3300                             |
| E18 Party wall between dwellings                                          | 5.5000  | 0.0400    | 0.2200                             |
| E7 Party floor between dwellings (in blocks of flats)                     | 20.0000 | 0.0660    | 1.3200                             |
| E10 Eaves (insulation at ceiling level)                                   | 3.2000  | 0.0440    | 0.1408                             |
| E17 Corner (inverted - internal area greater than external area)          | 5.5000  | 0.0150    | 0.0825                             |
| P1 Party wall - Ground floor                                              | 10.1000 | 0.1600    | 1.6160                             |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | 10.1000 | 0.0000    | 0.0000                             |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                |         |           | 11.4418 (36)                       |
| Point Thermal bridges                                                     |         |           | (36a) = 0.0000                     |
| Total fabric heat loss                                                    |         |           | (33) + (36) + (36a) = 32.9713 (37) |

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

|                     |         |         |         |         |         |         |         |         |         |         |         |              |
|---------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| (38)m               | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| Heat transfer coeff | 20.6456 | 20.6456 | 20.6456 | 20.6456 | 20.6456 | 20.6456 | 20.6456 | 20.6456 | 20.6456 | 20.6456 | 20.6456 | 20.6456 (38) |
|                     | 53.6169 | 53.6169 | 53.6169 | 53.6169 | 53.6169 | 53.6169 | 53.6169 | 53.6169 | 53.6169 | 53.6169 | 53.6169 | 53.6169 (39) |

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Average = Sum(39)m / 12 =

53.6169

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |      |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| HLP           | 1.1784 | 1.1784 | 1.1784 | 1.1784 | 1.1784 | 1.1784 | 1.1784 | 1.1784 | 1.1784 | 1.1784 | 1.1784 | 1.1784 | (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 1.1784 |      |
| Days in month | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |      |

## 4. Water heating energy requirements (kWh/year)

|                                                                 |          |          |          |          |          |          |          |          |          |                                        |          |           |                                                                                             |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------------------------------|----------|-----------|---------------------------------------------------------------------------------------------|
| Assumed occupancy                                               |          |          |          |          |          |          |          |          |          |                                        |          |           | 1.5590 (42)                                                                                 |
| Hot water usage for mixer showers                               |          |          |          |          |          |          |          |          |          |                                        |          |           |                                                                                             |
| 69.2425                                                         | 68.2019  | 66.6855  | 63.7843  | 61.6433  | 59.2556  | 57.8985  | 59.4034  | 61.0530  | 63.6166  | 66.5801                                | 68.9772  | (42a)     |                                                                                             |
| Hot water usage for baths                                       |          |          |          |          |          |          |          |          |          |                                        |          |           |                                                                                             |
| 21.7789                                                         | 21.4554  | 21.0000  | 20.1601  | 19.5313  | 18.8340  | 18.4573  | 18.9096  | 19.4021  | 20.1482  | 21.0054                                | 21.7053  | (42b)     |                                                                                             |
| Hot water usage for other uses                                  |          |          |          |          |          |          |          |          |          |                                        |          |           |                                                                                             |
| 30.5954                                                         | 29.4828  | 28.3702  | 27.2577  | 26.1451  | 25.0326  | 25.0326  | 26.1451  | 27.2577  | 28.3702  | 29.4828                                | 30.5954  | (42c)     |                                                                                             |
| Average daily hot water use (litres/day)                        |          |          |          |          |          |          |          |          |          |                                        |          |           | 111.8456 (43)                                                                               |
| Daily hot water use                                             | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct                                    | Nov      | Dec       |                                                                                             |
| 121.6167                                                        | 119.1401 | 116.0557 | 111.2021 | 107.3197 | 103.1222 | 101.3884 | 104.4581 | 107.7127 | 112.1350 | 117.0682                               | 121.2778 | (44)      |                                                                                             |
| Energy content (annual)                                         | 192.6111 | 169.6539 | 178.3733 | 152.2302 | 144.4729 | 126.8008 | 122.6205 | 129.3410 | 132.8206 | 152.1662                               | 166.7852 | 189.8917  | (45)                                                                                        |
| Distribution loss (46)m = 0.15 x (45)m                          |          |          |          |          |          |          |          |          |          | Total = Sum(45)m =                     |          | 1857.7673 |                                                                                             |
| 28.8917                                                         | 25.4481  | 26.7560  | 22.8345  | 21.6709  | 19.0201  | 18.3931  | 19.4011  | 19.9231  | 22.8249  | 25.0178                                | 28.4838  | (46)      |                                                                                             |
| Water storage loss (or HIU loss):                               |          |          |          |          |          |          |          |          |          |                                        |          |           |                                                                                             |
| Store volume                                                    |          |          |          |          |          |          |          |          |          |                                        |          |           | 196.0000 (47)                                                                               |
| a) If manufacturer declared loss factor is known (kWh/day):     |          |          |          |          |          |          |          |          |          |                                        |          |           | 1.3120 (48)                                                                                 |
| Temperature factor from Table 2b                                |          |          |          |          |          |          |          |          |          |                                        |          |           | 0.5400 (49)                                                                                 |
| Enter (49) or (54) in (55)                                      |          |          |          |          |          |          |          |          |          |                                        |          |           | 0.7085 (55)                                                                                 |
| Total storage loss                                              |          |          |          |          |          |          |          |          |          |                                        |          |           |                                                                                             |
| 21.9629                                                         | 19.8374  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  | 21.9629  | 21.9629  | 21.2544  | 21.9629                                | 21.2544  | 21.9629   | (56)                                                                                        |
| If cylinder contains dedicated solar storage                    |          |          |          |          |          |          |          |          |          |                                        |          |           |                                                                                             |
| 21.9629                                                         | 19.8374  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  | 21.9629  | 21.9629  | 21.2544  | 21.9629                                | 21.2544  | 21.9629   | (57)                                                                                        |
| Primary loss                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000    | (59)                                                                                        |
| Combi loss                                                      | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000    | (61)                                                                                        |
| Total heat required for water heating calculated for each month |          |          |          |          |          |          |          |          |          |                                        |          |           |                                                                                             |
| 214.5740                                                        | 189.4914 | 200.3362 | 173.4846 | 166.4358 | 148.0552 | 144.5834 | 151.3038 | 154.0750 | 174.1291 | 188.0396                               | 211.8546 | (62)      |                                                                                             |
| WWHRS                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000    | (63a)                                                                                       |
| PV diverter                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000    | (63b)                                                                                       |
| Solar input                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000    | (63c)                                                                                       |
| FGHRS                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000    | (63d)                                                                                       |
| Output from w/h                                                 |          |          |          |          |          |          |          |          |          |                                        |          |           |                                                                                             |
| 214.5740                                                        | 189.4914 | 200.3362 | 173.4846 | 166.4358 | 148.0552 | 144.5834 | 151.3038 | 154.0750 | 174.1291 | 188.0396                               | 211.8546 | (64)      |                                                                                             |
| Electric shower(s)                                              |          |          |          |          |          |          |          |          |          | Total per year (kWh/year) = Sum(64)m = |          | 2116.3625 | (64)                                                                                        |
| 0.0000                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | (64a)     |                                                                                             |
|                                                                 |          |          |          |          |          |          |          |          |          |                                        |          |           | Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a) |
| Heat gains from water heating, kWh/month                        |          |          |          |          |          |          |          |          |          |                                        |          |           |                                                                                             |
| 64.0432                                                         | 56.4099  | 59.3091  | 50.6165  | 48.0373  | 42.1613  | 40.7713  | 43.0059  | 44.1628  | 50.5953  | 55.4561                                | 63.1390  | (65)      |                                                                                             |

## 5. Internal gains (see Table 5 and 5a)

| Metabolic gains (Table 5), Watts                                                    |          |          |          |          |          |          |          |          |          |          |          |          |      |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
|                                                                                     | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |      |
| (66)m                                                                               | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 19.4377  | 17.2644  | 14.0404  | 10.6295  | 7.9456   | 6.7080   | 7.2483   | 9.4216   | 12.6456  | 16.0565  | 18.7404  | 19.9780  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 202.3439 | 204.4436 | 199.1525 | 187.8882 | 173.6691 | 160.3051 | 151.3771 | 149.2775 | 154.5686 | 165.8329 | 180.0520 | 193.4160 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | (69) |
| Pumps, fans                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | (71) |
| Water heating gains (Table 5)                                                       | 86.0796  | 83.9433  | 79.7166  | 70.3007  | 64.5662  | 58.5573  | 54.8001  | 57.8036  | 61.3373  | 68.0044  | 77.0223  | 84.8642  | (72) |
| Total internal gains                                                                | 384.9532 | 382.7434 | 370.0014 | 345.9104 | 323.2729 | 302.6625 | 290.5176 | 293.5947 | 305.6436 | 326.9858 | 352.9067 | 375.3502 | (73) |

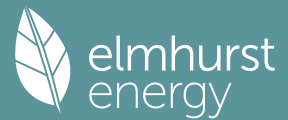
## 6. Solar gains

| [Jan]       |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | Specific data<br>or Table 6b | g        | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W   |          |               |
|-------------|----------|----------|----------|------------|--------------------------------|------------------------------|----------|------------------------------------|------------------------------|--------------|----------|---------------|
| -----       |          |          |          |            |                                |                              |          |                                    |                              |              |          |               |
| Northeast   |          |          |          | 0.7100     | 13.7804                        | 0.7600                       |          | 0.0000                             | 0.7700                       | 5.7257 (75)  |          |               |
| East        |          |          |          | 1.9300     | 23.8018                        | 0.7600                       |          | 0.0000                             | 0.7700                       | 26.8826 (76) |          |               |
| Southeast   |          |          |          | 0.7100     | 43.0593                        | 0.7600                       |          | 0.0000                             | 0.7700                       | 17.8908 (77) |          |               |
| West        |          |          |          | 4.4100     | 23.8018                        | 0.7600                       |          | 0.0000                             | 0.7700                       | 61.4260 (80) |          |               |
| -----       |          |          |          |            |                                |                              |          |                                    |                              |              |          |               |
| Solar gains | 111.9250 | 187.7506 | 300.8610 | 440.1107   | 523.7043                       | 566.9794                     | 534.4573 | 471.4426                           | 370.7634                     | 237.1121     | 136.6813 | 93.1365 (83)  |
| Total gains | 496.8782 | 570.4940 | 670.8624 | 786.0211   | 846.9773                       | 869.6418                     | 824.9749 | 765.0373                           | 676.4069                     | 564.0979     | 489.5881 | 468.4867 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 29.1352 | 29.1352 | 29.1352 | 29.1352 | 29.1352 | 29.1352 | 29.1352 | 29.1352 | 29.1352 | 29.1352 | 29.1352 | 29.1352      |
| alpha                                                                       | 2.9423  | 2.9423  | 2.9423  | 2.9423  | 2.9423  | 2.9423  | 2.9423  | 2.9423  | 2.9423  | 2.9423  | 2.9423  | 2.9423       |
| util living area                                                            |         |         |         |         |         |         |         |         |         |         |         |              |
|                                                                             | 0.9033  | 0.8626  | 0.7766  | 0.6354  | 0.4750  | 0.3128  | 0.2127  | 0.2356  | 0.4460  | 0.7071  | 0.8600  | 0.9146 (86)  |
| MIT                                                                         | 19.4292 | 19.7227 | 20.1898 | 20.6276 | 20.8757 | 20.9738 | 20.9942 | 20.9920 | 20.9221 | 20.5701 | 19.9261 | 19.3499 (87) |
| Th 2                                                                        | 19.9373 | 19.9373 | 19.9373 | 19.9373 | 19.9373 | 19.9373 | 19.9373 | 19.9373 | 19.9373 | 19.9373 | 19.9373 | 19.9373 (88) |
| util rest of house                                                          |         |         |         |         |         |         |         |         |         |         |         |              |

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|                        |         |         |         |         |         |         |         |         |                           |         |         |              |
|------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|
| MIT 2                  | 0.8886  | 0.8429  | 0.7471  | 0.5933  | 0.4216  | 0.2517  | 0.1450  | 0.1631  | 0.3759                    | 0.6592  | 0.8362  | 0.9012 (89)  |
| Living area fraction   | 18.1697 | 18.5269 | 19.0834 | 19.5788 | 19.8364 | 19.9224 | 19.9356 | 19.9348 | 19.8851                   | 19.5352 | 18.7857 | 18.0732 (90) |
| MIT                    | 19.2271 | 19.5309 | 20.0123 | 20.4593 | 20.7090 | 20.8051 | 20.8243 | 20.8224 | fLA = Living area / (4) = |         |         | 0.8396 (91)  |
| Temperature adjustment |         |         |         |         |         |         |         |         | 20.7558                   | 20.4040 | 19.7431 | 19.1451 (92) |
| adjusted MIT           | 19.2271 | 19.5309 | 20.0123 | 20.4593 | 20.7090 | 20.8051 | 20.8243 | 20.8224 | 20.7558                   | 20.4040 | 19.7431 | 19.1451 (93) |

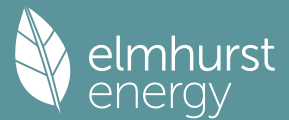
## 8. Space heating requirement

|                                                                                |          |          |          |          |          |          |          |          |          |          |               |           |       |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|-----------|-------|
|                                                                                | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov           | Dec       |       |
| Utilisation                                                                    | 0.8772   | 0.8345   | 0.7493   | 0.6146   | 0.4608   | 0.3018   | 0.2016   | 0.2236   | 0.4304   | 0.6812   | 0.8313        | 0.8895    | (94)  |
| Useful gains                                                                   | 435.8633 | 476.0885 | 502.6845 | 483.0527 | 390.2900 | 262.4659 | 166.2885 | 171.0919 | 291.1397 | 384.2478 | 407.0158      | 416.7077  | (95)  |
| Ext temp.                                                                      | 5.1000   | 5.7000   | 7.4000   | 9.9000   | 12.9000  | 15.8000  | 17.7000  | 17.6000  | 15.0000  | 11.5000  | 8.0000        | 5.1000    | (96)  |
| Heat loss rate W                                                               | 757.4521 | 741.5688 | 676.2311 | 566.1567 | 418.6921 | 268.3576 | 167.5161 | 172.7754 | 308.6057 | 477.4067 | 629.6285      | 753.0548  | (97)  |
| Space heating kWh                                                              | 239.2621 | 178.4027 | 129.1186 | 59.8349  | 21.1312  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 69.3103  | 160.2811      | 250.2422  | (98a) |
| Space heating requirement - total per year (kWh/year)                          |          |          |          |          |          |          |          |          |          |          |               | 1107.5831 |       |
| Solar heating kWh                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | (98b) |
| Solar heating contribution - total per year (kWh/year)                         |          |          |          |          |          |          |          |          |          |          |               | 0.0000    |       |
| Space heating kWh                                                              | 239.2621 | 178.4027 | 129.1186 | 59.8349  | 21.1312  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 69.3103  | 160.2811      | 250.2422  | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |          |          |          |          |          |          |          |          |          |          |               | 1107.5831 |       |
| Space heating per m2                                                           |          |          |          |          |          |          |          |          |          |          | (98c) / (4) = | 24.3425   | (99)  |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                                                              |          |          |          |          |          |          |          |          |          |          |          |                 |                |
|--------------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                        |          |          |          |          |          |          |          |          |          |          |          |                 | 0.0000 (201)   |
| Fraction of space heat from main system(s)                                                                   |          |          |          |          |          |          |          |          |          |          |          |                 | 1.0000 (202)   |
| Fraction of main heating from main system 2                                                                  |          |          |          |          |          |          |          |          |          |          |          |                 | 0.0000 (203)   |
| Fraction of total heating from main system 1                                                                 |          |          |          |          |          |          |          |          |          |          |          |                 | 1.0000 (204)   |
| Fraction of total heating from main system 2                                                                 |          |          |          |          |          |          |          |          |          |          |          |                 | 0.0000 (205)   |
| Efficiency of main space heating system 1 (in %)                                                             |          |          |          |          |          |          |          |          |          |          |          |                 | 100.0000 (206) |
| Efficiency of main space heating system 2 (in %)                                                             |          |          |          |          |          |          |          |          |          |          |          |                 | 0.0000 (207)   |
| Efficiency of secondary/supplementary heating system, %                                                      |          |          |          |          |          |          |          |          |          |          |          |                 | 0.0000 (208)   |
|                                                                                                              | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |                |
| Space heating requirement                                                                                    | 239.2621 | 178.4027 | 129.1186 | 59.8349  | 21.1312  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 69.3103  | 160.2811 | 250.2422 (98)   |                |
| Space heating efficiency (main heating system 1)                                                             | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 100.0000 | 100.0000 | 100.0000 (210)  |                |
| Space heating fuel (main heating system)                                                                     | 239.2621 | 178.4027 | 129.1186 | 59.8349  | 21.1312  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 69.3103  | 160.2811 | 250.2422 (211)  |                |
| Space heating efficiency (main heating system 2)                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |                |
| Space heating fuel (main heating system 2)                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |                |
| Space heating fuel (secondary)                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |                |
| Space heating fuel used, main system 2                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |                |
| Water heating                                                                                                |          |          |          |          |          |          |          |          |          |          |          |                 |                |
| Water heating requirement                                                                                    | 214.5740 | 189.4914 | 200.3362 | 173.4846 | 166.4358 | 148.0552 | 144.5834 | 151.3038 | 154.0750 | 174.1291 | 188.0396 | 211.8546 (64)   |                |
| Efficiency of water heater (217)m                                                                            | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 (216)  |                |
| Fuel for water heating, kWh/month                                                                            | 68.4654  | 60.4621  | 63.9225  | 55.3548  | 53.1057  | 47.2408  | 46.1331  | 48.2774  | 49.1616  | 55.5604  | 59.9989  | 67.5977 (219)   |                |
| Space cooling fuel requirement (221)m                                                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |                |
| Pumps and Fa                                                                                                 | 8.5958   | 7.7639   | 8.5958   | 8.3185   | 8.5958   | 8.3185   | 8.5958   | 8.5958   | 8.3185   | 8.5958   | 8.3185   | 8.5958 (231)    |                |
| Lighting                                                                                                     | 17.0137  | 13.6490  | 12.2894  | 9.0038   | 6.9548   | 5.6821   | 6.3444   | 8.2467   | 10.7116  | 14.0542  | 15.8742  | 17.4866 (232)   |                |
| Electricity generated by PVs (Appendix M) (negative quantity) (233a)m                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (233a)   |                |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |                |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |                |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |                |
| Electricity generated by PVs (Appendix M) (negative quantity) (233b)m                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (233b)   |                |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |                |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |                |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |                |
| Annual totals kWh/year                                                                                       |          |          |          |          |          |          |          |          |          |          |          |                 |                |
| Space heating fuel - main system 1                                                                           |          |          |          |          |          |          |          |          |          |          |          | 1107.5831 (211) |                |
| Space heating fuel - main system 2                                                                           |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |                |
| Space heating fuel - secondary                                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |                |
| Efficiency of water heater                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 313.4050        |                |
| Water heating fuel used                                                                                      |          |          |          |          |          |          |          |          |          |          |          | 675.2804 (219)  |                |
| Space cooling fuel                                                                                           |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (221)    |                |
| Electricity for pumps and fans: (MEVCentralised, Database: in-use factor = 1.3000, SFP = 0.6630)             |          |          |          |          |          |          |          |          |          |          |          |                 |                |
| mechanical ventilation fans (SFP = 0.6630)                                                                   |          |          |          |          |          |          |          |          |          |          |          | 101.2086 (230a) |                |
| Total electricity for the above, kWh/year                                                                    |          |          |          |          |          |          |          |          |          |          |          | 101.2086 (231)  |                |
| Electricity for lighting (calculated in Appendix L)                                                          |          |          |          |          |          |          |          |          |          |          |          | 137.3105 (232)  |                |
| Energy saving/generation technologies (Appendices M ,N and Q)                                                |          |          |          |          |          |          |          |          |          |          |          |                 |                |
| PV generation                                                                                                |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (233)    |                |
| Wind generation                                                                                              |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (234)    |                |
| Hydro-electric generation (Appendix N)                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (235a)   |                |
| Electricity generated - Micro CHP (Appendix N)                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (235)    |                |
| Appendix Q - special features                                                                                |          |          |          |          |          |          |          |          |          |          |          |                 |                |
| Energy saved or generated                                                                                    |          |          |          |          |          |          |          |          |          |          |          | -0.0000 (236)   |                |
| Energy used                                                                                                  |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (237)    |                |
| Total delivered energy for all uses                                                                          |          |          |          |          |          |          |          |          |          |          |          | 2021.3826 (238) |                |

# Full SAP Calculation Printout



## 10a. Fuel costs - using BEDF prices (585)

|                                             | Fuel<br>kWh/year | Fuel price<br>p/kWh | Fuel cost<br>£/year |
|---------------------------------------------|------------------|---------------------|---------------------|
| Space heating - main system 1               | 1107.5831        | 28.4300             | 314.8859 (240)      |
| Space heating - main system 2               | 0.0000           | 28.4300             | 0.0000 (241)        |
| Total CO2 associated with community systems |                  |                     | 0.0000 (473)        |
| Water heating (other fuel)                  | 675.2804         | 28.4300             | 191.9822 (247)      |
| Energy for instantaneous electric shower(s) | 0.0000           | 28.4300             | 0.0000 (247a)       |
| Pumps, fans and electric keep-hot           | 101.2086         | 28.4300             | 28.7736 (249)       |
| Energy for lighting                         | 137.3105         | 28.4300             | 39.0374 (250)       |
| Additional standing charges                 |                  |                     | 0.0000 (251)        |
| Total energy cost                           |                  |                     | 574.6791 (255)      |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|---------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1               | 1107.5831          | 0.1563                        | 173.0631 (261)           |
| Space heating - main system 2               | 0.0000             | 0.0000                        | 0.0000 (262)             |
| Total CO2 associated with community systems |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                  | 675.2804           | 0.1412                        | 95.3686 (264)            |
| Space and water heating                     |                    |                               | 268.4317 (265)           |
| Pumps, fans and electric keep-hot           | 101.2086           | 0.1387                        | 14.0389 (267)            |
| Energy for lighting                         | 137.3105           | 0.1443                        | 19.8181 (268)            |
| Total CO2, kg/year                          |                    |                               | 302.2887 (272)           |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 1107.5831          | 1.5785                              | 1748.2700 (275)            |
| Space heating - main system 2               | 0.0000             | 0.0000                              | 0.0000 (276)               |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 675.2804           | 1.5222                              | 1027.9298 (278)            |
| Space and water heating                     |                    |                                     | 2776.1998 (279)            |
| Pumps, fans and electric keep-hot           | 101.2086           | 1.5128                              | 153.1084 (281)             |
| Energy for lighting                         | 137.3105           | 1.5338                              | 210.6114 (282)             |
| Total Primary energy kWh/year               |                    |                                     | 3139.9196 (286)            |

# Predicted Energy Assessment



Flat 1, 85, Pell Street, Reading, RG1 2NP

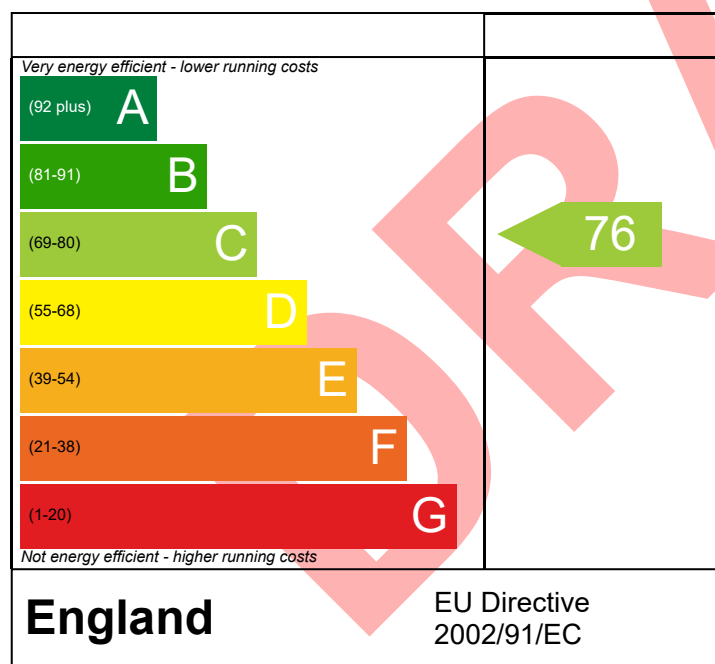
Dwelling type:  
Date of assessment:  
SAP Version:  
Produced by:  
Total floor area:  
DRRN:

Flat, End-Terrace  
28/11/2025  
10.2  
Peter Yearsley  
45.5 m<sup>2</sup>

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

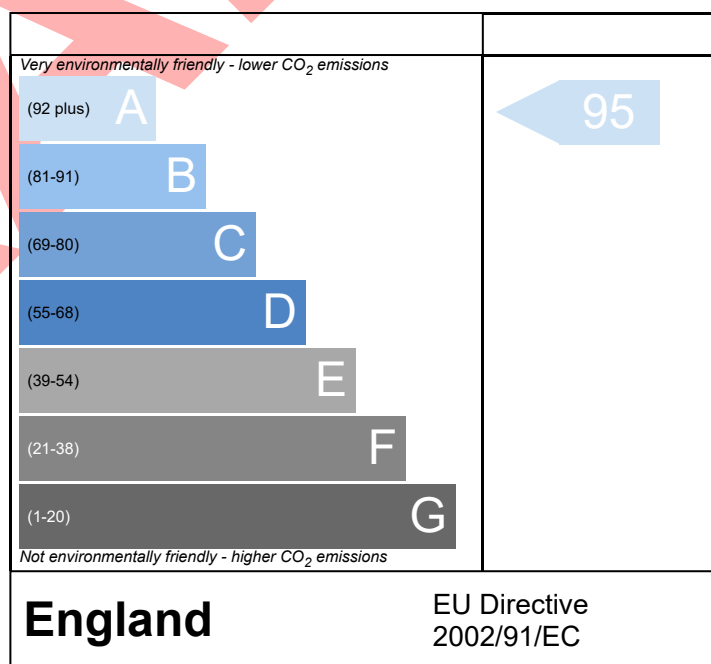
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO<sub>2</sub>) emissions.

## Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

## Environmental Impact (CO<sub>2</sub>) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO<sub>2</sub>) emissions. The higher the rating the less impact it has on the environment.

# Summary for Input Data



|                      |                                           |                |            |
|----------------------|-------------------------------------------|----------------|------------|
| Plot Reference       | Flat 1, 85 Pell Street                    | Issued on Date | 28/11/2025 |
| Assessment Reference | Electric Panel Heaters HC                 | Plot Type Ref  |            |
| Plot Address         | Flat 1, 85, Pell Street, Reading, RG1 2NP | SAP Version    | 10.2       |

|                                    |          |               |       |      |       |
|------------------------------------|----------|---------------|-------|------|-------|
| SAP Rating                         | 76 C     | DER           | 7.59  | TER  | 17.39 |
| Environmental                      | 95 A     | % DER < TER   |       |      | 56.35 |
| CO <sub>2</sub> Emissions (t/year) | 0.3      | DFEE          | 41.77 | TFEE | 43.81 |
| Compliance Check                   | See BREL | % DFEE < TFEE |       |      | 4.66  |
| % DPER < TPER                      | 14.90    | DPER          | 78.64 | TPER | 92.40 |

|                  |                    |             |           |
|------------------|--------------------|-------------|-----------|
| Assessor Details | Mr. Peter Yearsley | Assessor ID | R301-0001 |
| Client           |                    |             |           |

## SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

|                                |                     |        |
|--------------------------------|---------------------|--------|
| Orientation                    | North               |        |
| Property Tenture               | ND                  |        |
| Transaction Type               | 6                   |        |
| Terrain Type                   | Suburban            |        |
| 1.0 Property Type              | Flat, End-Terrace   |        |
| Position of Flat               | Ground-floor flat   |        |
| Which Floor                    | 0                   |        |
| 2.0 Number of Storeys          | 1                   |        |
| 3.0 Date Built                 | 2025                |        |
| 4.0 Sheltered Sides            | 1                   |        |
| 5.0 Sunlight/Shade             | Average or unknown  |        |
| 6.0 Thermal Mass Parameter     | Precise calculation |        |
| Thermal Mass                   | 123.60              | kJ/m²K |
|                                |                     |        |
| 7.0 Electricity Tariff         | Standard            |        |
| Smart electricity meter fitted | No                  |        |
| Smart gas meter fitted         | No                  |        |

|                  |               |                     |                      |                       |
|------------------|---------------|---------------------|----------------------|-----------------------|
| 7.0 Measurements |               | Heat Loss Perimeter | Internal Floor Area  | Average Storey Height |
|                  | Ground floor: | 20.00 m             | 45.50 m <sup>2</sup> | 2.75 m                |

|                 |       |                |
|-----------------|-------|----------------|
| 8.0 Living Area | 38.20 | m <sup>2</sup> |
|-----------------|-------|----------------|

| Description   | Type         | Construction                                   | U-Value (W/m <sup>2</sup> K) | Kappa (kJ/m <sup>2</sup> K) | Gross Area(m <sup>2</sup> ) | Nett Area (m <sup>2</sup> ) | Shelter Res | Shelter | Openings | Area Calculation Type |
|---------------|--------------|------------------------------------------------|------------------------------|-----------------------------|-----------------------------|-----------------------------|-------------|---------|----------|-----------------------|
| External Wall | Timber Frame | Timber framed wall (one layer of plasterboard) | 0.15                         | 9.00                        | 55.00                       | 47.24                       | 0.00        | None    | 7.76     | Calculate Wall Area   |

| Description  | Type                            | Construction | U-Value (W/m <sup>2</sup> K) | Kappa (kJ/m <sup>2</sup> K) | Area (m <sup>2</sup> ) | Shelter Res | Shelter |
|--------------|---------------------------------|--------------|------------------------------|-----------------------------|------------------------|-------------|---------|
| Party Wall 1 | Filled Cavity with Edge Sealing | Other        | 0.00                         | 45.00                       | 27.78                  |             | None    |

| Description     | Construction                 | Kappa (kJ/m <sup>2</sup> K) | Area (m <sup>2</sup> ) |
|-----------------|------------------------------|-----------------------------|------------------------|
| Internal Wall 1 | Plasterboard on timber frame | 9.00                        | 58.85                  |

| Description | Type                | Construction                             | U-Value (W/m <sup>2</sup> K) | Kappa (kJ/m <sup>2</sup> K) | Gross Area(m <sup>2</sup> ) | Nett Area (m <sup>2</sup> ) | Shelter Code | Shelter Factor | Calculation Type | Openings |
|-------------|---------------------|------------------------------------------|------------------------------|-----------------------------|-----------------------------|-----------------------------|--------------|----------------|------------------|----------|
| Bay Roof    | External Plane Roof | Plasterboard, insulated at ceiling level | 0.14                         | 9.00                        | 0.70                        | 0.70                        | None         | 0.00           | Enter Gross Area | 0.00     |

| Description     | Construction | Kappa (kJ/m <sup>2</sup> K) | Area (m <sup>2</sup> ) |
|-----------------|--------------|-----------------------------|------------------------|
| Party Ceiling 1 | Other        | 0.00                        | 44.80                  |

# Summary for Input Data

## 11.0 Heat Loss Floors

| Description      | Type                 | Storey Index    | Construction | U-Value (W/m²K) | Shelter Code | Shelter Factor | Kappa (kJ/m²K) | Area (m²) |
|------------------|----------------------|-----------------|--------------|-----------------|--------------|----------------|----------------|-----------|
| Heatloss Floor 1 | Ground Floor - Solid | Lowest occupied | Other        | 0.12            | None         | 0.00           | 75.00          | 45.50     |

## 12.0 Opening Types

| Description            | Data Source               | Type       | Glazing       | Glazing Gap | Filling Type | G-value | Frame Type | Frame Factor | U Value (W/m²K) |
|------------------------|---------------------------|------------|---------------|-------------|--------------|---------|------------|--------------|-----------------|
| Solid Door             | Manufacturer              | Solid Door |               |             |              | 0.00    |            |              | 1.20            |
| Windows / Glazed Doors | BFRC, BSI or CERTASS data | Window     | Double glazed |             |              | 0.76    |            |              | 1.20            |

## 13.0 Openings

| Name     | Opening Type           | Location      | Orientation | Area (m²) | Pitch |
|----------|------------------------|---------------|-------------|-----------|-------|
| Opening2 | Windows / Glazed Doors | External Wall | East        | 1.93      |       |
| Opening3 | Windows / Glazed Doors | External Wall | South East  | 0.71      |       |
| Opening4 | Windows / Glazed Doors | External Wall | North East  | 0.71      |       |
| Opening5 | Windows / Glazed Doors | External Wall | West        | 4.41      |       |

## 14.0 Conservatory

## 15.0 Draught Proofing

 %

## 16.0 Draught Lobby

## 17.0 Thermal Bridging

## 17.1 List of Bridges

| Bridge Type                                                               | Source Type            | Length | Psi  | Adjusted | Reference:           | Imported |
|---------------------------------------------------------------------------|------------------------|--------|------|----------|----------------------|----------|
| E2 Other lintels (including other steel lintels)                          | Independently assessed | 4.66   | 0.08 | 0.08     | R.O.I. Psi Value     | Yes      |
| E3 Sill                                                                   | Independently assessed | 1.65   | 0.03 | 0.03     | R.O.I. Psi Value     | No       |
| E4 Jamb                                                                   | Independently assessed | 20.58  | 0.04 | 0.04     | R.O.I. Psi Value     | Yes      |
| E5 Ground floor (normal)                                                  | Table K1 - Default     | 20.00  | 0.32 | 0.32     |                      | No       |
| E16 Corner (normal)                                                       | Independently assessed | 11.00  | 0.03 | 0.03     | R.O.I. Psi Value     | No       |
| E18 Party wall between dwellings                                          | Independently assessed | 5.50   | 0.04 | 0.04     | R.O.I. Psi Value     | Yes      |
| E7 Party floor between dwellings (in blocks of flats)                     | Independently assessed | 20.00  | 0.07 | 0.07     | R.O.I. Psi Value     | No       |
| E10 Eaves (insulation at ceiling level)                                   | Independently assessed | 3.20   | 0.04 | 0.04     | R.O.I. Psi Value     | No       |
| E17 Corner (inverted – internal area greater than external area)          | Independently assessed | 5.50   | 0.01 | 0.01     | R.O.I. Psi Value     | No       |
| P1 Party wall - Ground floor                                              | Independently assessed | 10.10  | 0.16 | 0.16     | Default Value Halved | No       |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | Table K1 - Default     | 10.10  | 0.00 | 0.00     |                      | No       |

Y-value  W/m²K

## 19.0 Mechanical Ventilation

### Mechanical Ventilation

|                                       |                                                                           |
|---------------------------------------|---------------------------------------------------------------------------|
| Mechanical Ventilation System Present | <input type="text" value="Yes"/>                                          |
| Approved Installation                 | <input type="text" value="Yes"/>                                          |
| Mechanical Ventilation data Type      | <input type="text" value="Database"/>                                     |
| Type                                  | <input type="text" value="Mechanical extract ventilation - centralised"/> |
| MV Reference Number                   | <input type="text" value="500735"/>                                       |
| Configuration                         | <input type="text" value="1"/>                                            |
| Manufacturer SFP                      | <input type="text" value="0.51"/>                                         |
| Duct Type                             | <input type="text" value="Rigid"/>                                        |
| Wet Rooms                             | <input type="text" value="1"/>                                            |

## 20.0 Fans, Open Fireplaces, Flues

|                                                  |                                |
|--------------------------------------------------|--------------------------------|
| Number of open chimneys                          | <input type="text" value="0"/> |
| Number of open flues                             | <input type="text" value="0"/> |
| Number of chimneys/flues attached to closed fire | <input type="text" value="0"/> |
| Number of flues attached to solid fuel boiler    | <input type="text" value="0"/> |
| Number of flues attached to other heater         | <input type="text" value="0"/> |
| Number of blocked chimneys                       | <input type="text" value="0"/> |
| Number of intermittent extract fans              | <input type="text" value="0"/> |
| Number of passive vents                          | <input type="text" value="0"/> |
| Number of flueless gas fires                     | <input type="text" value="0"/> |

## 21.0 Fixed Cooling System

## 22.0 Pressure Testing

# Summary for Input Data

Designed AP<sub>50</sub> 4.00 m<sup>2</sup>/(h.m<sup>2</sup>) @ 50 Pa  
 Test Method Blower Door

## 22.0 Lighting

No Fixed Lighting No

| Name       | Efficacy | Power | Capacity | Count |
|------------|----------|-------|----------|-------|
| Lighting 1 | 90.00    | 5.00  | 450.00   | 6     |

## 24.0 Main Heating 1

SAP table SAP table

Percentage of Heat 100.00 %

Fuel Type Electricity

SAP Code 691

In Winter 100.00

In Summer 313.40

Controls SAP Code 2603

Controls description Programmer and appliance thermostats

## 25.0 Main Heating 2

Database Database

Percentage of Heat 0.00 %

Database Ref. No. 105943

Fuel Type Electricity

In Winter 0.00

In Summer 313.40

Model Name KERS MEV-W200SL

Manufacturer KERS Innovations UK Ltd

Controls 2100

Controls description Not applicable (heating provides DHW only)

## 26.0 Heat Networks

None

## 27.0 Secondary Heating

None

## 28.0 Water Heating

Water Heating Main Heating 2

SAP Code 914

Flue Gas Heat Recovery System No

Waste Water Heat Recovery Instantaneous System 1 No

Waste Water Heat Recovery Instantaneous System 2 No

Waste Water Heat Recovery Storage System No

Solar Panel No

Water use <= 125 litres/person/day Yes

Cold Water Source From mains

Bath Count 1

Immersion Only Heating Hot Water No

## 28.1 Showers

| Description | Shower Type                               | Flow Rate [l/min] | Rated Power [kW] | Connected | Connected To |
|-------------|-------------------------------------------|-------------------|------------------|-----------|--------------|
| Shower      | Combi boiler or unvented hot water system | 11.00             |                  | No        |              |

## 28.3 Waste Water Heat Recovery System

## 29.0 Hot Water Cylinder

Internal Store Internal Store

Insulation Type Measured Loss

Cylinder Volume 196.00 L

Loss 1.31 kWh/day

# Summary for Input Data



## 34.0 Small-scale Hydro

None

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

### Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

|                     | Typical Cost | Typical savings per year | Ratings after improvement |                      |
|---------------------|--------------|--------------------------|---------------------------|----------------------|
|                     |              |                          | SAP rating                | Environmental Impact |
| Solar water heating |              |                          | 0                         | 0                    |
| Photovoltaic        |              |                          | 0                         | 0                    |
| Wind turbine        |              |                          | 0                         | 0                    |

# Thermal Bridging

|                      |                                           |               |                  |            |
|----------------------|-------------------------------------------|---------------|------------------|------------|
| Plot Reference       | Flat 1, 85 Pell Street                    |               | Issued on Date   | 28/11/2025 |
| Assessment Reference | Electric Panel Heaters HC                 | Plot Type Ref | End-Terrace Flat |            |
| Plot Address         | Flat 1, 85, Pell Street, Reading, RG1 2NP |               | SAP Version      | 10.2       |

|                                    |          |               |       |      |       |
|------------------------------------|----------|---------------|-------|------|-------|
| SAP Rating                         | 76 C     | DER           | 7.59  | TER  | 17.39 |
| Environmental                      | 95 A     | % DER < TER   |       |      | 56.35 |
| CO <sub>2</sub> Emissions (t/year) | 0.3      | DFEE          | 41.77 | TFEE | 43.81 |
| Compliance Check                   | See BREL | % DFEE < TFEE |       |      | 4.66  |
| % DPER < TPER                      | 14.90    | DPER          | 78.64 | TPER | 92.40 |

|                  |                    |             |           |
|------------------|--------------------|-------------|-----------|
| Assessor Details | Mr. Peter Yearsley | Assessor ID | R301-0001 |
| Client           |                    |             |           |

|               | Junction details                                                          | Source Type            | Psi (W/mK) | Length (m) | Result | Reference            |
|---------------|---------------------------------------------------------------------------|------------------------|------------|------------|--------|----------------------|
| External wall | E2 Other lintels (including other steel lintels)                          | Independently assessed | 0.084      | 4.66       | 0.39   | R.O.I. Psi Value     |
| External wall | E3 Sill                                                                   | Independently assessed | 0.034      | 1.65       | 0.06   | R.O.I. Psi Value     |
| External wall | E4 Jamb                                                                   | Independently assessed | 0.043      | 20.58      | 0.88   | R.O.I. Psi Value     |
| External wall | E5 Ground floor (normal)                                                  | Table K1 - Default     | 0.320      | 20.00      | 6.40   |                      |
| External wall | E16 Corner (normal)                                                       | Independently assessed | 0.030      | 11.00      | 0.33   | R.O.I. Psi Value     |
| External wall | E18 Party wall between dwellings                                          | Independently assessed | 0.040      | 5.50       | 0.22   | R.O.I. Psi Value     |
| External wall | E7 Party floor between dwellings (in blocks of flats)                     | Independently assessed | 0.066      | 20.00      | 1.32   | R.O.I. Psi Value     |
| External wall | E10 Eaves (insulation at ceiling level)                                   | Independently assessed | 0.044      | 3.20       | 0.14   | R.O.I. Psi Value     |
| External wall | E17 Corner (inverted – internal area greater than external area)          | Independently assessed | 0.015      | 5.50       | 0.08   | R.O.I. Psi Value     |
| Party wall    | P1 Party wall - Ground floor                                              | Independently assessed | 0.160      | 10.10      | 1.62   | Default Value Halved |
| Party wall    | P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | Table K1 - Default     | 0.000      | 10.10      | 0.00   |                      |

Total: 112.29 W/mK:  
Y-Value: 0.11 W/m²K:

# Energy Report



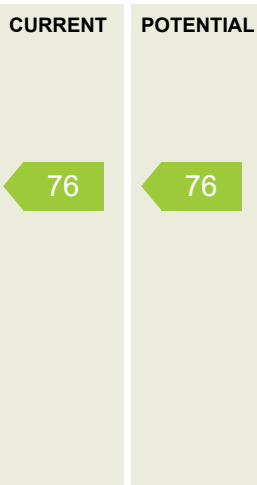
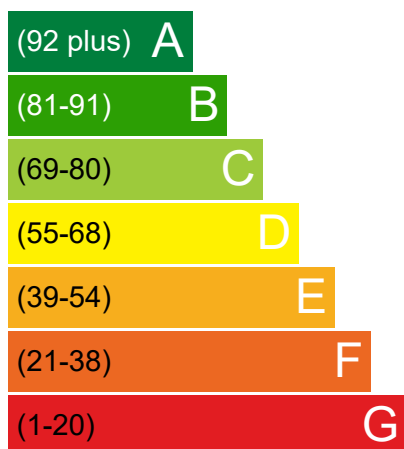
|                  |                                                  |
|------------------|--------------------------------------------------|
| Dwelling Address | Flat 1, 85, Pell Street, Reading, RG1 2NP        |
| Reference        | Flat 1, 85 Pell Street-Electric Panel Heaters HC |
| SAP Version      | 10.2                                             |
| Assessment Date  | 28/11/2025                                       |
| Submission Date  |                                                  |
| Property Type    | Flat, End-Terrace                                |
| Total Floor Area | 46                                               |

This Energy Report has been generated using the UK's National Calculation Methodology for dwellings, Standard Assessment Procedure (SAP). This methodology is used to assess the energy efficiency of dwellings which is calculated based on a dwelling's heating, hot water, ventilation and lighting usage.

This document is not an Energy Performance Certificate (EPC) as required by the Energy Performance of Buildings Regulations

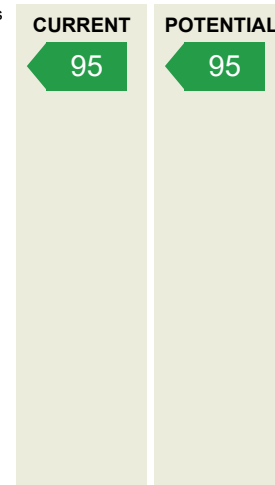
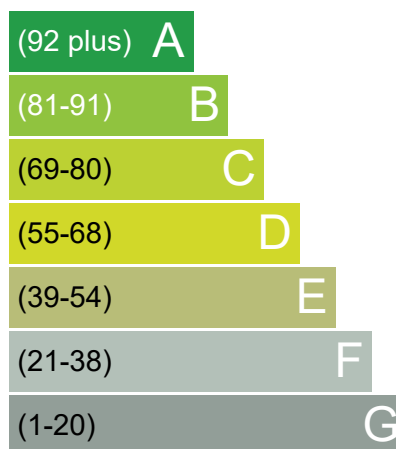
## Energy Efficiency Rating

Most energy efficient - lower running costs



## Carbon Dioxide (CO2) Emissions Rating

Very environmentally friendly - lower CO2 emissions



## Additional ratings for your home

# Energy Report

|           | Primary Energy | Energy      | Carbon    | Cost        | HTC       |
|-----------|----------------|-------------|-----------|-------------|-----------|
| CURRENT   | 69.01<br>kWh   | 2021<br>kWh | 302<br>kg | 574.68<br>£ | 54<br>W/K |
| POTENTIAL | 69.01<br>kWh   | 2021<br>kWh | 302<br>kg | 574.68<br>£ | 54<br>W/K |

## Breakdown of property's energy performance

Each feature is assessed as one of the following:

|           |      |         |      |           |
|-----------|------|---------|------|-----------|
| Very Poor | Poor | Average | Good | Very Good |
|-----------|------|---------|------|-----------|

| Feature               | Description                                                              | Energy Performance |
|-----------------------|--------------------------------------------------------------------------|--------------------|
| Walls                 | Average thermal transmittance 0.15 W/m <sup>2</sup> K                    | Very Good          |
| Roof                  | Average thermal transmittance 0.14 W/m <sup>2</sup> K                    | Very Good          |
| Floor                 | Average thermal transmittance 0.12 W/m <sup>2</sup> K                    | Very Good          |
| Windows               | High performance glazing                                                 | Very Good          |
| Main heating          | Room heaters, electric                                                   | Very Poor          |
| Main heating controls | Programmer and appliance thermostats                                     | Good               |
| Secondary heating     | None                                                                     |                    |
| Hot water             | From main system                                                         | Very Good          |
| Lighting              | Good lighting efficiency                                                 | Good               |
| Air tightness         | Air permeability [AP50] = 4.0 m <sup>3</sup> /h.m <sup>2</sup> (assumed) | Good               |

## Recommendations

The recommended measures provided below will help to improve the energy efficiency of the dwelling. To reach the dwelling's potential energy rating all of the recommended measures shown below would need to be installed. Having these measures installed individually or in any other order may give a different result when compared with the cumulative potential rating.

| Recommended measures | Cumulative savings (per year) | Cumulative rating | Typical costs | Incremental savings (per year) | Cumulative CO2 rating |
|----------------------|-------------------------------|-------------------|---------------|--------------------------------|-----------------------|
|----------------------|-------------------------------|-------------------|---------------|--------------------------------|-----------------------|

The typical cost is based on average installation prices across the country so may not be representative of the actual costs in your area.

## Estimated energy costs of the dwelling

# Energy Report

The table below shows the estimated running costs of the space and water heating and lighting within the dwelling. It does not include the energy used from household appliances. The estimated annual costs after potential improvements indicates the total energy cost if all recommended measures named above were installed.

|                                    |                                                                                   | Estimated annual costs | Estimated annual costs after potential improvements | Potential future savings                                                            |
|------------------------------------|-----------------------------------------------------------------------------------|------------------------|-----------------------------------------------------|-------------------------------------------------------------------------------------|
| Lighting                           |  | £39                    | £39                                                 |  |
| Heating                            |  | £344                   | £344                                                |                                                                                     |
| Hot Water                          |  | £192                   | £192                                                |                                                                                     |
| New Technologies e.g. Impact of PV |                                                                                   | £0                     | £0                                                  |                                                                                     |
| TOTAL                              |                                                                                   | £575                   | £575                                                |                                                                                     |

## Estimated energy use and potential savings



Space Heating

**1108**

kWh per year



Water Heating

**675**

kWh per year

## About this document

Created by:

Company/Trading name:

Phone number:

Email address:

### Disclaimer

This Energy Report should not under any circumstances be treated as a Condition Survey and cannot be used to indicate that any element of the dwelling (e.g. heating system) is working correctly.

This Energy Report must not be used in situations where an Energy Performance Certificate (EPC) is required.

This Energy Report is generated from a set of data inputs which may not reflect the actual dimensions, services or construction of the dwelling.

The calculation used to generate this report reflects the SAP Methodology current at the time of report generation.

## Glossary terms for additional metrics

|                           |                                                                                                                                                                                                                                                                       |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Primary Energy            | The measure of the energy required for lighting, heating and hot water in a property. This includes the efficiency of the property's heating system, power station efficiency for electricity and the energy used to produce the fuel and deliver it to the property. |
| Energy Used               | The estimated amount of fuel energy for lighting, heating and hot water for the property. The estimate is based on typical usage which is likely to be different to actual consumption.                                                                               |
| Carbon (CO2)              | The current emissions based on the energy estimates.                                                                                                                                                                                                                  |
| Cost                      | The estimated cost of energy. The cost of each unit of fuel is based on an industry standard which is likely to be different to those the occupier actually pays.                                                                                                     |
| Heat Transfer Coefficient | Heat flow through the property envelope where internal and external temperatures are different.                                                                                                                                                                       |

# Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Fri 28 Nov 2025 14:01:32

| Project Information |                |                 |                   |
|---------------------|----------------|-----------------|-------------------|
| Assessed By         | Peter Yearsley | Building Type   | Flat, Mid-terrace |
| OCDEA Registration  | EES/017088     | Assessment Date | 2025-11-28        |

| Dwelling Details |                                         |                  |                           |
|------------------|-----------------------------------------|------------------|---------------------------|
| Assessment Type  | As designed                             | Total Floor Area | 46 m <sup>2</sup>         |
| Site Reference   | Flat 2, 85 Pell Street                  | Plot Reference   | Electric Panel Heaters HC |
| Address          | 85 Flat 2 Pell Street, Reading, RG1 2NP |                  |                           |

| Client Details |       |
|----------------|-------|
| Name           | Array |
| Company        | Array |
| Address        |       |

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

## 1a Target emission rate and dwelling emission rate

|                                       |                                          |
|---------------------------------------|------------------------------------------|
| Fuel for main heating system          | Electricity                              |
| Target carbon dioxide emission rate   | 16.42 kgCO <sub>2</sub> /m <sup>2</sup>  |
| Dwelling carbon dioxide emission rate | 7.1 kgCO <sub>2</sub> /m <sup>2</sup> OK |

## 1b Target primary energy rate and dwelling primary energy

|                         |                                           |
|-------------------------|-------------------------------------------|
| Target primary energy   | 87.19 kWh <sub>PE</sub> /m <sup>2</sup>   |
| Dwelling primary energy | 73.7 kWh <sub>PE</sub> /m <sup>2</sup> OK |

## 1c Target fabric energy efficiency and dwelling fabric energy efficiency

|                                   |                            |
|-----------------------------------|----------------------------|
| Target fabric energy efficiency   | 39.7 kWh/m <sup>2</sup>    |
| Dwelling fabric energy efficiency | 37.5 kWh/m <sup>2</sup> OK |

## 2a Fabric U-values

| Element                          | Maximum permitted average U-Value [W/m <sup>2</sup> K] | Dwelling average U-Value [W/m <sup>2</sup> K] | Element with highest individual U-Value |     |
|----------------------------------|--------------------------------------------------------|-----------------------------------------------|-----------------------------------------|-----|
| External walls                   | 0.26                                                   | 0.15                                          | Walls (1) (0.15)                        | OK  |
| Party walls                      | 0.2                                                    | 0                                             | Party Wall (1) (0)                      | N/A |
| Curtain walls                    | 1.6                                                    | 0                                             | N/A                                     | N/A |
| Floors                           | 0.18                                                   | 0.12                                          | Heatloss Floor 1 (0.12)                 | OK  |
| Roofs                            | 0.16                                                   | 0.14                                          | Roof (1) (0.14)                         | OK  |
| Windows, doors, and roof windows | 1.6                                                    | 1.2                                           | Opening2 (1.2)                          | OK  |
| Rooflights                       | 2.2                                                    | N/A                                           | N/A                                     | N/A |

## 2b Envelope elements (better than typically expected values are flagged with a subsequent (!))

| Name                                             | Net area [m <sup>2</sup> ] | U-Value [W/m <sup>2</sup> K] |
|--------------------------------------------------|----------------------------|------------------------------|
| Exposed wall: Walls (1)                          | 34.1805                    | 0.15                         |
| Party wall: Party Wall (1)                       | 40.98                      | 0 (!)                        |
| Ground floor: Heatloss Floor 1, Heatloss Floor 1 | 45.5                       | 0.12                         |
| Exposed roof: Roof (1)                           | 0.7                        | 0.14                         |

## 2c Openings (better than typically expected values are flagged with a subsequent (!))

| Name                             | Area [m <sup>2</sup> ] | Orientation | Frame factor | U-Value [W/m <sup>2</sup> K] |
|----------------------------------|------------------------|-------------|--------------|------------------------------|
| Opening2, Windows / Glazed Doors | 1.9285                 | East        | 1.0          | 1.2                          |
| Opening3, Windows / Glazed Doors | 0.7105                 | South East  | 1.0          | 1.2                          |
| Opening4, Windows / Glazed Doors | 0.7105                 | North East  | 1.0          | 1.2                          |
| Opening5, Windows / Glazed Doors | 4.41                   | West        | 1.0          | 1.2                          |

## 2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

| Building part 1: Thermal bridging calculated from linear thermal transmittances for each junction |                                                   |                                              |                  |                     |
|---------------------------------------------------------------------------------------------------|---------------------------------------------------|----------------------------------------------|------------------|---------------------|
| Main element                                                                                      | Junction detail                                   | Source                                       | Psi value [W/mK] | Drawing / reference |
| External wall                                                                                     | E2: Other lintels (including other steel lintels) | Calculated by person with suitable expertise | 0.084            | R.O.I. Psi Value    |
| External wall                                                                                     | E3: Sill                                          | Calculated by person with suitable expertise | 0.034 (!)        | R.O.I. Psi Value    |

| Main element  | Junction detail                                                   | Source                                       | Psi value [W/mK] | Drawing / reference  |
|---------------|-------------------------------------------------------------------|----------------------------------------------|------------------|----------------------|
| External wall | E4: Jamb                                                          | Calculated by person with suitable expertise | 0.043            | R.O.I. Psi Value     |
| External wall | E5: Ground floor (normal)                                         | SAP table default                            | 0.32             |                      |
| External wall | E16: Corner (normal)                                              | Calculated by person with suitable expertise | 0.03 (!)         | R.O.I. Psi Value     |
| External wall | E18: Party wall between dwellings                                 | Calculated by person with suitable expertise | 0.04             | R.O.I. Psi Value     |
| External wall | E7: Party floor between dwellings (in blocks of flats)            | Calculated by person with suitable expertise | 0.066            | R.O.I. Psi Value     |
| External wall | E10: Eaves (insulation at ceiling level)                          | Calculated by person with suitable expertise | 0.044            | R.O.I. Psi Value     |
| External wall | E17: Corner (inverted - internal area greater than external area) | Calculated by person with suitable expertise | 0.015 (!)        | R.O.I. Psi Value     |
| Party wall    | P1: Ground floor                                                  | Calculated by person with suitable expertise | 0.16             | Default Value Halved |
| Party wall    | P3: Intermediate floor between dwellings (in blocks of flats)     | SAP table default                            | 0 (!)            |                      |
| External wall | E25: Staggered party wall between dwellings                       | Calculated by person with suitable expertise | 0.12             | Default Value Halved |

### 3 Air permeability (better than typically expected values are flagged with a subsequent (!))

|                                             |                                                      |    |
|---------------------------------------------|------------------------------------------------------|----|
| Maximum permitted air permeability at 50Pa  | 8 m <sup>3</sup> /hm <sup>2</sup>                    |    |
| Dwelling air permeability at 50Pa           | 3 m <sup>3</sup> /hm <sup>2</sup> , Design value (!) | OK |
| Air permeability test certificate reference |                                                      |    |

### 4 Space heating

#### Main heating system 1: Room heaters - Electricity

|                  |                                     |
|------------------|-------------------------------------|
| Efficiency       | 100.0%                              |
| Emitter type     |                                     |
| Flow temperature |                                     |
| System type      | Panel, convector or radiant heaters |
| Manufacturer     |                                     |
| Model            |                                     |
| Commissioning    |                                     |

#### Main heating system 2: Heat pump with radiators or underfloor heating - Electricity

|                  |                         |
|------------------|-------------------------|
| Efficiency       | 0.0%                    |
| Emitter type     |                         |
| Flow temperature |                         |
| System type      | Heat Pump               |
| Manufacturer     | KERS Innovations UK Ltd |
| Model            | KERS MEV-W200SL         |
| Commissioning    |                         |

#### Secondary heating system: N/A

|               |     |
|---------------|-----|
| Fuel          | N/A |
| Efficiency    | N/A |
| Commissioning |     |

### 5 Hot water

#### Cylinder/store - type: N/A

|                            |     |
|----------------------------|-----|
| Capacity                   | N/A |
| Declared heat loss         | N/A |
| Primary pipework insulated | N/A |
| Manufacturer               |     |
| Model                      |     |
| Commissioning              |     |

#### Waste water heat recovery system 1 - type: N/A

|              |  |
|--------------|--|
| Efficiency   |  |
| Manufacturer |  |
| Model        |  |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                   |                        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|------------------------|
| <b>6 Controls</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                   |                        |
| <b>Main heating 1</b> - type: Programmer and appliance thermostats                                                                                                                                                                                                                                                                                                                                                                                                                               |                   |                        |
| Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                   |                        |
| Ecodesign class                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                   |                        |
| Manufacturer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                   |                        |
| Model                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                        |
| <b>Main heating 2</b> - type: Not applicable                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                   |                        |
| Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                   |                        |
| Ecodesign class                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                   |                        |
| Manufacturer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                   |                        |
| Model                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                        |
| <b>Water heating</b> - type: N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                   |                        |
| Manufacturer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                   |                        |
| Model                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                        |
| <b>7 Lighting</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                   |                        |
| Minimum permitted light source efficacy                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 75 lm/W           |                        |
| Lowest light source efficacy                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 90 lm/W           | OK                     |
| External lights control                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | N/A               |                        |
| <b>8 Mechanical ventilation</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                   |                        |
| <b>System type:</b> Centralised mechanical extract                                                                                                                                                                                                                                                                                                                                                                                                                                               |                   |                        |
| Maximum permitted specific fan power                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0.7 W/(l/s)       |                        |
| Specific fan power                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 0.51 W/(l/s)      | OK                     |
| Minimum permitted heat recovery efficiency                                                                                                                                                                                                                                                                                                                                                                                                                                                       | N/A               |                        |
| Heat recovery efficiency                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | N/A               | N/A                    |
| Manufacturer/Model                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | KERS MEV-W200SL   |                        |
| Commissioning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                   |                        |
| <b>9 Local generation</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                   |                        |
| N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                   |                        |
| <b>10 Heat networks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                   |                        |
| N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                   |                        |
| <b>11 Supporting documentary evidence</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                   |                        |
| N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                   |                        |
| <b>12 Declarations</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                   |                        |
| <b>a. Assessor Declaration</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                   |                        |
| This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report. |                   |                        |
| Signed:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>P Yearsley</b> | Assessor ID: R301-0001 |
| Name:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Peter Yearsley    | Date: 28/11/2025       |
| <b>b. Client Declaration</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                   |                        |
| N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                   |                        |

# Full SAP Calculation Printout



|                                    |                                           |               |       |                |            |       |
|------------------------------------|-------------------------------------------|---------------|-------|----------------|------------|-------|
| Plot Reference                     | Flat 2, 85 Pell Street                    |               |       | Issued on Date | 28/11/2025 |       |
| Assessment Reference               | Electric Panel Heaters HC                 | Plot Type Ref |       |                |            |       |
| Plot Address                       | Flat 2, 85, Pell Street, Reading, RG1 2NP |               |       | SAP Version    | 10.2       |       |
|                                    |                                           |               |       |                |            |       |
| SAP Rating                         | 78 C                                      | DER           | 7.10  | TER            | 16.42      |       |
| Environmental                      | 95 A                                      | % DER < TER   |       |                |            | 56.76 |
| CO <sub>2</sub> Emissions (t/year) | 0.28                                      | DFEE          | 37.48 | TFEE           | 39.69      |       |
| Compliance Check                   | See BREL                                  | % DFEE < TFEE |       |                |            | 5.57  |
| % DPER < TPER                      | 15.47                                     | DPER          | 73.70 | TPER           | 87.19      |       |
|                                    |                                           |               |       |                |            |       |
| Assessor Details                   | Mr. Peter Yearsley                        |               |       | Assessor ID    | R301-0001  |       |
| Client                             |                                           |               |       |                |            |       |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m) | Volume<br>(m <sup>3</sup> )                    |
|--------------------------------------------------------|---------------------------|----------------------|------------------------------------------------|
| Main dwelling                                          | 45.5000 (1b)              | 2.7500 (2b)          | 125.1250 (1b) - (3b)                           |
| Ground floor                                           |                           |                      |                                                |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 45.5000                   |                      | 125.1250 (4)                                   |
| Dwelling volume                                        |                           |                      | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 125.1250 (5) |

## 2. Ventilation rate

|                                                    | m <sup>3</sup> per hour |
|----------------------------------------------------|-------------------------|
| Number of open chimneys                            | 0 * 80 = 0.0000 (6a)    |
| Number of open flues                               | 0 * 20 = 0.0000 (6b)    |
| Number of chimneys / flues attached to closed fire | 0 * 10 = 0.0000 (6c)    |
| Number of flues attached to solid fuel boiler      | 0 * 20 = 0.0000 (6d)    |
| Number of flues attached to other heater           | 0 * 35 = 0.0000 (6e)    |
| Number of blocked chimneys                         | 0 * 20 = 0.0000 (6f)    |
| Number of intermittent extract fans                | 0 * 10 = 0.0000 (7a)    |
| Number of passive vents                            | 0 * 10 = 0.0000 (7b)    |
| Number of flueless gas fires                       | 0 * 40 = 0.0000 (7c)    |

|                                                                                                    |                             |             |
|----------------------------------------------------------------------------------------------------|-----------------------------|-------------|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 / (5) =              | 0.0000 (8)  |
| Pressure test                                                                                      | Yes                         |             |
| Pressure Test Method                                                                               | Blower Door                 |             |
| Measured/design AP50                                                                               | 3.0000                      | (17)        |
| Infiltration rate                                                                                  | 0.1500                      | (18)        |
| Number of sides sheltered                                                                          | 2                           | (19)        |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = | 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) =        | 0.1275 (21) |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate                                                                                         | 0.1626 | 0.1594 | 0.1562 | 0.1403 | 0.1371 | 0.1211 | 0.1211 | 0.1179 | 0.1275 | 0.1371 | 0.1434 | 0.1498 (22b) |
| Mechanical extract ventilation - centralised                                                            |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        |              |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                                        | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K       | A x K<br>kJ/K   |
|----------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------------|-----------------|
| Main dwelling                                                  |                         |                            |                           |                               |              |                                      |                 |
| Windows / Glazed Doors                                         |                         |                            | 7.7600                    | 1.1450                        | 8.8855       |                                      | (27)            |
| Heatloss Floor 1                                               |                         |                            | 45.5000                   | 0.1200                        | 5.4600       | 75.0000                              | 3412.5000 (28a) |
| External Wall                                                  | 41.9375                 | 7.7600                     | 34.1775                   | 0.1500                        | 5.1266       | 9.0000                               | 307.5975 (29a)  |
| Bay Roof                                                       | 0.7000                  |                            | 0.7000                    | 0.1400                        | 0.0980       | 9.0000                               | 6.3000 (30)     |
| Total net area of external elements Aum(A, m <sup>2</sup> )    |                         |                            | 88.1375                   |                               |              |                                      | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                            |                         |                            | (26)...(30) + (32) =      |                               | 19.5701      |                                      | (33)            |
| Main dwelling                                                  |                         |                            |                           |                               |              |                                      |                 |
| Party Wall 1                                                   |                         |                            | 40.9800                   | 0.0000                        | 0.0000       | 45.0000                              | 1844.1000 (32)  |
| Party Ceiling 1                                                |                         |                            | 44.8000                   |                               |              | 0.0000                               | 0.0000 (32b)    |
| Internal Wall 1                                                |                         |                            | 58.8500                   |                               |              | 9.0000                               | 529.6500 (32c)  |
| Heat capacity Cm = Sum(A x k)                                  |                         |                            |                           |                               |              | (28)...(30) + (32) + (32a)...(32e) = | 6100.1475 (34)  |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K |                         |                            |                           |                               |              |                                      | 134.0692 (35)   |
| List of Thermal Bridges                                        |                         |                            |                           |                               |              |                                      |                 |
| K1 Element                                                     |                         |                            |                           | Length                        | Psi-value    | Total                                |                 |
| E2 Other lintels (including other steel lintels)               |                         |                            |                           | 4.6600                        | 0.0840       | 0.3914                               |                 |

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|                                                                           |         |                       |              |
|---------------------------------------------------------------------------|---------|-----------------------|--------------|
| E3 Sill                                                                   | 1.6500  | 0.0340                | 0.0561       |
| E4 Jamb                                                                   | 20.5800 | 0.0430                | 0.8849       |
| E5 Ground floor (normal)                                                  | 15.2500 | 0.3200                | 4.8800       |
| E16 Corner (normal)                                                       | 8.2500  | 0.0300                | 0.2475       |
| E18 Party wall between dwellings                                          | 8.2500  | 0.0400                | 0.3300       |
| E7 Party floor between dwellings (in blocks of flats)                     | 15.2500 | 0.0660                | 1.0065       |
| E10 Eaves (insulation at ceiling level)                                   | 3.2000  | 0.0440                | 0.1408       |
| E17 Corner (inverted - internal area greater than external area)          | 5.5000  | 0.0150                | 0.0825       |
| P1 Party wall - Ground floor                                              | 14.9000 | 0.1600                | 2.3840       |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | 14.9000 | 0.0000                | 0.0000       |
| E25 Staggered party wall between dwellings                                | 2.7500  | 0.1200                | 0.3300       |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                |         |                       | 10.7338 (36) |
| Point Thermal Bridges                                                     |         |                       | 0.0000       |
| Total fabric heat loss                                                    |         | (33) + (36) + (36a) = | 30.3039 (37) |

|                                                                     |         |         |         |         |         |         |         |         |         |         |         |              |
|---------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) |         |         |         |         |         |         |         |         |         |         |         |              |
| (38)m                                                               | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| Heat transfer coeff                                                 | 20.6456 | 20.6456 | 20.6456 | 20.6456 | 20.6456 | 20.6456 | 20.6456 | 20.6456 | 20.6456 | 20.6456 | 20.6456 | 20.6456 (38) |
|                                                                     | 50.9495 | 50.9495 | 50.9495 | 50.9495 | 50.9495 | 50.9495 | 50.9495 | 50.9495 | 50.9495 | 50.9495 | 50.9495 | 50.9495 (39) |
| Average = Sum(39)m / 12 =                                           |         |         |         |         |         |         |         |         |         |         |         | 50.9495      |
| HLP                                                                 | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| HLP (average)                                                       | 1.1198  | 1.1198  | 1.1198  | 1.1198  | 1.1198  | 1.1198  | 1.1198  | 1.1198  | 1.1198  | 1.1198  | 1.1198  | 1.1198 (40)  |
| Days in mont                                                        | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31           |

## 4. Water heating energy requirements (kWh/year)

|                                                                 |          |          |          |          |          |          |          |          |          |                                        |          |                |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------------------------------|----------|----------------|
| Assumed occupancy                                               |          |          |          |          |          |          |          |          |          |                                        |          | 1.5590 (42)    |
| Hot water usage for mixer showers                               | 69.2425  | 68.2019  | 66.6855  | 63.7843  | 61.6433  | 59.2556  | 57.8985  | 59.4034  | 61.0530  | 63.6166                                | 66.5801  | 68.9772 (42a)  |
| Hot water usage for baths                                       | 21.7789  | 21.4554  | 21.0000  | 20.1601  | 19.5313  | 18.8340  | 18.4573  | 18.9096  | 19.4021  | 20.1482                                | 21.0054  | 21.7053 (42b)  |
| Hot water usage for other uses                                  | 30.5954  | 29.4828  | 28.3702  | 27.2577  | 26.1451  | 25.0326  | 25.0326  | 26.1451  | 27.2577  | 28.3702                                | 29.4828  | 30.5954 (42c)  |
| Average daily hot water use (litres/day)                        |          |          |          |          |          |          |          |          |          |                                        |          | 111.8456 (43)  |
| Daily hot water use                                             | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct                                    | Nov      | Dec            |
| Energy conte                                                    | 121.6167 | 119.1401 | 116.0557 | 111.2021 | 107.3197 | 103.1222 | 101.3884 | 104.4581 | 107.7127 | 112.1350                               | 117.0682 | 121.2778 (44)  |
| Energy content (annual)                                         | 192.6111 | 169.6539 | 178.3733 | 152.2302 | 144.4729 | 126.8008 | 122.6205 | 129.3410 | 132.8206 | 152.1662                               | 166.7852 | 189.8917 (45)  |
| Distribution loss (46)m = 0.15 x (45)m                          |          |          |          |          |          |          |          |          |          | Total = Sum(45)m =                     |          | 1857.7673      |
| Water storage loss (or HIU loss):                               | 28.8917  | 25.4481  | 26.7560  | 22.8345  | 21.6709  | 19.0201  | 18.3931  | 19.4011  | 19.9231  | 22.8249                                | 25.0178  | 28.4838 (46)   |
| Store volume                                                    |          |          |          |          |          |          |          |          |          |                                        |          | 196.0000 (47)  |
| a) If manufacturer declared loss factor is known (kWh/day):     |          |          |          |          |          |          |          |          |          |                                        |          | 1.3120 (48)    |
| Temperature factor from Table 2b                                |          |          |          |          |          |          |          |          |          |                                        |          | 0.5400 (49)    |
| Enter (49) or (54) in (55)                                      |          |          |          |          |          |          |          |          |          |                                        |          | 0.7085 (55)    |
| Total storage loss                                              | 21.9629  | 19.8374  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  | 21.9629  | 21.2544  | 21.9629                                | 21.2544  | 21.9629 (56)   |
| If cylinder contains dedicated solar storage                    | 21.9629  | 19.8374  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  | 21.9629  | 21.2544  | 21.9629                                | 21.2544  | 21.9629 (57)   |
| Primary loss                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000 (59)    |
| Combi loss                                                      | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000 (61)    |
| Total heat required for water heating calculated for each month | 214.5740 | 189.4914 | 200.3362 | 173.4846 | 166.4358 | 148.0552 | 144.5834 | 151.3038 | 154.0750 | 174.1291                               | 188.0396 | 211.8546 (62)  |
| WWHRS                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000 (63a)   |
| PV diverter                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000 (63b)   |
| Solar input                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000 (63c)   |
| FGHRS                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000 (63d)   |
| Output from w/h                                                 | 214.5740 | 189.4914 | 200.3362 | 173.4846 | 166.4358 | 148.0552 | 144.5834 | 151.3038 | 154.0750 | 174.1291                               | 188.0396 | 211.8546 (64)  |
| 12Total per year (kWh/year)                                     |          |          |          |          |          |          |          |          |          | Total per year (kWh/year) = Sum(64)m = |          | 2116.3625 (64) |
| Electric shower(s)                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000 (64a)   |
|                                                                 |          |          |          |          |          |          |          |          |          |                                        |          | 0.0000 (64a)   |
| Heat gains from water heating, kWh/month                        | 64.0432  | 56.4099  | 59.3091  | 50.6165  | 48.0373  | 42.1613  | 40.7713  | 43.0059  | 44.1628  | 50.5953                                | 55.4561  | 63.1390 (65)   |

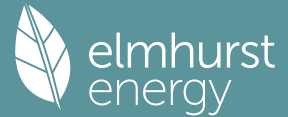
## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Metabolic gains (Table 5), Watts                                                    | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
| (66)m                                                                               | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 70.4835  | 78.0354  | 70.4835  | 72.8330  | 70.4835  | 72.8330  | 70.4835  | 70.4835  | 72.8330  | 70.4835  | 72.8330  | 70.4835 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 135.5704 | 136.9772 | 133.4321 | 125.8851 | 116.3583 | 107.4044 | 101.4227 | 100.0159 | 103.5610 | 111.1080 | 120.6348 | 129.5887 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948 (69)  |
| Pumps, fans                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (70)   |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 (71) |
| Water heating gains (Table 5)                                                       | 86.0796  | 83.9433  | 79.7166  | 70.3007  | 64.5662  | 58.5573  | 54.8001  | 57.8036  | 61.3373  | 68.0044  | 77.0223  | 84.8642 (72)  |
| Total internal gains                                                                | 338.5180 | 345.3404 | 330.0167 | 315.4033 | 297.7925 | 285.1792 | 273.0908 | 274.6875 | 284.1157 | 295.9804 | 316.8746 | 331.3209 (73) |

## 6. Solar gains

| [Jan]     | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W   |
|-----------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|
| Northeast | 0.7100     | 11.2829                        | 0.7600                            | 0.0000                             | 0.7700                       | 4.6880 (75)  |
| East      | 1.9300     | 19.6403                        | 0.7600                            | 0.0000                             | 0.7700                       | 22.1824 (76) |
| Southeast | 0.7100     | 36.7938                        | 0.7600                            | 0.0000                             | 0.7700                       | 15.2875 (77) |
| West      | 4.4100     | 19.6403                        | 0.7600                            | 0.0000                             | 0.7700                       | 50.6863 (80) |

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|             |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Solar gains | 92.8442  | 178.1294 | 287.5760 | 414.7564 | 506.9945 | 519.0809 | 494.1084 | 424.8126 | 332.5572 | 209.5854 | 115.0683 | 76.8350 (83)  |
| Total gains | 431.3622 | 523.4698 | 617.5928 | 730.1597 | 804.7870 | 804.2601 | 767.1993 | 699.5001 | 616.6729 | 505.5658 | 431.9429 | 408.1560 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |                           |         |         |              |             |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|-------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |                           |         |         | 21.0000 (85) |             |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |                           |         |         |              |             |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep                       | Oct     | Nov     | Dec          |             |
| tau                                                                         | 33.2581 | 33.2581 | 33.2581 | 33.2581 | 33.2581 | 33.2581 | 33.2581 | 33.2581 | 33.2581                   | 33.2581 | 33.2581 | 33.2581      |             |
| alpha                                                                       | 3.2172  | 3.2172  | 3.2172  | 3.2172  | 3.2172  | 3.2172  | 3.2172  | 3.2172  | 3.2172                    | 3.2172  | 3.2172  | 3.2172       |             |
| util living area                                                            | 0.9412  | 0.8996  | 0.8262  | 0.6948  | 0.5394  | 0.3919  | 0.2882  | 0.3284  | 0.5257                    | 0.7805  | 0.9092  | 0.9495 (86)  |             |
| MIT                                                                         | 19.3309 | 19.6891 | 20.1425 | 20.5905 | 20.8510 | 20.9592 | 20.9886 | 20.9825 | 20.8974                   | 20.4923 | 19.8163 | 19.2424 (87) |             |
| Th 2                                                                        | 19.9847 | 19.9847 | 19.9847 | 19.9847 | 19.9847 | 19.9847 | 19.9847 | 19.9847 | 19.9847                   | 19.9847 | 19.9847 | 19.9847 (88) |             |
| util rest of house                                                          | 0.9316  | 0.8844  | 0.8018  | 0.6576  | 0.4910  | 0.3340  | 0.2233  | 0.2585  | 0.4604                    | 0.7412  | 0.8927  | 0.9411 (89)  |             |
| MIT 2                                                                       | 18.0720 | 18.5134 | 19.0610 | 19.5772 | 19.8550 | 19.9571 | 19.9794 | 19.9761 | 19.9082                   | 19.4867 | 18.6805 | 17.9620 (90) |             |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         |              | 0.8396 (91) |
| MIT                                                                         | 19.1289 | 19.5005 | 19.9690 | 20.4279 | 20.6912 | 20.7985 | 20.8267 | 20.8210 | 20.7387                   | 20.3310 | 19.6341 | 19.0370 (92) |             |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |             |
| adjusted MIT                                                                | 19.1289 | 19.5005 | 19.9690 | 20.4279 | 20.6912 | 20.7985 | 20.8267 | 20.8210 | 20.7387                   | 20.3310 | 19.6341 | 19.0370 (93) |             |

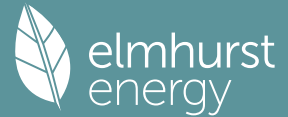
## 8. Space heating requirement

|                                                                                |          |          |          |          |          |          |          |          |          |               |          |                |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|----------|----------------|
|                                                                                | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov      | Dec            |
| Utilisation                                                                    | 0.9220   | 0.8762   | 0.8014   | 0.6744   | 0.5251   | 0.3807   | 0.2773   | 0.3163   | 0.5095   | 0.7554        | 0.8861   | 0.9316 (94)    |
| Useful gains                                                                   | 397.6973 | 458.6717 | 494.9400 | 492.3845 | 422.5987 | 306.1422 | 212.7345 | 221.2279 | 314.2125 | 381.8921      | 382.7524 | 380.2255 (95)  |
| Ext temp.                                                                      | 4.3000   | 4.9000   | 6.5000   | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000   | 4.2000 (96)    |
| Heat loss rate W                                                               | 755.5248 | 743.8871 | 686.2397 | 587.3407 | 458.0995 | 315.8085 | 215.3463 | 225.2484 | 338.2389 | 495.7903      | 638.6061 | 755.9381 (97)  |
| Space heating kWh                                                              | 266.2236 | 191.6647 | 142.3270 | 68.3685  | 26.4126  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 84.7403       | 184.2147 | 279.5301 (98a) |
| Space heating requirement - total per year (kWh/year)                          |          |          |          |          |          |          |          |          |          |               |          | 1243.4814      |
| Solar heating kWh                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000   | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |          |          |          |          |          |          |          |          |          |               |          | 0.0000         |
| Space heating kWh                                                              | 266.2236 | 191.6647 | 142.3270 | 68.3685  | 26.4126  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 84.7403       | 184.2147 | 279.5301 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |          |          |          |          |          |          |          |          |          |               |          | 1243.4814      |
| Space heating per m2                                                           |          |          |          |          |          |          |          |          |          | (98c) / (4) = |          | 27.3293 (99)   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                                                              |          |          |          |          |          |          |          |          |          |          |          |                 |
|--------------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                        |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)    |
| Fraction of space heat from main system(s)                                                                   |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)    |
| Fraction of main heating from main system 2                                                                  |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (203)    |
| Fraction of total heating from main system 1                                                                 |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (204)    |
| Fraction of total heating from main system 2                                                                 |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (205)    |
| Efficiency of main space heating system 1 (in %)                                                             |          |          |          |          |          |          |          |          |          |          |          | 100.0000 (206)  |
| Efficiency of main space heating system 2 (in %)                                                             |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
|                                                                                                              | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                                                                    | 266.2236 | 191.6647 | 142.3270 | 68.3685  | 26.4126  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 84.7403  | 184.2147 | 279.5301 (98)   |
| Space heating efficiency (main heating system 1)                                                             | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 100.0000 | 100.0000 | 100.0000 (210)  |
| Space heating fuel (main heating system)                                                                     | 266.2236 | 191.6647 | 142.3270 | 68.3685  | 26.4126  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 84.7403  | 184.2147 | 279.5301 (211)  |
| Space heating efficiency (main heating system 2)                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |
| Space heating fuel (secondary)                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Space heating fuel used, main system 2                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |
| Water heating                                                                                                |          |          |          |          |          |          |          |          |          |          |          |                 |
| Water heating requirement                                                                                    | 214.5740 | 189.4914 | 200.3362 | 173.4846 | 166.4358 | 148.0552 | 144.5834 | 151.3038 | 154.0750 | 174.1291 | 188.0396 | 211.8546 (64)   |
| Efficiency of water heater (217)m                                                                            | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 (216)  |
| Fuel for water heating, kWh/month                                                                            | 68.4654  | 60.4621  | 63.9225  | 55.3548  | 53.1057  | 47.2408  | 46.1331  | 48.2774  | 49.1616  | 55.5604  | 59.9989  | 67.5977 (219)   |
| Space cooling fuel requirement (221)m                                                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                                                 | 8.5958   | 7.7639   | 8.5958   | 8.3185   | 8.5958   | 8.3185   | 8.5958   | 8.5958   | 8.3185   | 8.5958   | 8.3185   | 8.5958 (231)    |
| Lighting                                                                                                     | 17.0137  | 13.6490  | 12.2894  | 9.0038   | 6.9548   | 5.6821   | 6.3444   | 8.2467   | 10.7116  | 14.0542  | 15.8742  | 17.4866 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity) (233a)m                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (233a)   |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity) (233b)m                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (233b)   |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |
| Annual totals kWh/year                                                                                       |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system 1                                                                           |          |          |          |          |          |          |          |          |          |          |          | 1243.4814 (211) |
| Space heating fuel - main system 2                                                                           |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |
| Efficiency of water heater                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 313.4050        |

# Full SAP Calculation Printout



|                                                                                                                                                   |                 |
|---------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| Water heating fuel used                                                                                                                           | 675.2804 (219)  |
| Space cooling fuel                                                                                                                                | 0.0000 (221)    |
| Electricity for pumps and fans:<br>(MEVCentralised, Database: in-use factor = 1.3000, SFP = 0.6630)<br>mechanical ventilation fans (SFP = 0.6630) | 101.2086 (230a) |
| Total electricity for the above, kWh/year                                                                                                         | 101.2086 (231)  |
| Electricity for lighting (calculated in Appendix L)                                                                                               | 137.3105 (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                                                                     |                 |
| PV generation                                                                                                                                     | 0.0000 (233)    |
| Wind generation                                                                                                                                   | 0.0000 (234)    |
| Hydro-electric generation (Appendix N)                                                                                                            | 0.0000 (235a)   |
| Electricity generated - Micro CHP (Appendix N)                                                                                                    | 0.0000 (235)    |
| Appendix Q - special features                                                                                                                     |                 |
| Energy saved or generated                                                                                                                         | -0.0000 (236)   |
| Energy used                                                                                                                                       | 0.0000 (237)    |
| Total delivered energy for all uses                                                                                                               | 2157.2808 (238) |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                                 | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|-------------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1                   | 1243.4814          | 0.1560                        | 194.0045 (261)           |
| Space heating - main system 2                   | 0.0000             | 0.0000                        | 0.0000 (262)             |
| Total CO2 associated with community systems     |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                      | 675.2804           | 0.1412                        | 95.3686 (264)            |
| Space and water heating                         |                    |                               | 289.3730 (265)           |
| Pumps, fans and electric keep-hot               | 101.2086           | 0.1387                        | 14.0389 (267)            |
| Energy for lighting                             | 137.3105           | 0.1443                        | 19.8181 (268)            |
| Total CO2, kg/year                              |                    |                               | 323.2301 (272)           |
| EPC Dwelling Carbon Dioxide Emission Rate (DER) |                    |                               | 7.1000 (273)             |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 1243.4814          | 1.5776                              | 1961.6821 (275)            |
| Space heating - main system 2               | 0.0000             | 0.0000                              | 0.0000 (276)               |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 675.2804           | 1.5222                              | 1027.9298 (278)            |
| Space and water heating                     |                    |                                     | 2989.6119 (279)            |
| Pumps, fans and electric keep-hot           | 101.2086           | 1.5128                              | 153.1084 (281)             |
| Energy for lighting                         | 137.3105           | 1.5338                              | 210.6114 (282)             |
| Total Primary energy kWh/year               |                    |                                     | 3353.3317 (286)            |
| Dwelling Primary energy Rate (DPER)         |                    |                                     | 73.7000 (287)              |

## SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET EMISSIONS

### 1. Overall dwelling characteristics

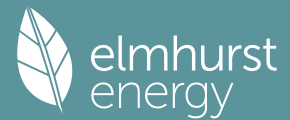
|                                                        | Area<br>(m2) | Storey height<br>(m)            | Volume<br>(m3)         |
|--------------------------------------------------------|--------------|---------------------------------|------------------------|
| Main dwelling                                          | 45.5000 (1b) | x 2.7500 (2b)                   | = 125.1250 (1b) - (3b) |
| Ground floor                                           |              |                                 | (4)                    |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 45.5000      |                                 |                        |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 125.1250 (5)         |

### 2. Ventilation rate

|                                                      | m3 per hour                                                                      |
|------------------------------------------------------|----------------------------------------------------------------------------------|
| Number of open chimneys                              | 0 * 80 = 0.0000 (6a)                                                             |
| Number of open flues                                 | 0 * 20 = 0.0000 (6b)                                                             |
| Number of chimneys / flues attached to closed fire   | 0 * 10 = 0.0000 (6c)                                                             |
| Number of flues attached to solid fuel boiler        | 0 * 20 = 0.0000 (6d)                                                             |
| Number of flues attached to other heater             | 0 * 35 = 0.0000 (6e)                                                             |
| Number of blocked chimneys                           | 0 * 20 = 0.0000 (6f)                                                             |
| Number of intermittent extract fans                  | 2 * 10 = 20.0000 (7a)                                                            |
| Number of passive vents                              | 0 * 10 = 0.0000 (7b)                                                             |
| Number of flueless gas fires                         | 0 * 40 = 0.0000 (7c)                                                             |
| Infiltration due to chimneys, flues and fans         | = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 20.0000 / (5) = 0.1598 (8) |
| Pressure test                                        | Yes                                                                              |
| Pressure Test Method                                 | Blower Door                                                                      |
| Measured/design AP50                                 | 5.0000 (17)                                                                      |
| Infiltration rate                                    | 0.4098 (18)                                                                      |
| Number of sides sheltered                            | 2 (19)                                                                           |
| Shelter factor                                       | (20) = 1 - [0.075 x (19)] = 0.8500 (20)                                          |
| Infiltration rate adjusted to include shelter factor | (21) = (18) x (20) = 0.3484 (21)                                                 |

|                 | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed      | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor     | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate | 0.4442 | 0.4355 | 0.4267 | 0.3832 | 0.3745 | 0.3309 | 0.3309 | 0.3222 | 0.3484 | 0.3745 | 0.3919 | 0.4093 (22b) |
| Effective ac    | 0.5986 | 0.5948 | 0.5911 | 0.5734 | 0.5701 | 0.5548 | 0.5548 | 0.5519 | 0.5607 | 0.5701 | 0.5768 | 0.5838 (25)  |

# Full SAP Calculation Printout



## 3. Heat losses and heat loss parameter

|                                                                           |         |          |                        |         |           |                       |               |         |         |         |         |              |  |
|---------------------------------------------------------------------------|---------|----------|------------------------|---------|-----------|-----------------------|---------------|---------|---------|---------|---------|--------------|--|
| Element                                                                   | Gross   | Openings | NetArea                | U-value | A x U     | K-value               | A x K         |         |         |         |         |              |  |
| Main dwelling                                                             | m2      | m2       | m2                     | W/m2K   | W/K       | kJ/m2K                | kJ/K          |         |         |         |         |              |  |
| TER Opening Type                                                          |         |          | 7.7600                 | 1.1450  | 8.8855    |                       | (27)          |         |         |         |         |              |  |
| Heatloss Floor 1                                                          |         |          | 45.5000                | 0.1300  | 5.9150    |                       | (28a)         |         |         |         |         |              |  |
| External Wall                                                             | 41.9375 | 7.7600   | 34.1775                | 0.1800  | 6.1520    |                       | (29a)         |         |         |         |         |              |  |
| Bay Roof                                                                  | 0.7000  |          | 0.7000                 | 0.1100  | 0.0770    |                       | (30)          |         |         |         |         |              |  |
| Total net area of external elements Aum(A, m2)                            |         |          | 88.1375                |         |           |                       | (31)          |         |         |         |         |              |  |
| Fabric heat loss, W/K = Sum (A x U)                                       |         |          | (26) ... (30) + (32) = |         | 21.0294   |                       | (33)          |         |         |         |         |              |  |
| Main dwelling                                                             |         |          |                        |         |           |                       |               |         |         |         |         |              |  |
| Party Wall 1                                                              |         |          | 40.9800                | 0.0000  | 0.0000    |                       | (32)          |         |         |         |         |              |  |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K                         |         |          |                        |         |           |                       | 134.0692 (35) |         |         |         |         |              |  |
| List of Thermal Bridges                                                   |         |          |                        |         |           |                       |               |         |         |         |         |              |  |
| K1 Element                                                                |         |          |                        | Length  | Psi-value |                       | Total         |         |         |         |         |              |  |
| E2 Other lintels (including other steel lintels)                          |         |          |                        | 4.6600  | 0.0500    |                       | 0.2330        |         |         |         |         |              |  |
| E3 Sill                                                                   |         |          |                        | 1.6500  | 0.0500    |                       | 0.0825        |         |         |         |         |              |  |
| E4 Jamb                                                                   |         |          |                        | 20.5800 | 0.0500    |                       | 1.0290        |         |         |         |         |              |  |
| E5 Ground floor (normal)                                                  |         |          |                        | 15.2500 | 0.1600    |                       | 2.4400        |         |         |         |         |              |  |
| E16 Corner (normal)                                                       |         |          |                        | 8.2500  | 0.0900    |                       | 0.7425        |         |         |         |         |              |  |
| E18 Party wall between dwellings                                          |         |          |                        | 8.2500  | 0.0600    |                       | 0.4950        |         |         |         |         |              |  |
| E7 Party floor between dwellings (in blocks of flats)                     |         |          |                        | 15.2500 | 0.0700    |                       | 1.0675        |         |         |         |         |              |  |
| E10 Eaves (insulation at ceiling level)                                   |         |          |                        | 3.2000  | 0.0600    |                       | 0.1920        |         |         |         |         |              |  |
| E17 Corner (inverted - internal area greater than external area)          |         |          |                        | 5.5000  | -0.0900   |                       | -0.4950       |         |         |         |         |              |  |
| P1 Party wall - Ground floor                                              |         |          |                        | 14.9000 | 0.0800    |                       | 1.1920        |         |         |         |         |              |  |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) |         |          |                        | 14.9000 | 0.0000    |                       | 0.0000        |         |         |         |         |              |  |
| E25 Staggered party wall between dwellings                                |         |          |                        | 2.7500  | 0.0600    |                       | 0.1650        |         |         |         |         |              |  |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                |         |          |                        |         |           |                       | 7.1435 (36)   |         |         |         |         |              |  |
| Point Thermal bridges                                                     |         |          |                        |         |           | (36a) =               | 0.0000        |         |         |         |         |              |  |
| Total fabric heat loss                                                    |         |          |                        |         |           | (33) + (36) + (36a) = | 28.1729 (37)  |         |         |         |         |              |  |
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)       |         |          |                        |         |           |                       |               |         |         |         |         |              |  |
| Jan                                                                       | Feb     | Mar      | Apr                    | May     | Jun       | Jul                   | Aug           | Sep     | Oct     | Nov     | Dec     |              |  |
| (38)m                                                                     | 24.7186 | 24.5605  | 24.4054                | 23.6773 | 23.5410   | 22.9068               | 22.9068       | 22.7894 | 23.1511 | 23.5410 | 23.8167 | 24.1048 (38) |  |
| Heat transfer coeff                                                       | 52.8916 | 52.7334  | 52.5784                | 51.8502 | 51.7140   | 51.0798               | 51.0798       | 50.9623 | 51.3241 | 51.7140 | 51.9896 | 52.2777 (39) |  |
| Average = Sum(39)m / 12 =                                                 |         |          |                        |         |           |                       |               |         |         |         |         | 51.8496      |  |
| HLP                                                                       | Jan     | Feb      | Mar                    | Apr     | May       | Jun                   | Jul           | Aug     | Sep     | Oct     | Nov     | Dec          |  |
| HLP (average)                                                             | 1.1625  | 1.1590   | 1.1556                 | 1.1396  | 1.1366    | 1.1226                | 1.1226        | 1.1201  | 1.1280  | 1.1366  | 1.1426  | 1.1490 (40)  |  |
| Days in mont                                                              | 31      | 28       | 31                     | 30      | 31        | 30                    | 31            | 31      | 30      | 31      | 30      | 31           |  |

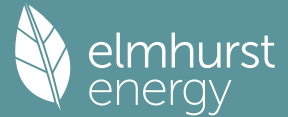
## 4. Water heating energy requirements (kWh/year)

|                                                                 |          |          |          |          |          |          |          |                                        |          |                    |          |                |             |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------------------------------------|----------|--------------------|----------|----------------|-------------|
| Assumed occupancy                                               |          |          |          |          |          |          |          |                                        |          |                    |          |                | 1.5590 (42) |
| Hot water usage for mixer showers                               | 50.3581  | 49.6014  | 48.4986  | 46.3886  | 44.8315  | 43.0950  | 42.1080  | 43.2024                                | 44.4021  | 46.2666            | 48.4219  | 50.1652 (42a)  |             |
| Hot water usage for baths                                       | 21.7789  | 21.4554  | 21.0000  | 20.1601  | 19.5313  | 18.8340  | 18.4573  | 18.9096                                | 19.4021  | 20.1482            | 21.0054  | 21.7053 (42b)  |             |
| Hot water usage for other uses                                  | 30.5954  | 29.4828  | 28.3702  | 27.2577  | 26.1451  | 25.0326  | 25.0326  | 26.1451                                | 27.2577  | 28.3702            | 29.4828  | 30.5954 (42c)  |             |
| Average daily hot water use (litres/day)                        |          |          |          |          |          |          |          |                                        |          |                    |          | 94.4349 (43)   |             |
| Daily hot water use                                             | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug                                    | Sep      | Oct                | Nov      | Dec            |             |
| Energy content (annual)                                         | 102.7324 | 100.5396 | 97.8688  | 93.8064  | 90.5079  | 86.9616  | 85.5979  | 88.2572                                | 91.0619  | 94.7851            | 98.9100  | 102.4658 (44)  |             |
| Distribution loss (46)m = 0.15 x (45)m                          | 162.7030 | 143.1670 | 150.4207 | 128.4163 | 121.8410 | 106.9294 | 103.5232 | 109.2808                               | 112.2885 | 128.6224           | 140.9155 | 160.4367 (45)  |             |
| Water storage loss (or HIU loss):                               |          |          |          |          |          |          |          |                                        |          | Total = Sum(45)m = |          | 1568.5445      |             |
| Store volume                                                    | 24.4054  | 21.4751  | 22.5631  | 19.2624  | 18.2762  | 16.0394  | 15.5285  | 16.3921                                | 16.8433  | 19.2934            | 21.1373  | 24.0655 (46)   |             |
| a) If manufacturer declared loss factor is known (kWh/day):     |          |          |          |          |          |          |          |                                        |          |                    |          | 150.0000 (47)  |             |
| Temperature factor from Table 2b                                |          |          |          |          |          |          |          |                                        |          |                    |          | 1.3938 (48)    |             |
| Enter (49) or (54) in (55)                                      |          |          |          |          |          |          |          |                                        |          |                    |          | 0.5400 (49)    |             |
| Total storage loss                                              |          |          |          |          |          |          |          |                                        |          |                    |          | 0.7527 (55)    |             |
| If cylinder contains dedicated solar storage                    | 23.3325  | 21.0745  | 23.3325  | 22.5798  | 23.3325  | 22.5798  | 23.3325  | 23.3325                                | 22.5798  | 23.3325            | 22.5798  | 23.3325 (56)   |             |
| Primary loss                                                    | 23.3325  | 21.0745  | 23.3325  | 22.5798  | 23.3325  | 22.5798  | 23.3325  | 23.3325                                | 22.5798  | 23.3325            | 22.5798  | 23.3325 (57)   |             |
| Combi loss                                                      | 23.2624  | 21.0112  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624  | 23.2624                                | 22.5120  | 23.2624            | 22.5120  | 23.2624 (59)   |             |
| Total heat required for water heating calculated for each month | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000             | 0.0000   | 0.0000 (61)    |             |
| WWHRS                                                           | 209.2979 | 185.2528 | 197.0156 | 173.5081 | 168.4359 | 152.0212 | 150.1181 | 155.8757                               | 157.3803 | 175.2173           | 186.0073 | 207.0316 (62)  |             |
| PV diverter                                                     | -23.0216 | -20.3605 | -21.3204 | -17.6541 | -16.4530 | -14.0789 | -13.1968 | -14.0334                               | -14.5666 | -17.1724           | -19.4543 | -22.5953 (63a) |             |
| Solar input                                                     | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000                                | -0.0000  | -0.0000            | -0.0000  | -0.0000 (63b)  |             |
| FGHRS                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000             | 0.0000   | 0.0000 (63c)   |             |
| Output from w/h                                                 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000             | 0.0000   | 0.0000 (63d)   |             |
| 12Total per year (kWh/year)                                     | 186.2762 | 164.8922 | 175.6952 | 155.8540 | 151.9829 | 137.9423 | 136.9214 | 141.8423                               | 142.8137 | 158.0449           | 166.5530 | 184.4363 (64)  |             |
| Electric shower(s)                                              |          |          |          |          |          |          |          | Total per year (kWh/year) = Sum(64)m = |          |                    |          | 1903.2544 (64) |             |
|                                                                 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000             | 0.0000   | 0.0000 (64a)   |             |
| Heat gains from water heating, kWh/month                        |          |          |          |          |          |          |          |                                        |          |                    |          | 0.0000 (64a)   |             |
|                                                                 | 91.3747  | 81.2716  | 87.2908  | 78.7719  | 77.7881  | 71.6275  | 71.6974  | 73.6118                                | 73.4094  | 80.0429            | 82.9279  | 90.6211 (65)   |             |

## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |                |                |                |                |                |                |                |                |                |                |                |                |      |
|-------------------------------------------------------------------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|------|
| Metabolic gains (Table 5), Watts                                                    |                |                |                |                |                |                |                |                |                |                |                |                |      |
| (66)m                                                                               | Jan<br>77.9482 | Feb<br>77.9482 | Mar<br>77.9482 | Apr<br>77.9482 | May<br>77.9482 | Jun<br>77.9482 | Jul<br>77.9482 | Aug<br>77.9482 | Sep<br>77.9482 | Oct<br>77.9482 | Nov<br>77.9482 | Dec<br>77.9482 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 70.4835        | 78.0354        | 70.4835        | 72.8330        | 70.4835        | 72.8330        | 70.4835        | 70.4835        | 72.8330        | 70.4835        | 72.8330        | 70.4835        | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 135.5704       | 136.9772       | 133.4321       | 125.8851       | 116.3583       | 107.4044       | 101.4227       | 100.0159       | 103.5610       | 111.1080       | 120.6348       | 129.5887       | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 30.7948        | 30.7948        | 30.7948        | 30.7948        | 30.7948        | 30.7948        | 30.7948        | 30.7948        | 30.7948        | 30.7948        | 30.7948        | 30.7948        | (69) |

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|                                                     |          |          |          |          |          |          |          |          |          |          |          |               |
|-----------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Pumps, fans                                         | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 3.0000   | 3.0000   | 3.0000 (70)   |
| Losses e.g. evaporation (negative values) (Table 5) | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 (71) |
| Water heating gains (Table 5)                       | 122.8154 | 120.9399 | 117.3263 | 109.4054 | 104.5538 | 99.4826  | 96.3675  | 98.9406  | 101.9575 | 107.5845 | 115.1776 | 121.8026 (72) |
| Total internal gains                                | 378.2538 | 385.3369 | 370.6265 | 357.5079 | 340.7801 | 326.1045 | 314.6582 | 315.8245 | 324.7359 | 338.5606 | 358.0299 | 371.2593 (73) |

## 6. Solar gains

| [Jan]       |          |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c |          |          | Access<br>factor<br>Table 6d | Gains<br>W    |
|-------------|----------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|----------|----------|------------------------------|---------------|
| Northeast   |          |          |          |          | 0.7100     | 11.2829                        | 0.6300                            | 0.7000                             |          |          | 0.7700                       | 2.4482 (75)   |
| East        |          |          |          |          | 1.9300     | 19.6403                        | 0.6300                            | 0.7000                             |          |          | 0.7700                       | 11.5845 (76)  |
| Southeast   |          |          |          |          | 0.7100     | 36.7938                        | 0.6300                            | 0.7000                             |          |          | 0.7700                       | 7.9837 (77)   |
| West        |          |          |          |          | 4.4100     | 19.6403                        | 0.6300                            | 0.7000                             |          |          | 0.7700                       | 26.4702 (80)  |
|             |          |          |          |          |            |                                |                                   |                                    |          |          |                              |               |
| Solar gains | 48.4867  | 93.0258  | 150.1828 | 216.6011 | 264.7712   | 271.0832                       | 258.0416                          | 221.8528                           | 173.6736 | 109.4532 | 60.0929                      | 40.1261 (83)  |
| Total gains | 426.7405 | 478.3627 | 520.8093 | 574.1090 | 605.5513   | 597.1877                       | 572.6998                          | 537.6773                           | 498.4095 | 448.0138 | 418.1228                     | 411.3854 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 32.0370 | 32.1330 | 32.2278 | 32.6804 | 32.7665 | 33.1733 | 33.1733 | 33.2498 | 33.0154 | 32.7665 | 32.5928 | 32.4131      |
| alpha                                                                       | 3.1358  | 3.1422  | 3.1485  | 3.1787  | 3.1844  | 3.2116  | 3.2116  | 3.2167  | 3.2010  | 3.1844  | 3.1729  | 3.1609       |
| util living area                                                            | 0.9445  | 0.9207  | 0.8798  | 0.7933  | 0.6674  | 0.5086  | 0.3804  | 0.4184  | 0.6201  | 0.8254  | 0.9173  | 0.9495 (86)  |
| MIT                                                                         | 19.2201 | 19.4841 | 19.8704 | 20.3585 | 20.7132 | 20.9130 | 20.9741 | 20.9646 | 20.8314 | 20.3725 | 19.7360 | 19.1856 (87) |
| Th 2                                                                        | 20.4188 | 20.4205 | 20.4222 | 20.4302 | 20.4317 | 20.4387 | 20.4387 | 20.4400 | 20.4360 | 20.4317 | 20.4287 | 20.4255 (88) |
| util rest of house                                                          | 0.9395  | 0.9138  | 0.8694  | 0.7759  | 0.6403  | 0.4710  | 0.3351  | 0.3720  | 0.5831  | 0.8068  | 0.9091  | 0.9450 (89)  |
| MIT 2                                                                       | 18.7450 | 19.0059 | 19.3853 | 19.8616 | 20.1935 | 20.3751 | 20.4230 | 20.4179 | 20.3067 | 19.8828 | 19.2626 | 18.7160 (90) |
| Living area fraction                                                        | 19.1438 | 19.4074 | 19.7926 | 20.2788 | 20.6298 | 20.8267 | 20.8857 | 20.8769 | 20.7472 | 20.2940 | 19.6601 | 19.1103 (92) |
| MIT                                                                         | 19.1438 | 19.4074 | 19.7926 | 20.2788 | 20.6298 | 20.8267 | 20.8857 | 20.8769 | 20.7472 | 20.2940 | 19.6601 | 19.1103 (93) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 19.1438 | 19.4074 | 19.7926 | 20.2788 | 20.6298 | 20.8267 | 20.8857 | 20.8769 | 20.7472 | 20.2940 | 19.6601 | 19.1103 (93) |

## 8. Space heating requirement

|                                                                                |          |          |          |          |          |          |          |          |          |               |          |                |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|----------|----------------|
|                                                                                | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov      | Dec            |
| Utilisation                                                                    | 0.9266   | 0.9000   | 0.8568   | 0.7710   | 0.6500   | 0.4972   | 0.3713   | 0.4084   | 0.6039   | 0.8019        | 0.8965   | 0.9326 (94)    |
| Useful gains                                                                   | 395.4306 | 430.5307 | 446.2260 | 442.6182 | 393.6083 | 296.9134 | 212.6407 | 219.5872 | 301.0041 | 359.2658      | 374.8299 | 383.6771 (95)  |
| Ext temp.                                                                      | 4.3000   | 4.9000   | 6.5000   | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000   | 4.2000 (96)    |
| Heat loss rate W                                                               | 785.1142 | 765.0242 | 698.9031 | 589.9920 | 461.7969 | 318.0593 | 218.9125 | 228.1516 | 341.1603 | 501.3135      | 652.9923 | 779.4741 (97)  |
| Space heating kWh                                                              | 289.9246 | 224.7796 | 187.9917 | 106.1092 | 50.7323  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 105.6835      | 200.2769 | 294.4730 (98a) |
| Space heating requirement - total per year (kWh/year)                          |          |          |          |          |          |          |          |          |          |               |          | 1459.9708      |
| Solar heating kWh                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000   | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |          |          |          |          |          |          |          |          |          |               |          | 0.0000         |
| Space heating kWh                                                              | 289.9246 | 224.7796 | 187.9917 | 106.1092 | 50.7323  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 105.6835      | 200.2769 | 294.4730 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |          |          |          |          |          |          |          |          |          |               |          | 1459.9708      |
| Space heating per m2                                                           |          |          |          |          |          |          |          |          |          | (98c) / (4) = |          | 32.0873 (99)   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                         |          |          |          |          |          |          |          |          |          |          |          |                 |
|-------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)    |
| Fraction of space heat from main system(s)                              |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                        |          |          |          |          |          |          |          |          |          |          |          | 92.3000 (206)   |
| Efficiency of main space heating system 2 (in %)                        |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                 |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
|                                                                         | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                               | 289.9246 | 224.7796 | 187.9917 | 106.1092 | 50.7323  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 105.6835 | 200.2769 | 294.4730 (98)   |
| Space heating efficiency (main heating system 1)                        | 92.3000  | 92.3000  | 92.3000  | 92.3000  | 92.3000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 92.3000  | 92.3000  | 92.3000 (210)   |
| Space heating fuel (main heating system)                                | 314.1111 | 243.5315 | 203.6747 | 114.9612 | 54.9646  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 114.5000 | 216.9848 | 319.0390 (211)  |
| Space heating efficiency (main heating system 2)                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |
| Space heating fuel (secondary)                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Water heating                                                           |          |          |          |          |          |          |          |          |          |          |          |                 |
| Water heating requirement                                               | 186.2762 | 164.8922 | 175.6952 | 155.8540 | 151.9829 | 137.9423 | 136.9214 | 141.8423 | 142.8137 | 158.0449 | 166.5530 | 184.4363 (64)   |
| Efficiency of water heater (217)m                                       | 85.0479  | 84.7551  | 84.2118  | 83.2163  | 81.8768  | 79.8000  | 79.8000  | 79.8000  | 79.8000  | 83.1782  | 84.4743  | 85.1036 (217)   |
| Fuel for water heating, kWh/month                                       | 219.0250 | 194.5514 | 208.6349 | 187.2879 | 185.6240 | 172.8600 | 171.5807 | 177.7472 | 178.9645 | 190.0075 | 197.1640 | 216.7198 (219)  |
| Space cooling fuel requirement (221)m                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                            | 7.3041   | 6.5973   | 7.3041   | 7.0685   | 7.3041   | 7.0685   | 7.3041   | 7.3041   | 7.0685   | 7.3041   | 7.0685   | 7.3041 (231)    |
| Lighting                                                                | 14.6451  | 11.7488  | 10.5785  | 7.7503   | 5.9865   | 4.8911   | 5.4611   | 7.0986   | 9.2203   | 12.0976  | 13.6642  | 15.0521 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity) (233a)m   | -15.7289 | -23.0244 | -34.3617 | -40.1851 | -44.7155 | -42.2821 | -41.8036 | -38.7997 | -33.7025 | -27.0492 | -17.6050 | -13.5040 (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity) |          |          |          |          |          |          |          |          |          |          |          |                 |

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|                                                                                                      |         |          |          |          |          |          |          |          |          |          |         |           |        |
|------------------------------------------------------------------------------------------------------|---------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------|-----------|--------|
| (234a)m                                                                                              | 0.0000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000  | 0.0000    | (234a) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |         |          |          |          |          |          |          |          |          |          |         |           |        |
| (235a)m                                                                                              | 0.0000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000  | 0.0000    | (235a) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |         |          |          |          |          |          |          |          |          |          |         |           |        |
| (235c)m                                                                                              | 0.0000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000  | 0.0000    | (235c) |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |         |          |          |          |          |          |          |          |          |          |         |           |        |
| (233b)m                                                                                              | -6.4781 | -13.8465 | -27.9186 | -42.5040 | -56.7396 | -57.1708 | -56.4595 | -47.5256 | -34.4957 | -19.9474 | -8.6994 | -5.1037   | (233b) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |         |          |          |          |          |          |          |          |          |          |         |           |        |
| (234b)m                                                                                              | 0.0000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000  | 0.0000    | (234b) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |         |          |          |          |          |          |          |          |          |          |         |           |        |
| (235b)m                                                                                              | 0.0000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000  | 0.0000    | (235b) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |         |          |          |          |          |          |          |          |          |          |         |           |        |
| (235d)m                                                                                              | 0.0000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000  | 0.0000    | (235d) |
| Annual totals kWh/year                                                                               |         |          |          |          |          |          |          |          |          |          |         |           |        |
| Space heating fuel - main system 1                                                                   |         |          |          |          |          |          |          |          |          |          |         | 1581.7669 | (211)  |
| Space heating fuel - main system 2                                                                   |         |          |          |          |          |          |          |          |          |          |         | 0.0000    | (213)  |
| Space heating fuel - secondary                                                                       |         |          |          |          |          |          |          |          |          |          |         | 0.0000    | (215)  |
| Efficiency of water heater                                                                           |         |          |          |          |          |          |          |          |          |          |         | 79.8000   |        |
| Water heating fuel used                                                                              |         |          |          |          |          |          |          |          |          |          |         | 2300.1669 | (219)  |
| Space cooling fuel                                                                                   |         |          |          |          |          |          |          |          |          |          |         | 0.0000    | (221)  |
| Electricity for pumps and fans:                                                                      |         |          |          |          |          |          |          |          |          |          |         |           |        |
| Total electricity for the above, kWh/year                                                            |         |          |          |          |          |          |          |          |          |          |         | 86.0000   | (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |         |          |          |          |          |          |          |          |          |          |         | 118.1943  | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |         |          |          |          |          |          |          |          |          |          |         |           |        |
| PV generation                                                                                        |         |          |          |          |          |          |          |          |          |          |         | -749.6505 | (233)  |
| Wind generation                                                                                      |         |          |          |          |          |          |          |          |          |          |         | 0.0000    | (234)  |
| Hydro-electric generation (Appendix N)                                                               |         |          |          |          |          |          |          |          |          |          |         | 0.0000    | (235a) |
| Electricity generated - Micro CHP (Appendix N)                                                       |         |          |          |          |          |          |          |          |          |          |         | 0.0000    | (235)  |
| Appendix Q - special features                                                                        |         |          |          |          |          |          |          |          |          |          |         |           |        |
| Energy saved or generated                                                                            |         |          |          |          |          |          |          |          |          |          |         | -0.0000   | (236)  |
| Energy used                                                                                          |         |          |          |          |          |          |          |          |          |          |         | 0.0000    | (237)  |
| Total delivered energy for all uses                                                                  |         |          |          |          |          |          |          |          |          |          |         | 3336.4776 | (238)  |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                               | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |       |
|-----------------------------------------------|--------------------|-------------------------------|--------------------------|-------|
| Space heating - main system 1                 | 1581.7669          | 0.2100                        | 332.1710                 | (261) |
| Total CO2 associated with community systems   |                    |                               | 0.0000                   | (373) |
| Water heating (other fuel)                    | 2300.1669          | 0.2100                        | 483.0351                 | (264) |
| Space and water heating                       |                    |                               | 815.2061                 | (265) |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293                  | (267) |
| Energy for lighting                           | 118.1943           | 0.1443                        | 17.0591                  | (268) |
| Energy saving/generation technologies         |                    |                               |                          |       |
| PV Unit electricity used in dwelling          | -372.7616          | 0.1338                        | -49.8635                 |       |
| PV Unit electricity exported                  | -376.8889          | 0.1255                        | -47.3060                 |       |
| Total                                         |                    |                               | -97.1694                 | (269) |
| Total CO2, kg/year                            |                    |                               | 747.0250                 | (272) |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 16.4200                  | (273) |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |       |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|-------|
| Space heating - main system 1               | 1581.7669          | 1.1300                              | 1787.3966                  | (275) |
| Total CO2 associated with community systems |                    |                                     | 0.0000                     | (473) |
| Water heating (other fuel)                  | 2300.1669          | 1.1300                              | 2599.1887                  | (278) |
| Space and water heating                     |                    |                                     | 4386.5852                  | (279) |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008                   | (281) |
| Energy for lighting                         | 118.1943           | 1.5338                              | 181.2903                   | (282) |
| Energy saving/generation technologies       |                    |                                     |                            |       |
| PV Unit electricity used in dwelling        | -372.7616          | 1.4943                              | -557.0312                  |       |
| PV Unit electricity exported                | -376.8889          | 0.4607                              | -173.6393                  |       |
| Total                                       |                    |                                     | -730.6705                  | (283) |
| Total Primary energy kWh/year               |                    |                                     | 3967.3058                  | (286) |
| Target Primary Energy Rate (TPER)           |                    |                                     | 87.1900                    | (287) |

## SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF FABRIC ENERGY EFFICIENCY

### 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m) | Volume<br>(m3) |             |
|--------------------------------------------------------|--------------|----------------------|----------------|-------------|
| Main dwelling                                          | 45.5000      | 2.7500               | 125.1250       | (1b) - (3b) |
| Ground floor                                           |              |                      |                | (4)         |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 45.5000      |                      |                |             |
| Dwelling volume                                        |              |                      | 125.1250       | (5)         |

### 2. Ventilation rate

|                                                    | m3 per hour |             |
|----------------------------------------------------|-------------|-------------|
| Number of open chimneys                            | 0 * 80 =    | 0.0000 (6a) |
| Number of open flues                               | 0 * 20 =    | 0.0000 (6b) |
| Number of chimneys / flues attached to closed fire | 0 * 10 =    | 0.0000 (6c) |
| Number of flues attached to solid fuel boiler      | 0 * 20 =    | 0.0000 (6d) |

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Number of flues attached to other heater  
Number of blocked chimneys  
Number of intermittent extract fans  
Number of passive vents  
Number of flueless gas fires

0 \* 35 = 0.0000 (6e)  
0 \* 20 = 0.0000 (6f)  
2 \* 10 = 20.0000 (7a)  
0 \* 10 = 0.0000 (7b)  
0 \* 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 20.0000 / (5) = 0.1598 (8)  
Pressure test  
Pressure Test Method  
Measured/design AP50  
Infiltration rate  
Number of sides sheltered

Air changes per hour  
Yes  
Blower Door  
3.0000 (17)  
0.3098 (18)  
2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)  
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.2634 (21)

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate                                                                                         | 0.3358 | 0.3292 | 0.3226 | 0.2897 | 0.2831 | 0.2502 | 0.2502 | 0.2436 | 0.2634 | 0.2831 | 0.2963 | 0.3095 (22b) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.0000 (23b) |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =            |        |        |        |        |        |        |        |        |        |        |        | 0.0000 (23c) |
| Effective ac                                                                                            | 0.5564 | 0.5542 | 0.5520 | 0.5420 | 0.5401 | 0.5313 | 0.5313 | 0.5297 | 0.5347 | 0.5401 | 0.5439 | 0.5479 (25)  |

### 3. Heat losses and heat loss parameter

| Element                                           | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K     | A x U<br>W/K | K-value<br>kJ/m2K | A x K<br>kJ/K                                       |
|---------------------------------------------------|-------------|----------------|---------------|----------------------|--------------|-------------------|-----------------------------------------------------|
| Main dwelling                                     |             |                |               |                      |              |                   |                                                     |
| Windows / Glazed Doors                            |             |                | 7.7600        | 1.1450               | 8.8855       |                   |                                                     |
| Heatloss Floor 1                                  |             |                | 45.5000       | 0.1200               | 5.4600       | 75.0000           | 3412.5000 (28a)                                     |
| External Wall                                     | 41.9375     | 7.7600         | 34.1775       | 0.1500               | 5.1266       | 9.0000            | 307.5975 (29a)                                      |
| Bay Roof                                          | 0.7000      |                | 0.7000        | 0.1400               | 0.0980       | 9.0000            | 6.3000 (30)                                         |
| Total net area of external elements Aum(A, m2)    |             |                | 88.1375       |                      |              |                   |                                                     |
| Fabric heat loss, W/K = Sum (A x U)               |             |                |               | (26)...(30) + (32) = | 19.5701      |                   |                                                     |
| Main dwelling                                     |             |                |               |                      |              |                   |                                                     |
| Party Wall 1                                      |             |                | 40.9800       | 0.0000               | 0.0000       | 45.0000           | 1844.1000 (32)                                      |
| Party Ceiling 1                                   |             |                | 44.8000       |                      |              | 0.0000            | 0.0000 (32b)                                        |
| Internal Wall 1                                   |             |                | 58.8500       |                      |              | 9.0000            | 529.6500 (32c)                                      |
| Heat capacity Cm = Sum(A x k)                     |             |                |               |                      |              |                   | (28)...(30) + (32) + (32a)...(32e) = 6100.1475 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K |             |                |               |                      |              |                   | 134.0692 (35)                                       |

List of Thermal Bridges

| K1 Element                                                                | Length  | Psi-value | Total                              |
|---------------------------------------------------------------------------|---------|-----------|------------------------------------|
| E2 Other lintels (including other steel lintels)                          | 4.6600  | 0.0840    | 0.3914                             |
| E3 Sill                                                                   | 1.6500  | 0.0340    | 0.0561                             |
| E4 Jamb                                                                   | 20.5800 | 0.0430    | 0.8849                             |
| E5 Ground floor (normal)                                                  | 15.2500 | 0.3200    | 4.8800                             |
| E16 Corner (normal)                                                       | 8.2500  | 0.0300    | 0.2475                             |
| E18 Party wall between dwellings                                          | 8.2500  | 0.0400    | 0.3300                             |
| E7 Party floor between dwellings (in blocks of flats)                     | 15.2500 | 0.0660    | 1.0065                             |
| E10 Eaves (insulation at ceiling level)                                   | 3.2000  | 0.0440    | 0.1408                             |
| E17 Corner (inverted - internal area greater than external area)          | 5.5000  | 0.0150    | 0.0825                             |
| P1 Party wall - Ground floor                                              | 14.9000 | 0.1600    | 2.3840                             |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | 14.9000 | 0.0000    | 0.0000                             |
| E25 Staggered party wall between dwellings                                | 2.7500  | 0.1200    | 0.3300                             |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                |         |           | 10.7338 (36)                       |
| Point Thermal bridges                                                     |         |           | (36a) = 0.0000                     |
| Total fabric heat loss                                                    |         |           | (33) + (36) + (36a) = 30.3039 (37) |

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

|                           | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| (38)m                     | 22.9735 | 22.8831 | 22.7945 | 22.3783 | 22.3005 | 21.9380 | 21.9380 | 21.8709 | 22.0776 | 22.3005 | 22.4580 | 22.6227 (38) |
| Heat transfer coeff       | 53.2774 | 53.1870 | 53.0984 | 52.6822 | 52.6044 | 52.2419 | 52.2419 | 52.1748 | 52.3815 | 52.6044 | 52.7619 | 52.9266 (39) |
| Average = Sum(39)m / 12 = |         |         |         |         |         |         |         |         |         |         |         | 52.6819      |

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec         |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
| HLP           | 1.1709 | 1.1689 | 1.1670 | 1.1579 | 1.1561 | 1.1482 | 1.1482 | 1.1467 | 1.1512 | 1.1561 | 1.1596 | 1.1632 (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 1.1578      |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31          |

### 4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.5590 (42)

Hot water usage for mixer showers 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42a)

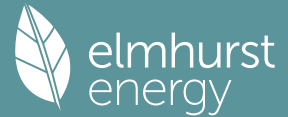
Hot water usage for baths 21.7789 21.4554 21.0000 20.1601 19.5313 18.8340 18.4573 18.9096 19.4021 20.1482 21.0054 21.7053 (42b)

Hot water usage for other uses 30.5954 29.4828 28.3702 27.2577 26.1451 25.0326 25.0326 26.1451 27.2577 28.3702 29.4828 30.5954 (42c)

Average daily hot water use (litres/day) 48.0064 (43)

|                                                                 | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct                | Nov     | Dec          |
|-----------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------------|---------|--------------|
| Daily hot water use                                             | 52.3742 | 50.9382 | 49.3702 | 47.4178 | 45.6764 | 43.8665 | 43.4899 | 45.0548 | 46.6598 | 48.5185            | 50.4881 | 52.3006 (44) |
| Energy conte                                                    | 82.9480 | 72.5354 | 75.8801 | 64.9126 | 61.4892 | 53.9390 | 52.5973 | 55.7872 | 57.5362 | 65.8391            | 71.9296 | 81.8901 (45) |
| Energy content (annual)                                         |         |         |         |         |         |         |         |         |         | Total = Sum(45)m = |         | 797.2838     |
| Distribution loss (46)m = 0.15 x (45)m                          | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000             | 0.0000  | 0.0000 (46)  |
| Water storage loss (or HIU loss):                               |         |         |         |         |         |         |         |         |         |                    |         |              |
| Total storage loss                                              | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000             | 0.0000  | 0.0000 (56)  |
| If cylinder contains dedicated solar storage                    |         |         |         |         |         |         |         |         |         |                    |         |              |
| 0.0000                                                          | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000             | 0.0000  | 0.0000 (57)  |
| Primary loss                                                    | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000             | 0.0000  | 0.0000 (59)  |
| Combi loss                                                      | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000             | 0.0000  | 0.0000 (61)  |
| Total heat required for water heating calculated for each month | 70.5058 | 61.6551 | 64.4981 | 55.1757 | 52.2658 | 45.8482 | 44.7077 | 47.4191 | 48.9057 | 55.9632            | 61.1402 | 69.6066 (62) |
| WWHRS                                                           | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000             | 0.0000  | 0.0000 (63a) |
| PV diverter                                                     | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000             | 0.0000  | 0.0000 (63b) |
| Solar input                                                     | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000             | 0.0000  | 0.0000 (63c) |

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|                                          |         |         |         |         |         |         |         |         |         |         |         |                |
|------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------------|
| FGHRS                                    | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (63d)   |
| Output from w/h                          | 70.5058 | 61.6551 | 64.4981 | 55.1757 | 52.2658 | 45.8482 | 44.7077 | 47.4191 | 48.9057 | 55.9632 | 61.1402 | 69.6066 (64)   |
| 12Total per year (kWh/year)              |         |         |         |         |         |         |         |         |         |         |         | 677.6912 (64)  |
| Electric shower(s)                       | 40.3285 | 35.9330 | 39.2375 | 37.4438 | 38.1465 | 36.3880 | 37.6010 | 38.1465 | 37.4438 | 39.2375 | 38.4997 | 40.3285 (64a)  |
|                                          |         |         |         |         |         |         |         |         |         |         |         | 458.7342 (64a) |
| Heat gains from water heating, kWh/month | 27.7086 | 24.3970 | 25.9339 | 23.1549 | 22.6031 | 20.5590 | 20.5772 | 21.3914 | 21.5874 | 23.8002 | 24.9100 | 27.4838 (65)   |

## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Metabolic gains (Table 5), Watts                                                    |          |          |          |          |          |          |          |          |          |          |          |               |
| (66)m                                                                               | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 70.4835  | 78.0354  | 70.4835  | 72.8330  | 70.4835  | 72.8330  | 70.4835  | 70.4835  | 72.8330  | 70.4835  | 72.8330  | 70.4835 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 135.5704 | 136.9772 | 133.4321 | 125.8851 | 116.3583 | 107.4044 | 101.4227 | 100.0159 | 103.5610 | 111.1080 | 120.6348 | 129.5887 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948 (69)  |
| Pumps, fans                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (70)   |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 (71) |
| Water heating gains (Table 5)                                                       | 37.2427  | 36.3051  | 34.8574  | 32.1596  | 30.3805  | 28.5542  | 27.6575  | 28.7519  | 29.9825  | 31.9895  | 34.5972  | 36.9406 (72)  |
| Total internal gains                                                                | 289.6811 | 297.7021 | 285.1575 | 277.2621 | 263.6068 | 255.1761 | 245.9482 | 245.6358 | 252.7609 | 259.9655 | 274.4495 | 283.3973 (73) |

## 6. Solar gains

| [Jan]       |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 |          | g<br>Specific data<br>or Table 6b |          | FF<br>Specific data<br>or Table 6c |          | Access<br>factor<br>Table 6d |  | Gains<br>W    |
|-------------|----------|----------|----------|------------|--------------------------------|----------|-----------------------------------|----------|------------------------------------|----------|------------------------------|--|---------------|
| Northeast   |          |          |          | 0.7100     | 11.2829                        |          | 0.7600                            |          | 0.0000                             |          | 0.7700                       |  | 4.6880 (75)   |
| East        |          |          |          | 1.9300     | 19.6403                        |          | 0.7600                            |          | 0.0000                             |          | 0.7700                       |  | 22.1824 (76)  |
| Southeast   |          |          |          | 0.7100     | 36.7938                        |          | 0.7600                            |          | 0.0000                             |          | 0.7700                       |  | 15.2875 (77)  |
| West        |          |          |          | 4.4100     | 19.6403                        |          | 0.7600                            |          | 0.0000                             |          | 0.7700                       |  | 50.6863 (80)  |
| Solar gains | 92.8442  | 178.1294 | 287.5760 | 414.7564   | 506.9945                       | 519.0809 | 494.1084                          | 424.8126 | 332.5572                           | 209.5854 | 115.0683                     |  | 76.8350 (83)  |
| Total gains | 382.5253 | 475.8316 | 572.7336 | 692.0186   | 770.6012                       | 774.2571 | 740.0566                          | 670.4484 | 585.3181                           | 469.5509 | 389.5178                     |  | 360.2323 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |              |
| tau                                                                         | 31.8049 | 31.8590 | 31.9122 | 32.1643 | 32.2119 | 32.4354 | 32.4354 | 32.4771 | 32.3489 | 32.2119 | 32.1157 | 32.0158      |
| alpha                                                                       | 3.1203  | 3.1239  | 3.1275  | 3.1443  | 3.1475  | 3.1624  | 3.1624  | 3.1651  | 3.1566  | 3.1475  | 3.1410  | 3.1344       |
| util living area                                                            | 0.9578  | 0.9222  | 0.8560  | 0.7267  | 0.5694  | 0.4141  | 0.3053  | 0.3490  | 0.5579  | 0.8134  | 0.9307  | 0.9641 (86)  |
| MIT                                                                         | 19.0650 | 19.4556 | 19.9649 | 20.5006 | 20.8129 | 20.9488 | 20.9853 | 20.9775 | 20.8703 | 20.3868 | 19.6244 | 18.9922 (87) |
| Th 2                                                                        | 19.9433 | 19.9449 | 19.9465 | 19.9539 | 19.9552 | 19.9617 | 19.9617 | 19.9629 | 19.9592 | 19.9552 | 19.9525 | 19.9495 (88) |
| util rest of house                                                          | 0.9504  | 0.9095  | 0.8338  | 0.6898  | 0.5190  | 0.3524  | 0.2354  | 0.2738  | 0.4895  | 0.7764  | 0.9171  | 0.9577 (89)  |
| MIT 2                                                                       | 18.2060 | 18.5856 | 19.0713 | 19.5642 | 19.8277 | 19.9346 | 19.9564 | 19.9542 | 19.8833 | 19.4816 | 18.7621 | 18.1392 (90) |
| Living area fraction                                                        |         |         |         |         |         |         |         |         |         |         |         | 0.8396 (91)  |
| MIT                                                                         | 18.9272 | 19.3160 | 19.8215 | 20.3503 | 20.6548 | 20.7861 | 20.8202 | 20.8133 | 20.7119 | 20.2415 | 19.4860 | 18.8553 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 18.9272 | 19.3160 | 19.8215 | 20.3503 | 20.6548 | 20.7861 | 20.8202 | 20.8133 | 20.7119 | 20.2415 | 19.4860 | 18.8553 (93) |

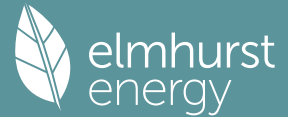
## 8. Space heating requirement

|                                                                                |          |          |          |          |          |          |          |          |          |               |          |                |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|----------|----------------|
| Utilisation                                                                    | 0.9416   | 0.9006   | 0.8309   | 0.7043   | 0.5533   | 0.4016   | 0.2933   | 0.3357   | 0.5397   | 0.7873        | 0.9099   | 0.9495 (94)    |
| Useful gains                                                                   | 360.1915 | 428.5490 | 475.8938 | 487.4120 | 426.3584 | 310.9693 | 217.0871 | 225.0690 | 315.9226 | 369.6747      | 354.4268 | 342.0352 (95)  |
| Ext temp.                                                                      | 4.3000   | 4.9000   | 6.5000   | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000   | 4.2000 (96)    |
| Heat loss rate W                                                               | 779.2978 | 766.7433 | 707.3513 | 603.2298 | 471.0614 | 323.1713 | 220.4712 | 230.2632 | 346.3428 | 507.1873      | 653.5100 | 775.6555 (97)  |
| Space heating kWh                                                              | 311.8151 | 227.2665 | 172.2044 | 83.3889  | 33.2590  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 102.3094      | 215.3399 | 322.6135 (98a) |
| Space heating requirement - total per year (kWh/year)                          |          |          |          |          |          |          |          |          |          |               |          | 1468.1967      |
| Solar heating kWh                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000   | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |          |          |          |          |          |          |          |          |          |               |          | 0.0000         |
| Space heating kWh                                                              | 311.8151 | 227.2665 | 172.2044 | 83.3889  | 33.2590  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 102.3094      | 215.3399 | 322.6135 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |          |          |          |          |          |          |          |          |          |               |          | 1468.1967      |
| Space heating per m2                                                           |          |          |          |          |          |          |          |          |          | (98c) / (4) = |          | 32.2681 (99)   |

## 8c. Space cooling requirement

|                                                     |        |        |        |        |         |          |          |          |         |         |        |              |
|-----------------------------------------------------|--------|--------|--------|--------|---------|----------|----------|----------|---------|---------|--------|--------------|
| Calculated for June, July and August. See Table 10b |        |        |        |        |         |          |          |          |         |         |        |              |
| Ext. temp.                                          | 4.3000 | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000  | 16.6000  | 16.4000  | 14.1000 | 10.6000 | 7.1000 | 4.2000       |
| Heat loss rate W                                    | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 491.0739 | 386.5901 | 396.5283 | 0.0000  | 0.0000  | 0.0000 | 0.0000 (100) |
| Utilisation                                         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.9231   | 0.9517   | 0.9347   | 0.0000  | 0.0000  | 0.0000 | 0.0000 (101) |
| Useful loss                                         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 453.3322 | 367.9360 | 370.6381 | 0.0000  | 0.0000  | 0.0000 | 0.0000 (102) |
| Total gains                                         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 878.8364 | 840.3197 | 760.3173 | 0.0000  | 0.0000  | 0.0000 | 0.0000 (103) |
| Space cooling kWh                                   |        |        |        |        |         |          |          |          |         |         |        |              |

# Full SAP Calculation Printout



|                                  |        |        |        |        |        |          |          |          |        |        |        |                |
|----------------------------------|--------|--------|--------|--------|--------|----------|----------|----------|--------|--------|--------|----------------|
| Cooled fraction                  | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 306.3630 | 351.4535 | 289.9214 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (104)   |
| Intermittency factor (Table 10b) | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500   | 0.2500   | 0.2500   | 0.2500 | 0.2500 | 0.2500 | 1.0000 (105)   |
| Space cooling kWh                | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 76.5908  | 87.8634  | 72.4803  | 0.0000 | 0.0000 | 0.0000 | 0.0000 (107)   |
| Space cooling requirement        |        |        |        |        |        |          |          |          |        |        |        | 236.9345 (107) |
| Energy for space heating         |        |        |        |        |        |          |          |          |        |        |        | 32.2681 (99)   |
| Energy for space cooling         |        |        |        |        |        |          |          |          |        |        |        | 5.2074 (108)   |
| Total                            |        |        |        |        |        |          |          |          |        |        |        | 37.4754 (109)  |
| Fabric Energy Efficiency (DFEE)  |        |        |        |        |        |          |          |          |        |        |        | 37.5 (109)     |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

## 1. Overall dwelling characteristics

|                                                        |                        |                                 |                          |
|--------------------------------------------------------|------------------------|---------------------------------|--------------------------|
| Main dwelling                                          | Area (m <sup>2</sup> ) | Storey height (m)               | Volume (m <sup>3</sup> ) |
| Ground floor                                           | 45.5000 (1b)           | x 2.7500 (2b)                   | = 125.1250 (1b) - (3b)   |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 45.5000                |                                 | (4)                      |
| Dwelling volume                                        |                        | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 125.1250 (5)           |

## 2. Ventilation rate

|                                                                                                    |                             |                            |
|----------------------------------------------------------------------------------------------------|-----------------------------|----------------------------|
| Number of open chimneys                                                                            | 0 * 80 =                    | 0.0000 (6a)                |
| Number of open flues                                                                               | 0 * 20 =                    | 0.0000 (6b)                |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 =                    | 0.0000 (6c)                |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 =                    | 0.0000 (6d)                |
| Number of flues attached to other heater                                                           | 0 * 35 =                    | 0.0000 (6e)                |
| Number of blocked chimneys                                                                         | 0 * 20 =                    | 0.0000 (6f)                |
| Number of intermittent extract fans                                                                | 2 * 10 =                    | 20.0000 (7a)               |
| Number of passive vents                                                                            | 0 * 10 =                    | 0.0000 (7b)                |
| Number of flueless gas fires                                                                       | 0 * 40 =                    | 0.0000 (7c)                |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | Air changes per hour        | 20.0000 / (5) = 0.1598 (8) |
| Pressure test                                                                                      | Yes                         |                            |
| Pressure Test Method                                                                               | Blower Door                 |                            |
| Measured/design AP50                                                                               | 5.0000                      | (17)                       |
| Infiltration rate                                                                                  | 0.4098                      | (18)                       |
| Number of sides sheltered                                                                          | 2                           | (19)                       |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = | 0.8500 (20)                |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) =        | 0.3484 (21)                |

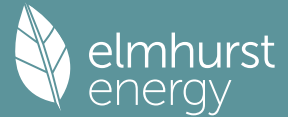
|                                                                                                         |        |        |        |        |        |        |        |        |        |        |        |              |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
| Wind factor                                                                                             | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Adj infilt rate                                                                                         | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
|                                                                                                         | 0.4442 | 0.4355 | 0.4267 | 0.3832 | 0.3745 | 0.3309 | 0.3309 | 0.3222 | 0.3484 | 0.3745 | 0.3919 | 0.4093 (22b) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.0000 (23b) |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =            |        |        |        |        |        |        |        |        |        |        |        | 0.0000 (23c) |
| Effective ac                                                                                            | 0.5986 | 0.5948 | 0.5911 | 0.5734 | 0.5701 | 0.5548 | 0.5548 | 0.5519 | 0.5607 | 0.5701 | 0.5768 | 0.5838 (25)  |

## 3. Heat losses and heat loss parameter

|                                                                           |                      |                         |                        |                            |           |                             |               |
|---------------------------------------------------------------------------|----------------------|-------------------------|------------------------|----------------------------|-----------|-----------------------------|---------------|
| Element                                                                   | Gross m <sup>2</sup> | Openings m <sup>2</sup> | NetArea m <sup>2</sup> | U-value W/m <sup>2</sup> K | A x U W/K | K-value kJ/m <sup>2</sup> K | A x K kJ/K    |
| Main dwelling                                                             |                      |                         |                        |                            |           |                             |               |
| TER Opening Type                                                          |                      |                         | 7.7600                 | 1.1450                     | 8.8855    |                             | (27)          |
| Heatloss Floor 1                                                          |                      |                         | 45.5000                | 0.1300                     | 5.9150    |                             | (28a)         |
| External Wall                                                             | 41.9375              | 7.7600                  | 34.1775                | 0.1800                     | 6.1520    |                             | (29a)         |
| Bay Roof                                                                  | 0.7000               |                         | 0.7000                 | 0.1100                     | 0.0770    |                             | (30)          |
| Total net area of external elements Aum(A, m <sup>2</sup> )               |                      |                         | 88.1375                |                            |           |                             | (31)          |
| Fabric heat loss, W/K = Sum (A x U)                                       |                      |                         | (26)...(30) + (32) =   |                            | 21.0294   |                             | (33)          |
| Main dwelling                                                             |                      |                         |                        |                            |           |                             |               |
| Party Wall 1                                                              |                      |                         | 40.9800                | 0.0000                     | 0.0000    |                             | (32)          |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K            |                      |                         |                        |                            |           |                             | 134.0692 (35) |
| List of Thermal Bridges                                                   |                      |                         |                        |                            |           |                             |               |
| K1 Element                                                                |                      |                         |                        | Length                     | Psi-value | Total                       |               |
| E2 Other lintels (including other steel lintels)                          |                      |                         |                        | 4.6600                     | 0.0500    | 0.2330                      |               |
| E3 Sill                                                                   |                      |                         |                        | 1.6500                     | 0.0500    | 0.0825                      |               |
| E4 Jamb                                                                   |                      |                         |                        | 20.5800                    | 0.0500    | 1.0290                      |               |
| E5 Ground floor (normal)                                                  |                      |                         |                        | 15.2500                    | 0.1600    | 2.4400                      |               |
| E16 Corner (normal)                                                       |                      |                         |                        | 8.2500                     | 0.0900    | 0.7425                      |               |
| E18 Party wall between dwellings                                          |                      |                         |                        | 8.2500                     | 0.0600    | 0.4950                      |               |
| E7 Party floor between dwellings (in blocks of flats)                     |                      |                         |                        | 15.2500                    | 0.0700    | 1.0675                      |               |
| E10 Eaves (insulation at ceiling level)                                   |                      |                         |                        | 3.2000                     | 0.0600    | 0.1920                      |               |
| E17 Corner (inverted - internal area greater than external area)          |                      |                         |                        | 5.5000                     | -0.0900   | -0.4950                     |               |
| P1 Party wall - Ground floor                                              |                      |                         |                        | 14.9000                    | 0.0800    | 1.1920                      |               |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) |                      |                         |                        | 14.9000                    | 0.0000    | 0.0000                      |               |
| E25 Staggered party wall between dwellings                                |                      |                         |                        | 2.7500                     | 0.0600    | 0.1650                      |               |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                |                      |                         |                        |                            |           |                             | 7.1435 (36)   |
| Point Thermal bridges                                                     |                      |                         |                        |                            |           | (36a) =                     | 0.0000        |
| Total fabric heat loss                                                    |                      |                         |                        |                            |           | (33) + (36) + (36a) =       | 28.1729 (37)  |

|                                                                     |     |     |     |     |     |     |     |     |     |     |     |     |
|---------------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---------------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|

# Full SAP Calculation Printout



|                           |         |         |         |         |         |         |         |         |         |         |         |              |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| (38)m                     | 24.7186 | 24.5605 | 24.4054 | 23.6773 | 23.5410 | 22.9068 | 22.9068 | 22.7894 | 23.1511 | 23.5410 | 23.8167 | 24.1048 (38) |
| Heat transfer coeff       | 52.8916 | 52.7334 | 52.5784 | 51.8502 | 51.7140 | 51.0798 | 51.0798 | 50.9623 | 51.3241 | 51.7140 | 51.9896 | 52.2777 (39) |
| Average = Sum(39)m / 12 = |         |         |         |         |         |         |         |         |         |         |         | 51.8496      |
|                           | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| HLP                       | 1.1625  | 1.1590  | 1.1556  | 1.1396  | 1.1366  | 1.1226  | 1.1226  | 1.1201  | 1.1280  | 1.1366  | 1.1426  | 1.1490 (40)  |
| HLP (average)             |         |         |         |         |         |         |         |         |         |         |         | 1.1396       |
| Days in mont              | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31           |

## 4. Water heating energy requirements (kWh/year)

|                                                                 |         |         |         |         |         |         |         |                                        |         |                    |         |                |
|-----------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|----------------------------------------|---------|--------------------|---------|----------------|
| Assumed occupancy                                               |         |         |         |         |         |         |         |                                        |         |                    |         | 1.5590 (42)    |
| Hot water usage for mixer showers                               |         |         |         |         |         |         |         |                                        |         |                    |         |                |
| 0.0000                                                          | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000             | 0.0000  | (42a)          |
| Hot water usage for baths                                       |         |         |         |         |         |         |         |                                        |         |                    |         |                |
| 21.7789                                                         | 21.4554 | 21.0000 | 20.1601 | 19.5313 | 18.8340 | 18.4573 | 18.9096 | 19.4021                                | 20.1482 | 21.0054            | 21.7053 | (42b)          |
| Hot water usage for other uses                                  |         |         |         |         |         |         |         |                                        |         |                    |         |                |
| 30.5954                                                         | 29.4828 | 28.3702 | 27.2577 | 26.1451 | 25.0326 | 25.0326 | 26.1451 | 27.2577                                | 28.3702 | 29.4828            | 30.5954 | (42c)          |
| Average daily hot water use (litres/day)                        |         |         |         |         |         |         |         |                                        |         |                    |         | 48.0064 (43)   |
|                                                                 | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug                                    | Sep     | Oct                | Nov     | Dec            |
| Daily hot water use                                             | 52.3742 | 50.9382 | 49.3702 | 47.4178 | 45.6764 | 43.8665 | 43.4899 | 45.0548                                | 46.6598 | 48.5185            | 50.4881 | 52.3006 (44)   |
| Energy conte                                                    | 82.9480 | 72.5354 | 75.8801 | 64.9126 | 61.4892 | 53.9390 | 52.5973 | 55.7872                                | 57.5362 | 65.8391            | 71.9296 | 81.8901 (45)   |
| Energy content (annual)                                         |         |         |         |         |         |         |         |                                        |         | Total = Sum(45)m = |         | 797.2838       |
| Distribution loss (46)m = 0.15 x (45)m                          |         |         |         |         |         |         |         |                                        |         |                    |         |                |
| 0.0000                                                          | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000             | 0.0000  | (46)           |
| Water storage loss (or HIU loss):                               |         |         |         |         |         |         |         |                                        |         |                    |         |                |
| Total storage loss                                              |         |         |         |         |         |         |         |                                        |         |                    |         |                |
| 0.0000                                                          | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000             | 0.0000  | (56)           |
| If cylinder contains dedicated solar storage                    |         |         |         |         |         |         |         |                                        |         |                    |         |                |
| 0.0000                                                          | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000             | 0.0000  | (57)           |
| Primary loss                                                    | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000             | 0.0000  | (59)           |
| Combi loss                                                      | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000             | 0.0000  | (61)           |
| Total heat required for water heating calculated for each month |         |         |         |         |         |         |         |                                        |         |                    |         |                |
| 70.5058                                                         | 61.6551 | 64.4981 | 55.1757 | 52.2658 | 45.8482 | 44.7077 | 47.4191 | 48.9057                                | 55.9632 | 61.1402            | 69.6066 | (62)           |
| WWHRS                                                           | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000             | 0.0000  | (63a)          |
| PV diverter                                                     | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000             | 0.0000  | (63b)          |
| Solar input                                                     | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000             | 0.0000  | (63c)          |
| FGHRS                                                           | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000             | 0.0000  | (63d)          |
| Output from w/h                                                 |         |         |         |         |         |         |         |                                        |         |                    |         |                |
| 70.5058                                                         | 61.6551 | 64.4981 | 55.1757 | 52.2658 | 45.8482 | 44.7077 | 47.4191 | 48.9057                                | 55.9632 | 61.1402            | 69.6066 | (64)           |
| 12Total per year (kWh/year)                                     |         |         |         |         |         |         |         | Total per year (kWh/year) = Sum(64)m = |         |                    |         | 677.6912 (64a) |
| Electric shower(s)                                              |         |         |         |         |         |         |         |                                        |         |                    |         | 678 (64)       |
| 40.3285                                                         | 35.9330 | 39.2375 | 37.4438 | 38.1465 | 36.3880 | 37.6010 | 38.1465 | 37.4438                                | 39.2375 | 38.4997            | 40.3285 | (64a)          |
| Heat gains from water heating, kWh/month                        |         |         |         |         |         |         |         |                                        |         |                    |         |                |
| 27.7086                                                         | 24.3970 | 25.9339 | 23.1549 | 22.6031 | 20.5590 | 20.5772 | 21.3914 | 21.5874                                | 23.8002 | 24.9100            | 27.4838 | (65)           |

## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |      |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| Metabolic gains (Table 5), Watts                                                    |          |          |          |          |          |          |          |          |          |          |          |      |
| (66)m                                                                               | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | 77.9482  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     |          |          |          |          |          |          |          |          |          |          |          |      |
| 70.4835                                                                             | 78.0354  | 70.4835  | 72.8330  | 70.4835  | 72.8330  | 70.4835  | 70.4835  | 72.8330  | 70.4835  | 72.8330  | 70.4835  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 |          |          |          |          |          |          |          |          |          |          |          |      |
| 135.5704                                                                            | 136.9772 | 133.4321 | 125.8851 | 116.3583 | 107.4044 | 101.4227 | 100.0159 | 103.5610 | 111.1080 | 120.6348 | 129.5887 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    |          |          |          |          |          |          |          |          |          |          |          |      |
| 30.7948                                                                             | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | 30.7948  | (69) |
| Pumps, fans                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 |          |          |          |          |          |          |          |          |          |          |          |      |
| -62.3586                                                                            | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | (71) |
| Water heating gains (Table 5)                                                       |          |          |          |          |          |          |          |          |          |          |          |      |
| 37.2427                                                                             | 36.3051  | 34.8574  | 32.1596  | 30.3805  | 28.5542  | 27.6575  | 28.7519  | 29.9825  | 31.9895  | 34.5972  | 36.9406  | (72) |
| Total internal gains                                                                |          |          |          |          |          |          |          |          |          |          |          |      |
| 289.6811                                                                            | 297.7021 | 285.1575 | 277.2621 | 263.6068 | 255.1761 | 245.9482 | 245.6358 | 252.7609 | 259.9655 | 274.4495 | 283.3973 | (73) |

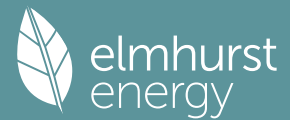
## 6. Solar gains

| [Jan]       |          |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c |          |          | Access<br>factor<br>Table 6d |  |  | Gains<br>W    |
|-------------|----------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|----------|----------|------------------------------|--|--|---------------|
| Northeast   |          |          |          |          | 0.7100     | 11.2829                        | 0.6300                            | 0.7000                             |          |          | 0.7700                       |  |  | 2.4482 (75)   |
| East        |          |          |          |          | 1.9300     | 19.6403                        | 0.6300                            | 0.7000                             |          |          | 0.7700                       |  |  | 11.5845 (76)  |
| Southeast   |          |          |          |          | 0.7100     | 36.7938                        | 0.6300                            | 0.7000                             |          |          | 0.7700                       |  |  | 7.9837 (77)   |
| West        |          |          |          |          | 4.4100     | 19.6403                        | 0.6300                            | 0.7000                             |          |          | 0.7700                       |  |  | 26.4702 (80)  |
|             |          |          |          |          |            |                                |                                   |                                    |          |          |                              |  |  |               |
| Solar gains | 48.4867  | 93.0258  | 150.1828 | 216.6011 | 264.7712   | 271.0832                       | 258.0416                          | 221.8528                           | 173.6736 | 109.4532 | 60.0929                      |  |  | 40.1261 (83)  |
| Total gains | 338.1678 | 390.7279 | 435.3403 | 493.8632 | 528.3780   | 526.2593                       | 503.9898                          | 467.4886                           | 426.4345 | 369.4187 | 334.5424                     |  |  | 323.5234 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |              |
| Jan                                                                         | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |              |
| tau                                                                         | 32.0370 | 32.1330 | 32.2278 | 32.6804 | 32.7665 | 33.1733 | 33.1733 | 33.2498 | 33.0154 | 32.7665 | 32.5928 | 32.4131      |
| alpha                                                                       | 3.1358  | 3.1422  | 3.1485  | 3.1787  | 3.1844  | 3.2116  | 3.2116  | 3.2167  | 3.2010  | 3.1844  | 3.1729  | 3.1609       |
| util living area                                                            |         |         |         |         |         |         |         |         |         |         |         |              |
| 0.9690                                                                      | 0.9509  | 0.9185  | 0.8426  | 0.7241  | 0.5623  | 0.4268  | 0.4728  | 0.6871  | 0.8805  | 0.9514  | 0.9727  | (86)         |
| MIT                                                                         | 18.9408 | 19.2286 | 19.6538 | 20.2119 | 20.6328 | 20.8837 | 20.9639 | 20.9496 | 20.7711 | 20.2063 | 19.4927 | 18.9031 (87) |
| Th 2                                                                        | 19.9502 | 19.9530 | 19.9557 | 19.9687 | 19.9711 | 19.9824 | 19.9824 | 19.9845 | 19.9780 | 19.9711 | 19.9662 | 19.9610 (88) |
| util rest of house                                                          |         |         |         |         |         |         |         |         |         |         |         |              |

# Full SAP Calculation Printout



|                        |         |         |         |         |         |         |         |         |         |         |         |              |
|------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| MIT 2                  | 0.9634  | 0.9422  | 0.9038  | 0.8144  | 0.6755  | 0.4893  | 0.3355  | 0.3789  | 0.6183  | 0.8525  | 0.9413  | 0.9677 (89)  |
| Living area fraction   | 18.0897 | 18.3738 | 18.7895 | 19.3281 | 19.7066 | 19.9170 | 19.9686 | 19.9638 | 19.8356 | 19.3374 | 18.6466 | 18.0603 (90) |
| MIT                    | 18.8043 | 19.0915 | 19.5151 | 20.0701 | 20.4842 | 20.7286 | 20.8042 | 20.7915 | 20.6210 | 20.0669 | 19.3570 | 0.8396 (91)  |
| Temperature adjustment |         |         |         |         |         |         |         |         |         |         |         | 0.0000 (92)  |
| adjusted MIT           | 18.8043 | 19.0915 | 19.5151 | 20.0701 | 20.4842 | 20.7286 | 20.8042 | 20.7915 | 20.6210 | 20.0669 | 19.3570 | 18.7679 (93) |

## 8. Space heating requirement

|                                                                                | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov           | Dec       |       |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|-----------|-------|
| Utilisation                                                                    | 0.9556   | 0.9335   | 0.8966   | 0.8174   | 0.7007   | 0.5437   | 0.4099   | 0.4543   | 0.6631   | 0.8554   | 0.9340        | 0.9605    | (94)  |
| Useful gains                                                                   | 323.1689 | 364.7372 | 390.3139 | 403.6966 | 370.2481 | 286.1076 | 206.5645 | 212.3769 | 282.7632 | 315.9931 | 312.4726      | 310.7301  | (95)  |
| Ext temp.                                                                      | 4.3000   | 4.9000   | 6.5000   | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000  | 7.1000        | 4.2000    | (96)  |
| Heat loss rate W                                                               | 767.1531 | 748.3659 | 684.3145 | 579.1740 | 454.2653 | 313.0483 | 214.7500 | 223.7998 | 334.6866 | 489.5728 | 637.2359      | 761.5766  | (97)  |
| Space heating kWh                                                              | 330.3242 | 257.7985 | 218.7364 | 126.3437 | 62.5088  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 129.1433 | 233.8296      | 335.4298  | (98a) |
| Space heating requirement - total per year (kWh/year)                          |          |          |          |          |          |          |          |          |          |          |               | 1694.1144 |       |
| Solar heating kWh                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | (98b) |
| Solar heating contribution - total per year (kWh/year)                         |          |          |          |          |          |          |          |          |          |          |               | 0.0000    |       |
| Space heating kWh                                                              | 330.3242 | 257.7985 | 218.7364 | 126.3437 | 62.5088  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 129.1433 | 233.8296      | 335.4298  | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |          |          |          |          |          |          |          |          |          |          |               | 1694.1144 |       |
| Space heating per m2                                                           |          |          |          |          |          |          |          |          |          |          | (98c) / (4) = | 37.2333   | (99)  |

## 8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

|                                  | Jan    | Feb    | Mar    | Apr    | May     | Jun      | Jul      | Aug      | Sep                      | Oct     | Nov    | Dec    |                |
|----------------------------------|--------|--------|--------|--------|---------|----------|----------|----------|--------------------------|---------|--------|--------|----------------|
| Ext. temp.                       | 4.3000 | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000  | 16.6000  | 16.4000  | 14.1000                  | 10.6000 | 7.1000 | 4.2000 |                |
| Heat loss rate W                 |        |        |        |        |         |          |          |          |                          |         |        |        |                |
|                                  | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 480.1500 | 377.9904 | 387.3138 | 0.0000                   | 0.0000  | 0.0000 | 0.0000 | (100)          |
| Utilisation                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.8338   | 0.8882   | 0.8626   | 0.0000                   | 0.0000  | 0.0000 | 0.0000 | (101)          |
| Useful loss                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 400.3651 | 335.7275 | 334.0858 | 0.0000                   | 0.0000  | 0.0000 | 0.0000 | (102)          |
| Total gains                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 588.9689 | 564.3974 | 523.0915 | 0.0000                   | 0.0000  | 0.0000 | 0.0000 | (103)          |
| Space cooling kWh                |        |        |        |        |         |          |          |          |                          |         |        |        |                |
|                                  | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 135.7947 | 170.1305 | 140.6203 | 0.0000                   | 0.0000  | 0.0000 | 0.0000 | (104)          |
| Cooled fraction                  |        |        |        |        |         |          |          |          | fc = cooled area / (4) = |         |        | 1.0000 | (105)          |
| Intermittency factor (Table 10b) | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500  | 0.2500   | 0.2500   | 0.2500   | 0.2500                   | 0.2500  | 0.2500 | 0.2500 | (106)          |
| Space cooling kWh                | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 33.9487  | 42.5326  | 35.1551  | 0.0000                   | 0.0000  | 0.0000 | 0.0000 | (107)          |
| Space cooling requirement        |        |        |        |        |         |          |          |          |                          |         |        |        | 111.6364 (107) |
| Energy for space heating         |        |        |        |        |         |          |          |          |                          |         |        |        | 37.2333 (99)   |
| Energy for space cooling         |        |        |        |        |         |          |          |          |                          |         |        |        | 2.4535 (108)   |
| Total                            |        |        |        |        |         |          |          |          |                          |         |        |        | 39.6868 (109)  |
| Fabric Energy Efficiency (TFEE)  |        |        |        |        |         |          |          |          |                          |         |        |        | 39.7 (109)     |

## SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF ENERGY RATING

### 1. Overall dwelling characteristics

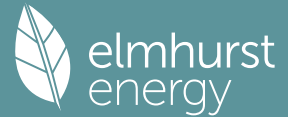
|                                                        | Area (m2)    | Storey height (m)               | Volume (m3)            |     |
|--------------------------------------------------------|--------------|---------------------------------|------------------------|-----|
| Main dwelling                                          | 45.5000 (1b) | x 2.7500 (2b)                   | = 125.1250 (1b) - (3b) |     |
| Ground floor                                           |              |                                 |                        |     |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 45.5000      |                                 |                        | (4) |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 125.1250 (5)         |     |

### 2. Ventilation rate

|                                                                                                  | m3 per hour                 |             |
|--------------------------------------------------------------------------------------------------|-----------------------------|-------------|
| Number of open chimneys                                                                          | 0 * 80 =                    | 0.0000 (6a) |
| Number of open flues                                                                             | 0 * 20 =                    | 0.0000 (6b) |
| Number of chimneys / flues attached to closed fire                                               | 0 * 10 =                    | 0.0000 (6c) |
| Number of flues attached to solid fuel boiler                                                    | 0 * 20 =                    | 0.0000 (6d) |
| Number of flues attached to other heater                                                         | 0 * 35 =                    | 0.0000 (6e) |
| Number of blocked chimneys                                                                       | 0 * 20 =                    | 0.0000 (6f) |
| Number of intermittent extract fans                                                              | 0 * 10 =                    | 0.0000 (7a) |
| Number of passive vents                                                                          | 0 * 10 =                    | 0.0000 (7b) |
| Number of flueless gas fires                                                                     | 0 * 40 =                    | 0.0000 (7c) |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) | 0.0000 / (5) =              | 0.0000 (8)  |
| Pressure test                                                                                    | Yes                         |             |
| Pressure Test Method                                                                             | Blower Door                 |             |
| Measured/design AP50                                                                             | 3.0000                      | (17)        |
| Infiltration rate                                                                                | 0.1500                      | (18)        |
| Number of sides sheltered                                                                        | 2                           | (19)        |
| Shelter factor                                                                                   | (20) = 1 - [0.075 x (19)] = | 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor                                             | (21) = (18) x (20) =        | 0.1275 (21) |

|             | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|-------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed  | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |

# Full SAP Calculation Printout



|                                                                                                         |        |        |        |        |        |        |        |        |        |        |        |              |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Adj infilt rate                                                                                         | 0.1626 | 0.1594 | 0.1562 | 0.1403 | 0.1371 | 0.1211 | 0.1211 | 0.1179 | 0.1275 | 0.1371 | 0.1434 | 0.1498 (22b) |
| Mechanical extract ventilation - centralised                                                            |        |        |        |        |        |        |        |        |        |        |        |              |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

## 3. Heat losses and heat loss parameter

|                                                                           |         |          |                      |         |                                      |         |           |       |
|---------------------------------------------------------------------------|---------|----------|----------------------|---------|--------------------------------------|---------|-----------|-------|
| Element                                                                   | Gross   | Openings | NetArea              | U-value | A x U                                | K-value | A x K     |       |
| Main dwelling                                                             | m2      | m2       | m2                   | W/m2K   | W/K                                  | kJ/m2K  | kJ/K      |       |
| Windows / Glazed Doors                                                    |         |          | 7.7600               | 1.1450  | 8.8855                               |         |           | (27)  |
| Heatloss Floor 1                                                          |         |          | 45.5000              | 0.1200  | 5.4600                               | 75.0000 | 3412.5000 | (28a) |
| External Wall                                                             | 41.9375 | 7.7600   | 34.1775              | 0.1500  | 5.1266                               | 9.0000  | 307.5975  | (29a) |
| Bay Roof                                                                  | 0.7000  |          | 0.7000               | 0.1400  | 0.0980                               | 9.0000  | 6.3000    | (30)  |
| Total net area of external elements Aum(A, m2)                            |         |          | 88.1375              |         |                                      |         |           | (31)  |
| Fabric heat loss, W/K = Sum (A x U)                                       |         |          | (26)...(30) + (32) = |         | 19.5701                              |         |           | (33)  |
| Main dwelling                                                             |         |          |                      |         |                                      |         |           |       |
| Party Wall 1                                                              |         |          | 40.9800              | 0.0000  | 0.0000                               | 45.0000 | 1844.1000 | (32)  |
| Party Ceiling 1                                                           |         |          | 44.8000              |         |                                      | 0.0000  | 0.0000    | (32b) |
| Internal Wall 1                                                           |         |          | 58.8500              |         |                                      | 9.0000  | 529.6500  | (32c) |
| Heat capacity Cm = Sum(A x k)                                             |         |          |                      |         | (28)...(30) + (32) + (32a)...(32e) = |         | 6100.1475 | (34)  |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K                         |         |          |                      |         |                                      |         | 134.0692  | (35)  |
| List of Thermal Bridges                                                   |         |          |                      |         |                                      |         |           |       |
| K1 Element                                                                |         |          |                      | Length  | Psi-value                            | Total   |           |       |
| E2 Other lintels (including other steel lintels)                          |         |          |                      | 4.6600  | 0.0840                               | 0.3914  |           |       |
| E3 Sill                                                                   |         |          |                      | 1.6500  | 0.0340                               | 0.0561  |           |       |
| E4 Jamb                                                                   |         |          |                      | 20.5800 | 0.0430                               | 0.8849  |           |       |
| E5 Ground floor (normal)                                                  |         |          |                      | 15.2500 | 0.3200                               | 4.8800  |           |       |
| E16 Corner (normal)                                                       |         |          |                      | 8.2500  | 0.0300                               | 0.2475  |           |       |
| E18 Party wall between dwellings                                          |         |          |                      | 8.2500  | 0.0400                               | 0.3300  |           |       |
| E7 Party floor between dwellings (in blocks of flats)                     |         |          |                      | 15.2500 | 0.0660                               | 1.0065  |           |       |
| E10 Eaves (insulation at ceiling level)                                   |         |          |                      | 3.2000  | 0.0440                               | 0.1408  |           |       |
| E17 Corner (inverted - internal area greater than external area)          |         |          |                      | 5.5000  | 0.0150                               | 0.0825  |           |       |
| P1 Party wall - Ground floor                                              |         |          |                      | 14.9000 | 0.1600                               | 2.3840  |           |       |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) |         |          |                      | 14.9000 | 0.0000                               | 0.0000  |           |       |
| E25 Staggered party wall between dwellings                                |         |          |                      | 2.7500  | 0.1200                               | 0.3300  |           |       |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                |         |          |                      |         |                                      |         | 10.7338   | (36)  |
| Point Thermal bridges                                                     |         |          |                      |         |                                      | (36a) = | 0.0000    |       |
| Total fabric heat loss                                                    |         |          |                      |         | (33) + (36) + (36a) =                |         | 30.3039   | (37)  |

## 4. Water heating energy requirements (kWh/year)

|                                                                 |          |          |          |          |          |          |          |          |          |          |          |               |             |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|-------------|
| Assumed occupancy                                               |          |          |          |          |          |          |          |          |          |          |          |               | 1.5590 (42) |
| Hot water usage for mixer showers                               | 69.2425  | 68.2019  | 66.6855  | 63.7843  | 61.6433  | 59.2556  | 57.8985  | 59.4034  | 61.0530  | 63.6166  | 66.5801  | 68.9772 (42a) |             |
| Hot water usage for baths                                       | 21.7789  | 21.4554  | 21.0000  | 20.1601  | 19.5313  | 18.8340  | 18.4573  | 18.9096  | 19.4021  | 20.1482  | 21.0054  | 21.7053 (42b) |             |
| Hot water usage for other uses                                  | 30.5954  | 29.4828  | 28.3702  | 27.2577  | 26.1451  | 25.0326  | 25.0326  | 26.1451  | 27.2577  | 28.3702  | 29.4828  | 30.5954 (42c) |             |
| Average daily hot water use (litres/day)                        |          |          |          |          |          |          |          |          |          |          |          | 111.8456 (43) |             |
| Daily hot water use                                             | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |             |
| Energy content (annual)                                         | 121.6167 | 119.1401 | 116.0557 | 111.2021 | 107.3197 | 103.1222 | 101.3884 | 104.4581 | 107.7127 | 112.1350 | 117.0682 | 121.2778 (44) |             |
| Distribution loss (46)m = 0.15 x (45)m                          | 192.6111 | 169.6539 | 178.3733 | 152.2302 | 144.4729 | 126.8008 | 122.6205 | 129.3410 | 132.8206 | 152.1662 | 166.7852 | 189.8917 (45) |             |
| Store volume                                                    | 28.8917  | 25.4481  | 26.7560  | 22.8345  | 21.6709  | 19.0201  | 18.3931  | 19.4011  | 19.9231  | 22.8249  | 25.0178  | 28.4838 (46)  |             |
| a) If manufacturer declared loss factor is known (kWh/day):     |          |          |          |          |          |          |          |          |          |          |          | 196.0000 (47) |             |
| Temperature factor from Table 2b                                |          |          |          |          |          |          |          |          |          |          |          | 1.3120 (48)   |             |
| Enter (49) or (54) in (55)                                      |          |          |          |          |          |          |          |          |          |          |          | 0.5400 (49)   |             |
| Total storage loss                                              | 21.9629  | 19.8374  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629 (56)  |             |
| If cylinder contains dedicated solar storage                    | 21.9629  | 19.8374  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629 (57)  |             |
| Primary loss                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (59)   |             |
| Combi loss                                                      | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (61)   |             |
| Total heat required for water heating calculated for each month | 214.5740 | 189.4914 | 200.3362 | 173.4846 | 166.4358 | 148.0552 | 144.5834 | 151.3038 | 154.0750 | 174.1291 | 188.0396 | 211.8546 (62) |             |
| WWHRS                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63a)  |             |
| PV diverter                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63b)  |             |
| Solar input                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63c)  |             |
| FGHRS                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63d)  |             |
| Output from w/h                                                 | 214.5740 | 189.4914 | 200.3362 | 173.4846 | 166.4358 | 148.0552 | 144.5834 | 151.3038 | 154.0750 | 174.1291 | 188.0396 | 211.8546 (64) |             |
| Electric shower(s)                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (64a)  |             |
| Heat gains from water heating, kWh/month                        | 64.0432  | 56.4099  | 59.3091  | 50.6165  | 48.0373  | 42.1613  | 40.7713  | 43.0059  | 44.1628  | 50.5953  | 55.4561  | 63.1390 (65)  |             |

## 5. Internal gains (see Table 5 and 5a)

# Full SAP Calculation Printout



|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |          |      |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| Metabolic gains (Table 5), Watts                                                    | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |      |
| (66)m                                                                               | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 19.4377  | 17.2644  | 14.0404  | 10.6295  | 7.9456   | 6.7080   | 7.2483   | 9.4216   | 12.6456  | 16.0565  | 18.7404  | 19.9780  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 202.3439 | 204.4436 | 199.1525 | 187.8882 | 173.6691 | 160.3051 | 151.3771 | 149.2775 | 154.5686 | 165.8329 | 180.0520 | 193.4160 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | (69) |
| Pumps, fans                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | (71) |
| Water heating gains (Table 5)                                                       | 86.0796  | 83.9433  | 79.7166  | 70.3007  | 64.5662  | 58.5573  | 54.8001  | 57.8036  | 61.3373  | 68.0044  | 77.0223  | 84.8642  | (72) |
| Total internal gains                                                                | 384.9532 | 382.7434 | 370.0014 | 345.9104 | 323.2729 | 302.6625 | 290.5176 | 293.5947 | 305.6436 | 326.9858 | 352.9067 | 375.3502 | (73) |

## 6. Solar gains

| [Jan]       |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 |          | g<br>Specific data<br>or Table 6b |          | FF<br>Specific data<br>or Table 6c |          | Access<br>factor<br>Table 6d |  | Gains<br>W    |
|-------------|----------|----------|----------|------------|--------------------------------|----------|-----------------------------------|----------|------------------------------------|----------|------------------------------|--|---------------|
|             |          |          |          |            |                                |          |                                   |          |                                    |          |                              |  |               |
| Northeast   |          |          |          | 0.7100     | 11.2829                        |          | 0.7600                            |          | 0.0000                             |          | 0.7700                       |  | 4.6880 (75)   |
| East        |          |          |          | 1.9300     | 19.6403                        |          | 0.7600                            |          | 0.0000                             |          | 0.7700                       |  | 22.1824 (76)  |
| Southeast   |          |          |          | 0.7100     | 36.7938                        |          | 0.7600                            |          | 0.0000                             |          | 0.7700                       |  | 15.2875 (77)  |
| West        |          |          |          | 4.4100     | 19.6403                        |          | 0.7600                            |          | 0.0000                             |          | 0.7700                       |  | 50.6863 (80)  |
|             |          |          |          |            |                                |          |                                   |          |                                    |          |                              |  |               |
| Solar gains | 92.8442  | 178.1294 | 287.5760 | 414.7564   | 506.9945                       | 519.0809 | 494.1084                          | 424.8126 | 332.5572                           | 209.5854 | 115.0683                     |  | 76.8350 (83)  |
| Total gains | 477.7974 | 560.8728 | 657.5774 | 760.6668   | 830.2674                       | 821.7434 | 784.6260                          | 718.4073 | 638.2007                           | 536.5712 | 467.9750                     |  | 452.1852 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |                           |         |         |         |         |      |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|---------|---------|------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |                           |         |         |         | 21.0000 | (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep                       | Oct     | Nov     | Dec     |         |      |
| tau                                                                         | 33.2581 | 33.2581 | 33.2581 | 33.2581 | 33.2581 | 33.2581 | 33.2581 | 33.2581 | 33.2581                   | 33.2581 | 33.2581 | 33.2581 |         |      |
| alpha                                                                       | 3.2172  | 3.2172  | 3.2172  | 3.2172  | 3.2172  | 3.2172  | 3.2172  | 3.2172  | 3.2172                    | 3.2172  | 3.2172  | 3.2172  |         |      |
| util living area                                                            | 0.9249  | 0.8835  | 0.8052  | 0.6775  | 0.5262  | 0.3843  | 0.2821  | 0.3202  | 0.5113                    | 0.7581  | 0.8917  | 0.9350  | (86)    |      |
| MIT                                                                         | 19.4656 | 19.7814 | 20.2148 | 20.6206 | 20.8614 | 20.9615 | 20.9893 | 20.9837 | 20.9053                   | 20.5380 | 19.9084 | 19.3748 | (87)    |      |
| Th 2                                                                        | 19.9847 | 19.9847 | 19.9847 | 19.9847 | 19.9847 | 19.9847 | 19.9847 | 19.9847 | 19.9847                   | 19.9847 | 19.9847 | 19.9847 | (88)    |      |
| util rest of house                                                          | 0.9132  | 0.8666  | 0.7793  | 0.6399  | 0.4783  | 0.3273  | 0.2185  | 0.2519  | 0.4469                    | 0.7172  | 0.8728  | 0.9247  | (89)    |      |
| MIT 2                                                                       | 18.2380 | 18.6245 | 19.1442 | 19.6091 | 19.8644 | 19.9587 | 19.9798 | 19.9767 | 19.9145                   | 19.5354 | 18.7907 | 18.1258 | (90)    |      |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         | 0.8396  | (91)    |      |
| MIT                                                                         | 19.2687 | 19.5958 | 20.0430 | 20.4583 | 20.7014 | 20.8006 | 20.8273 | 20.8222 | 20.7464                   | 20.3772 | 19.7291 | 19.1744 | (92)    |      |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000  |         |      |
| adjusted MIT                                                                | 19.2687 | 19.5958 | 20.0430 | 20.4583 | 20.7014 | 20.8006 | 20.8273 | 20.8222 | 20.7464                   | 20.3772 | 19.7291 | 19.1744 | (93)    |      |

## 8. Space heating requirement

|                                                                                |          |          |          |          |          |          |          |          |          |               |          |           |       |  |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|----------|-----------|-------|--|
| Utilisation                                                                    | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov      | Dec       |       |  |
| Useful gains                                                                   | 431.7428 | 481.9899 | 513.5039 | 500.4820 | 425.4937 | 306.7776 | 212.9280 | 221.5706 | 316.4030 | 393.7338      | 405.9706 | 413.7209  | (94)  |  |
| Ext temp.                                                                      | 4.3000   | 4.9000   | 6.5000   | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000   | 4.2000    | (96)  |  |
| Heat loss rate W                                                               | 762.6464 | 748.7433 | 690.0104 | 588.8924 | 458.6190 | 315.9177 | 215.3792 | 225.3069 | 338.6294 | 498.1426      | 643.4468 | 762.9397  | (97)  |  |
| Space heating kWh                                                              | 246.1923 | 179.2583 | 131.3208 | 63.6555  | 24.6452  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 77.6801       | 170.9828 | 259.8188  | (98a) |  |
| Space heating requirement - total per year (kWh/year)                          |          |          |          |          |          |          |          |          |          |               |          | 1153.5539 |       |  |
| Solar heating kWh                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000   | 0.0000    | (98b) |  |
| Solar heating contribution - total per year (kWh/year)                         |          |          |          |          |          |          |          |          |          |               |          | 0.0000    |       |  |
| Space heating kWh                                                              | 246.1923 | 179.2583 | 131.3208 | 63.6555  | 24.6452  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 77.6801       | 170.9828 | 259.8188  | (98c) |  |
| Space heating requirement after solar contribution - total per year (kWh/year) |          |          |          |          |          |          |          |          |          |               |          | 1153.5539 |       |  |
| Space heating per m2                                                           |          |          |          |          |          |          |          |          |          | (98c) / (4) = |          | 25.3528   | (99)  |  |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                       |          |          |          |          |          |        |        |        |        |          |          |          |          |       |
|-----------------------------------------------------------------------|----------|----------|----------|----------|----------|--------|--------|--------|--------|----------|----------|----------|----------|-------|
| Fraction of space heat from secondary/supplementary system (Table 11) |          |          |          |          |          |        |        |        |        |          |          |          | 0.0000   | (201) |
| Fraction of space heat from main system(s)                            |          |          |          |          |          |        |        |        |        |          |          |          | 1.0000   | (202) |
| Fraction of main heating from main system 2                           |          |          |          |          |          |        |        |        |        |          |          |          | 0.0000   | (203) |
| Fraction of total heating from main system 1                          |          |          |          |          |          |        |        |        |        |          |          |          | 1.0000   | (204) |
| Fraction of total heating from main system 2                          |          |          |          |          |          |        |        |        |        |          |          |          | 0.0000   | (205) |
| Efficiency of main space heating system 1 (in %)                      |          |          |          |          |          |        |        |        |        |          |          |          | 100.0000 | (206) |
| Efficiency of main space heating system 2 (in %)                      |          |          |          |          |          |        |        |        |        |          |          |          | 0.0000   | (207) |
| Efficiency of secondary/supplementary heating system, %               |          |          |          |          |          |        |        |        |        |          |          |          | 0.0000   | (208) |
| Space heating requirement                                             | Jan      | Feb      | Mar      | Apr      | May      | Jun    | Jul    | Aug    | Sep    | Oct      | Nov      | Dec      |          |       |
| Space heating efficiency (main heating system 1)                      | 246.1923 | 179.2583 | 131.3208 | 63.6555  | 24.6452  | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 77.6801  | 170.9828 | 259.8188 | (98)     |       |
| Space heating fuel (main heating system)                              | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 100.0000 | 100.0000 | 100.0000 | (210)    |       |
| Space heating efficiency (main heating system 2)                      | 246.1923 | 179.2583 | 131.3208 | 63.6555  | 24.6452  | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 77.6801  | 170.9828 | 259.8188 | (211)    |       |
| Space heating fuel (main heating system 2)                            | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000   | 0.0000   | 0.0000   | (212)    |       |
| Space heating fuel (secondary)                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000   | 0.0000   | 0.0000   | (213)    |       |
| Space heating fuel used, main system 2                                | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000   | 0.0000   | 0.0000   | (215)    |       |
| Water heating                                                         |          |          |          |          |          |        |        |        |        |          |          |          | 0.0000   | (213) |

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|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |                 |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Water heating requirement                                                                            | 214.5740 | 189.4914 | 200.3362 | 173.4846 | 166.4358 | 148.0552 | 144.5834 | 151.3038 | 154.0750 | 174.1291 | 188.0396 | 211.8546 (64)   |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 313.4050 (216)  |
| (217)m                                                                                               | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 (217)  |
| Fuel for water heating, kWh/month                                                                    | 68.4654  | 60.4621  | 63.9225  | 55.3548  | 53.1057  | 47.2408  | 46.1331  | 48.2774  | 49.1616  | 55.5604  | 59.9989  | 67.5977 (219)   |
| Space cooling fuel requirement                                                                       |          |          |          |          |          |          |          |          |          |          |          |                 |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                                         | 8.5958   | 7.7639   | 8.5958   | 8.3185   | 8.5958   | 8.3185   | 8.5958   | 8.5958   | 8.3185   | 8.5958   | 8.3185   | 8.5958 (231)    |
| Lighting                                                                                             | 17.0137  | 13.6490  | 12.2894  | 9.0038   | 6.9548   | 5.6821   | 6.3444   | 8.2467   | 10.7116  | 14.0542  | 15.8742  | 17.4866 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| (233a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (233a)   |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |                 |
| (234a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |                 |
| (235a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |                 |
| (235c)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| (233b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (233b)   |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |                 |
| (234b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |                 |
| (235b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |                 |
| (235d)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 1153.5539 (211) |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 313.4050        |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          | 675.2804 (219)  |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (221)    |
| Electricity for pumps and fans:                                                                      |          |          |          |          |          |          |          |          |          |          |          |                 |
| (MEV)Centralised, Database: in-use factor = 1.3000, SFP = 0.6630)                                    |          |          |          |          |          |          |          |          |          |          |          |                 |
| mechanical ventilation fans (SFP = 0.6630)                                                           |          |          |          |          |          |          |          |          |          |          |          | 101.2086 (230a) |
| Total electricity for the above, kWh/year                                                            |          |          |          |          |          |          |          |          |          |          |          | 101.2086 (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |          |          |          |          |          |          |          |          | 137.3105 (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| PV generation                                                                                        |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (233)    |
| Wind generation                                                                                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (234)    |
| Hydro-electric generation (Appendix N)                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (235a)   |
| Electricity generated - Micro CHP (Appendix N)                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (235)    |
| Appendix Q - special features                                                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| Energy saved or generated                                                                            |          |          |          |          |          |          |          |          |          |          |          | -0.0000 (236)   |
| Energy used                                                                                          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (237)    |
| Total delivered energy for all uses                                                                  |          |          |          |          |          |          |          |          |          |          |          | 2067.3533 (238) |

## 10a. Fuel costs - using Table 12 prices

|                                             | Fuel<br>kWh/year | Fuel price<br>p/kWh | Fuel cost<br>£/year |
|---------------------------------------------|------------------|---------------------|---------------------|
| Space heating - main system 1               | 1153.5539        | 16.4900             | 190.2210 (240)      |
| Space heating - main system 2               | 0.0000           | 16.4900             | 0.0000 (241)        |
| Total CO2 associated with community systems |                  |                     | 0.0000 (473)        |
| Water heating (other fuel)                  | 675.2804         | 16.4900             | 111.3537 (247)      |
| Energy for instantaneous electric shower(s) | 0.0000           | 16.4900             | 0.0000 (247a)       |
| Pumps, fans and electric keep-hot           | 101.2086         | 16.4900             | 16.6893 (249)       |
| Energy for lighting                         | 137.3105         | 16.4900             | 22.6425 (250)       |
| Additional standing charges                 |                  |                     | 0.0000 (251)        |
| Total energy cost                           |                  |                     | 340.9066 (255)      |

## 11a. SAP rating - Individual heating systems

|                                  |                                         |              |
|----------------------------------|-----------------------------------------|--------------|
| Energy cost deflator (Table 12): |                                         | 0.3600 (256) |
| Energy cost factor (ECF)         |                                         | 1.3561 (257) |
| SAP value                        | $[(255) \times (256)] / [(4) + 45.0] =$ | 78.0177      |
| SAP rating (Section 12)          |                                         | 78 (258)     |
| SAP band                         |                                         | C            |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|---------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1               | 1153.5539          | 0.1560                        | 179.9920 (261)           |
| Space heating - main system 2               | 0.0000             | 0.0000                        | 0.0000 (262)             |
| Total CO2 associated with community systems |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                  | 675.2804           | 0.1412                        | 95.3686 (264)            |
| Space and water heating                     |                    |                               | 275.3606 (265)           |
| Pumps, fans and electric keep-hot           | 101.2086           | 0.1387                        | 14.0389 (267)            |
| Energy for lighting                         | 137.3105           | 0.1443                        | 19.8181 (268)            |
| Total CO2, kg/year                          |                    |                               | 309.2176 (272)           |
| CO2 emissions per m2                        |                    |                               | 6.8000 (273)             |
| EI value                                    |                    |                               | 95.4215                  |
| EI rating                                   |                    |                               | 95 (274)                 |
| EI band                                     |                    |                               | A                        |

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## 1. Overall dwelling characteristics

| Main dwelling                                          | Area<br>(m <sup>2</sup> ) | Storey height<br>(m) | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|----------------------|-----------------------------|
| Ground floor                                           | 45.5000                   | 2.7500               | 125.1250                    |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 45.5000                   |                      |                             |
| Dwelling volume                                        |                           |                      |                             |

## 2. Ventilation rate

|                                                    | m <sup>3</sup> per hour |
|----------------------------------------------------|-------------------------|
| Number of open chimneys                            | 0 * 80 = 0.0000 (6a)    |
| Number of open flues                               | 0 * 20 = 0.0000 (6b)    |
| Number of chimneys / flues attached to closed fire | 0 * 10 = 0.0000 (6c)    |
| Number of flues attached to solid fuel boiler      | 0 * 20 = 0.0000 (6d)    |
| Number of flues attached to other heater           | 0 * 35 = 0.0000 (6e)    |
| Number of blocked chimneys                         | 0 * 20 = 0.0000 (6f)    |
| Number of intermittent extract fans                | 0 * 10 = 0.0000 (7a)    |
| Number of passive vents                            | 0 * 10 = 0.0000 (7b)    |
| Number of flueless gas fires                       | 0 * 40 = 0.0000 (7c)    |

|                                                      |                                                       |                |             |
|------------------------------------------------------|-------------------------------------------------------|----------------|-------------|
| Infiltration due to chimneys, flues and fans         | = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 / (5) = | 0.0000 (8)  |
| Pressure test                                        |                                                       |                | Yes         |
| Pressure Test Method                                 |                                                       |                | Blower Door |
| Measured/design AP50                                 |                                                       |                | 3.0000 (17) |
| Infiltration rate                                    |                                                       |                | 0.1500 (18) |
| Number of sides sheltered                            |                                                       |                | 2 (19)      |
| Shelter factor                                       | (20) = 1 - [0.075 x (19)] =                           |                | 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor | (21) = (18) x (20) =                                  |                | 0.1275 (21) |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 4.3000 | 4.1000 | 4.1000 | 3.8000 | 3.9000 | 3.4000 | 3.4000 | 3.3000 | 3.4000 | 3.8000 | 3.7000 | 4.0000       |
| Wind factor                                                                                             | 1.0750 | 1.0250 | 1.0250 | 0.9500 | 0.9750 | 0.8500 | 0.8500 | 0.8250 | 0.8500 | 0.9500 | 0.9250 | 1.0000       |
| Adj infilt rate                                                                                         | 0.1371 | 0.1307 | 0.1307 | 0.1211 | 0.1243 | 0.1084 | 0.1084 | 0.1052 | 0.1084 | 0.1211 | 0.1179 | 0.1275       |
| Mechanical extract ventilation - centralised                                                            |        |        |        |        |        |        |        |        |        |        |        |              |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

## 3. Heat losses and heat loss parameter

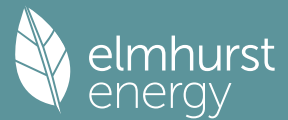
| Element                                                                   | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K         | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K                        |
|---------------------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|----------------------|--------------------------------|--------------------------------------|
| Main dwelling                                                             |                         |                            |                           |                               |                      |                                |                                      |
| Windows / Glazed Doors                                                    |                         |                            | 7.7600                    | 1.1450                        | 8.8855               |                                | (27)                                 |
| Heatloss Floor 1                                                          |                         |                            | 45.5000                   | 0.1200                        | 5.4600               | 75.0000                        | 3412.5000 (28a)                      |
| External Wall                                                             | 41.9375                 | 7.7600                     | 34.1775                   | 0.1500                        | 5.1266               | 9.0000                         | 307.5975 (29a)                       |
| Bay Roof                                                                  | 0.7000                  |                            | 0.7000                    | 0.1400                        | 0.0980               | 9.0000                         | 6.3000 (30)                          |
| Total net area of external elements Aum(A, m <sup>2</sup> )               |                         |                            | 88.1375                   |                               |                      |                                | (31)                                 |
| Fabric heat loss, W/K = Sum (A x U)                                       |                         |                            |                           |                               | (26)...(30) + (32) = | 19.5701                        | (33)                                 |
| Main dwelling                                                             |                         |                            |                           |                               |                      |                                |                                      |
| Party Wall 1                                                              |                         |                            | 40.9800                   | 0.0000                        | 0.0000               | 45.0000                        | 1844.1000 (32)                       |
| Party Ceiling 1                                                           |                         |                            | 44.8000                   |                               |                      | 0.0000                         | 0.0000 (32b)                         |
| Internal Wall 1                                                           |                         |                            | 58.8500                   |                               |                      | 9.0000                         | 529.6500 (32c)                       |
| Heat capacity Cm = Sum(A x k)                                             |                         |                            |                           |                               |                      |                                | (28)...(30) + (32) + (32a)...(32e) = |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K            |                         |                            |                           |                               |                      |                                | 6100.1475 (34)                       |
| List of Thermal Bridges                                                   |                         |                            |                           |                               |                      |                                | 134.0692 (35)                        |
| K1 Element                                                                |                         |                            |                           | Length                        | Psi-value            | Total                          |                                      |
| E2 Other lintels (including other steel lintels)                          |                         |                            |                           | 4.6600                        | 0.0840               | 0.3914                         |                                      |
| E3 Sill                                                                   |                         |                            |                           | 1.6500                        | 0.0340               | 0.0561                         |                                      |
| E4 Jamb                                                                   |                         |                            |                           | 20.5800                       | 0.0430               | 0.8849                         |                                      |
| E5 Ground floor (normal)                                                  |                         |                            |                           | 15.2500                       | 0.3200               | 4.8800                         |                                      |
| E16 Corner (normal)                                                       |                         |                            |                           | 8.2500                        | 0.0300               | 0.2475                         |                                      |
| E18 Party wall between dwellings                                          |                         |                            |                           | 8.2500                        | 0.0400               | 0.3300                         |                                      |
| E7 Party floor between dwellings (in blocks of flats)                     |                         |                            |                           | 15.2500                       | 0.0660               | 1.0065                         |                                      |
| E10 Eaves (insulation at ceiling level)                                   |                         |                            |                           | 3.2000                        | 0.0440               | 0.1408                         |                                      |
| E17 Corner (inverted - internal area greater than external area)          |                         |                            |                           | 5.5000                        | 0.0150               | 0.0825                         |                                      |
| P1 Party wall - Ground floor                                              |                         |                            |                           | 14.9000                       | 0.1600               | 2.3840                         |                                      |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) |                         |                            |                           | 14.9000                       | 0.0000               | 0.0000                         |                                      |
| E25 Staggered party wall between dwellings                                |                         |                            |                           | 2.7500                        | 0.1200               | 0.3300                         |                                      |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                |                         |                            |                           |                               |                      |                                | 10.7338 (36)                         |
| Point Thermal bridges                                                     |                         |                            |                           |                               |                      |                                | (36a) =                              |
| Total fabric heat loss                                                    |                         |                            |                           |                               |                      |                                | (33) + (36) + (36a) =                |

|                                                                     |         |         |         |         |         |         |         |         |         |         |         |             |
|---------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|-------------|
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) |         |         |         |         |         |         |         |         |         |         |         |             |
| (38)m                                                               | 20.6456 | 20.6456 | 20.6456 | 20.6456 | 20.6456 | 20.6456 | 20.6456 | 20.6456 | 20.6456 | 20.6456 | 20.6456 | 20.6456     |
| Heat transfer coeff                                                 | 50.9495 | 50.9495 | 50.9495 | 50.9495 | 50.9495 | 50.9495 | 50.9495 | 50.9495 | 50.9495 | 50.9495 | 50.9495 | 50.9495     |
| Average = Sum(39)m / 12 =                                           |         |         |         |         |         |         |         |         |         |         |         |             |
| HLP                                                                 | 1.1198  | 1.1198  | 1.1198  | 1.1198  | 1.1198  | 1.1198  | 1.1198  | 1.1198  | 1.1198  | 1.1198  | 1.1198  | 1.1198      |
| HLP (average)                                                       |         |         |         |         |         |         |         |         |         |         |         | 1.1198 (40) |
| Days in mont                                                        | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31          |

## 4. Water heating energy requirements (kWh/year)

|                                   |         |         |         |         |         |         |         |         |         |         |         |             |
|-----------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|-------------|
| Assumed occupancy                 |         |         |         |         |         |         |         |         |         |         |         | 1.5590 (42) |
| Hot water usage for mixer showers |         |         |         |         |         |         |         |         |         |         |         |             |
| 69.2425                           | 68.2019 | 66.6855 | 63.7843 | 61.6433 | 59.2556 | 57.8985 | 59.4034 | 61.0530 | 63.6166 | 66.5801 | 68.9772 | (42a)       |
| Hot water usage for baths         |         |         |         |         |         |         |         |         |         |         |         |             |

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|                                                                 |          |          |          |          |          |          |          |          |          |          |          |                                                                                             |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------------------------------------------------------------------------------------|
| Hot water usage for other uses                                  | 21.7789  | 21.4554  | 21.0000  | 20.1601  | 19.5313  | 18.8340  | 18.4573  | 18.9096  | 19.4021  | 20.1482  | 21.0054  | 21.7053 (42b)                                                                               |
| Average daily hot water use (litres/day)                        | 30.5954  | 29.4828  | 28.3702  | 27.2577  | 26.1451  | 25.0326  | 25.0326  | 26.1451  | 27.2577  | 28.3702  | 29.4828  | 30.5954 (42c)                                                                               |
|                                                                 |          |          |          |          |          |          |          |          |          |          |          | 111.8456 (43)                                                                               |
| Daily hot water use                                             | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec                                                                                         |
| Energy content (annual)                                         | 121.6167 | 119.1401 | 116.0557 | 111.2021 | 107.3197 | 103.1222 | 101.3884 | 104.4581 | 107.7127 | 112.1350 | 117.0682 | 121.2778 (44)                                                                               |
| Energy content (annual)                                         | 192.6111 | 169.6539 | 178.3733 | 152.2302 | 144.4729 | 126.8008 | 122.6205 | 129.3410 | 132.8206 | 152.1662 | 166.7852 | 189.8917 (45)                                                                               |
| Distribution loss (46)m = 0.15 x (45)m                          | 28.8917  | 25.4481  | 26.7560  | 22.8345  | 21.6709  | 19.0201  | 18.3931  | 19.4011  | 19.9231  | 22.8249  | 25.0178  | 28.4838 (46)                                                                                |
| Water storage loss (or HIU loss):                               |          |          |          |          |          |          |          |          |          |          |          | 196.0000 (47)                                                                               |
| Store volume                                                    |          |          |          |          |          |          |          |          |          |          |          | 1.3120 (48)                                                                                 |
| a) If manufacturer declared loss factor is known (kWh/day):     |          |          |          |          |          |          |          |          |          |          |          | 0.5400 (49)                                                                                 |
| Temperature factor from Table 2b                                |          |          |          |          |          |          |          |          |          |          |          | 0.7085 (55)                                                                                 |
| Enter (49) or (54) in (55)                                      |          |          |          |          |          |          |          |          |          |          |          |                                                                                             |
| Total storage loss                                              | 21.9629  | 19.8374  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629 (56)                                                                                |
| If cylinder contains dedicated solar storage                    | 21.9629  | 19.8374  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629 (57)                                                                                |
| Primary loss                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (59)                                                                                 |
| Combi loss                                                      | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (61)                                                                                 |
| Total heat required for water heating calculated for each month | 214.5740 | 189.4914 | 200.3362 | 173.4846 | 166.4358 | 148.0552 | 144.5834 | 151.3038 | 154.0750 | 174.1291 | 188.0396 | 211.8546 (62)                                                                               |
| WWHRS                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63a)                                                                                |
| PV diverter                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63b)                                                                                |
| Solar input                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63c)                                                                                |
| FGHRS                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63d)                                                                                |
| Output from w/h                                                 | 214.5740 | 189.4914 | 200.3362 | 173.4846 | 166.4358 | 148.0552 | 144.5834 | 151.3038 | 154.0750 | 174.1291 | 188.0396 | 211.8546 (64)                                                                               |
|                                                                 |          |          |          |          |          |          |          |          |          |          |          | Total per year (kWh/year) = Sum(64)m = 2116.3625 (64)                                       |
| Electric shower(s)                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (64a)                                                                                |
|                                                                 |          |          |          |          |          |          |          |          |          |          |          | Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a) |
| Heat gains from water heating, kWh/month                        | 64.0432  | 56.4099  | 59.3091  | 50.6165  | 48.0373  | 42.1613  | 40.7713  | 43.0059  | 44.1628  | 50.5953  | 55.4561  | 63.1390 (65)                                                                                |

## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Metabolic gains (Table 5), Watts                                                    | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
| (66)m                                                                               | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 19.4377  | 17.2644  | 14.0404  | 10.6295  | 7.9456   | 6.7080   | 7.2483   | 9.4216   | 12.6456  | 16.0565  | 18.7404  | 19.9780 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 202.3439 | 204.4436 | 199.1525 | 187.8882 | 173.6691 | 160.3051 | 151.3771 | 149.2775 | 154.5686 | 165.8329 | 180.0520 | 193.4160 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127 (69)  |
| Pumps, fans                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (70)   |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 (71) |
| Water heating gains (Table 5)                                                       | 86.0796  | 83.9433  | 79.7166  | 70.3007  | 64.5662  | 58.5573  | 54.8001  | 57.8036  | 61.3373  | 68.0044  | 77.0223  | 84.8642 (72)  |
| Total internal gains                                                                | 384.9532 | 382.7434 | 370.0014 | 345.9104 | 323.2729 | 302.6625 | 290.5176 | 293.5947 | 305.6436 | 326.9858 | 352.9067 | 375.3502 (73) |

## 6. Solar gains

| [Jan]       |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 |          | g<br>Specific data<br>or Table 6b |          | FF<br>Specific data<br>or Table 6c |          | Access<br>factor<br>Table 6d |  | Gains<br>W    |
|-------------|----------|----------|----------|------------|--------------------------------|----------|-----------------------------------|----------|------------------------------------|----------|------------------------------|--|---------------|
|             |          |          |          |            |                                |          |                                   |          |                                    |          |                              |  |               |
| Northeast   |          |          |          | 0.7100     | 13.7804                        |          | 0.7600                            |          | 0.0000                             |          | 0.7700                       |  | 5.7257 (75)   |
| East        |          |          |          | 1.9300     | 23.8018                        |          | 0.7600                            |          | 0.0000                             |          | 0.7700                       |  | 26.8826 (76)  |
| Southeast   |          |          |          | 0.7100     | 43.0593                        |          | 0.7600                            |          | 0.0000                             |          | 0.7700                       |  | 17.8908 (77)  |
| West        |          |          |          | 4.4100     | 23.8018                        |          | 0.7600                            |          | 0.0000                             |          | 0.7700                       |  | 61.4260 (80)  |
|             |          |          |          |            |                                |          |                                   |          |                                    |          |                              |  |               |
| Solar gains | 111.9250 | 187.7506 | 300.8610 | 440.1107   | 523.7043                       | 566.9794 | 534.4573                          | 471.4426 | 370.7634                           | 237.1121 | 136.6813                     |  | 93.1365 (83)  |
| Total gains | 496.8782 | 570.4940 | 670.8624 | 786.0211   | 846.9773                       | 869.6418 | 824.9749                          | 765.0373 | 676.4069                           | 564.0979 | 489.5881                     |  | 468.4867 (84) |

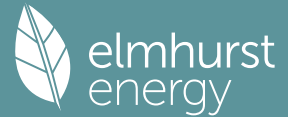
## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 33.2581 | 33.2581 | 33.2581 | 33.2581 | 33.2581 | 33.2581 | 33.2581 | 33.2581 | 33.2581 | 33.2581 | 33.2581 | 33.2581      |
| alpha                                                                       | 3.2172  | 3.2172  | 3.2172  | 3.2172  | 3.2172  | 3.2172  | 3.2172  | 3.2172  | 3.2172  | 3.2172  | 3.2172  | 3.2172       |
| util living area                                                            | 0.9081  | 0.8658  | 0.7751  | 0.6262  | 0.4613  | 0.3000  | 0.2028  | 0.2250  | 0.4320  | 0.7016  | 0.8631  | 0.9196 (86)  |
| MIT                                                                         | 19.6534 | 19.9284 | 20.3511 | 20.7250 | 20.9175 | 20.9848 | 20.9970 | 20.9958 | 20.9494 | 20.6688 | 20.1003 | 19.5769 (87) |
| Th 2                                                                        | 19.9847 | 19.9847 | 19.9847 | 19.9847 | 19.9847 | 19.9847 | 19.9847 | 19.9847 | 19.9847 | 19.9847 | 19.9847 | 19.9847 (88) |
| util rest of house                                                          | 0.8937  | 0.8462  | 0.7453  | 0.5845  | 0.4100  | 0.2432  | 0.1409  | 0.1585  | 0.3653  | 0.6536  | 0.8393  | 0.9066 (89)  |
| MIT 2                                                                       | 18.4713 | 18.8048 | 19.3051 | 19.7229 | 19.9188 | 19.9763 | 19.9838 | 19.9834 | 19.9515 | 19.6784 | 19.0233 | 18.3783 (90) |
| Living area fraction                                                        | 19.4637 | 19.7482 | 20.1832 | 20.5642 | 20.7572 | 20.8230 | 20.8344 | 20.8333 | 20.7893 | 20.5099 | 19.9275 | 19.3846 (92) |
| MIT                                                                         | 19.4637 | 19.7482 | 20.1832 | 20.5642 | 20.7572 | 20.8230 | 20.8344 | 20.8333 | 20.7893 | 20.5099 | 19.9275 | 19.3846 (93) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 19.4637 | 19.7482 | 20.1832 | 20.5642 | 20.7572 | 20.8230 | 20.8344 | 20.8333 | 20.7893 | 20.5099 | 19.9275 | 19.3846 (93) |

## 8. Space heating requirement

|              |          |          |          |          |          |          |          |          |          |          |          |               |
|--------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Utilisation  | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
| Useful gains | 439.8333 | 479.8661 | 504.1311 | 478.5453 | 380.5408 | 252.3700 | 159.0435 | 163.8112 | 283.0851 | 383.1823 | 410.2024 | 420.5479 (95) |
| Ext temp.    | 5.1000   | 5.7000   | 7.4000   | 9.9000   | 12.9000  | 15.8000  | 17.7000  | 17.6000  | 15.0000  | 11.5000  | 8.0000   | 5.1000 (96)   |

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|                                                                                |          |          |          |          |          |          |          |          |          |               |          |                |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|----------|----------------|
| Heat loss rate W                                                               | 731.8245 | 715.7474 | 651.2997 | 543.3368 | 400.3219 | 255.9192 | 159.6981 | 164.7372 | 294.9616 | 459.0512      | 607.6989 | 727.7938 (97)  |
| Space heating kWh                                                              | 217.2414 | 158.5122 | 109.4934 | 46.6499  | 14.7171  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 56.4465       | 142.1975 | 228.5910 (98a) |
| Space heating requirement - total per year (kWh/year)                          |          |          |          |          |          |          |          |          |          |               |          | 973.8491       |
| Solar heating kWh                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000   | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |          |          |          |          |          |          |          |          |          |               |          | 0.0000         |
| Space heating kWh                                                              | 217.2414 | 158.5122 | 109.4934 | 46.6499  | 14.7171  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 56.4465       | 142.1975 | 228.5910 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |          |          |          |          |          |          |          |          |          |               |          | 973.8491       |
| Space heating per m2                                                           |          |          |          |          |          |          |          |          |          | (98c) / (4) = |          | 21.4033 (99)   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                       |                |
|-----------------------------------------------------------------------|----------------|
| Fraction of space heat from secondary/supplementary system (Table 11) | 0.0000 (201)   |
| Fraction of space heat from main system(s)                            | 1.0000 (202)   |
| Fraction of main heating from main system 2                           | 0.0000 (203)   |
| Fraction of total heating from main system 1                          | 1.0000 (204)   |
| Fraction of total heating from main system 2                          | 0.0000 (205)   |
| Efficiency of main space heating system 1 (in %)                      | 100.0000 (206) |
| Efficiency of main space heating system 2 (in %)                      | 0.0000 (207)   |
| Efficiency of secondary/supplementary heating system, %               | 0.0000 (208)   |

|                                                  | Jan      | Feb      | Mar      | Apr      | May      | Jun    | Jul    | Aug    | Sep    | Oct      | Nov      | Dec      |       |
|--------------------------------------------------|----------|----------|----------|----------|----------|--------|--------|--------|--------|----------|----------|----------|-------|
| Space heating requirement                        | 217.2414 | 158.5122 | 109.4934 | 46.6499  | 14.7171  | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 56.4465  | 142.1975 | 228.5910 | (98)  |
| Space heating efficiency (main heating system 1) | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 100.0000 | 100.0000 | 100.0000 | (210) |
| Space heating fuel (main heating system)         | 217.2414 | 158.5122 | 109.4934 | 46.6499  | 14.7171  | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 56.4465  | 142.1975 | 228.5910 | (211) |
| Space heating efficiency (main heating system 2) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000   | 0.0000   | 0.0000   | (212) |
| Space heating fuel (main heating system 2)       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000   | 0.0000   | 0.0000   | (213) |
| Space heating fuel (secondary)                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000   | 0.0000   | 0.0000   | (215) |
| Space heating fuel used, main system 2           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000   | 0.0000   | 0.0000   | (213) |

|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |          |        |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------|
| Water heating                                                                                        |          |          |          |          |          |          |          |          |          |          |          |          |        |
| Water heating requirement                                                                            | 214.5740 | 189.4914 | 200.3362 | 173.4846 | 166.4358 | 148.0552 | 144.5834 | 151.3038 | 154.0750 | 174.1291 | 188.0396 | 211.8546 | (64)   |
| Efficiency of water heater (217)m                                                                    | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | (216)  |
| Fuel for water heating, kWh/month                                                                    | 68.4654  | 60.4621  | 63.9225  | 55.3548  | 53.1057  | 47.2408  | 46.1331  | 48.2774  | 49.1616  | 55.5604  | 59.9989  | 67.5977  | (219)  |
| Space cooling fuel requirement                                                                       |          |          |          |          |          |          |          |          |          |          |          |          |        |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (221)  |
| Pumps and Fa                                                                                         | 8.5958   | 7.7639   | 8.5958   | 8.3185   | 8.5958   | 8.3185   | 8.5958   | 8.5958   | 8.3185   | 8.5958   | 8.3185   | 8.5958   | (231)  |
| Lighting                                                                                             | 17.0137  | 13.6490  | 12.2894  | 9.0038   | 6.9548   | 5.6821   | 6.3444   | 8.2467   | 10.7116  | 14.0542  | 15.8742  | 17.4866  | (232)  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |          |        |
| (233a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |          |        |
| (234a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (234a) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |          |        |
| (235a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (235a) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |          |        |
| (235c)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (235c) |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |          |        |
| (233b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (233b) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |          |        |
| (234b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (234b) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |          |        |
| (235b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (235b) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |          |        |
| (235d)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (235d) |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |          |        |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 973.8491 | (211)  |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000   | (213)  |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000   | (215)  |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 313.4050 |        |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          | 675.2804 | (219)  |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000   | (221)  |

|                                                                  |  |  |  |  |  |  |  |  |  |  |  |          |        |
|------------------------------------------------------------------|--|--|--|--|--|--|--|--|--|--|--|----------|--------|
| Electricity for pumps and fans:                                  |  |  |  |  |  |  |  |  |  |  |  |          |        |
| (MEVCentralised, Database: in-use factor = 1.3000, SFP = 0.6630) |  |  |  |  |  |  |  |  |  |  |  |          |        |
| mechanical ventilation fans (SFP = 0.6630)                       |  |  |  |  |  |  |  |  |  |  |  | 101.2086 | (230a) |
| Total electricity for the above, kWh/year                        |  |  |  |  |  |  |  |  |  |  |  | 101.2086 | (231)  |
| Electricity for lighting (calculated in Appendix L)              |  |  |  |  |  |  |  |  |  |  |  | 137.3105 | (232)  |

|                                                               |  |  |  |  |  |  |  |  |  |  |  |           |        |
|---------------------------------------------------------------|--|--|--|--|--|--|--|--|--|--|--|-----------|--------|
| Energy saving/generation technologies (Appendices M ,N and Q) |  |  |  |  |  |  |  |  |  |  |  |           |        |
| PV generation                                                 |  |  |  |  |  |  |  |  |  |  |  | 0.0000    | (233)  |
| Wind generation                                               |  |  |  |  |  |  |  |  |  |  |  | 0.0000    | (234)  |
| Hydro-electric generation (Appendix N)                        |  |  |  |  |  |  |  |  |  |  |  | 0.0000    | (235a) |
| Electricity generated - Micro CHP (Appendix N)                |  |  |  |  |  |  |  |  |  |  |  | 0.0000    | (235)  |
| Appendix Q - special features                                 |  |  |  |  |  |  |  |  |  |  |  |           |        |
| Energy saved or generated                                     |  |  |  |  |  |  |  |  |  |  |  | -0.0000   | (236)  |
| Energy used                                                   |  |  |  |  |  |  |  |  |  |  |  | 0.0000    | (237)  |
| Total delivered energy for all uses                           |  |  |  |  |  |  |  |  |  |  |  | 1887.6485 | (238)  |

## 10a. Fuel costs - using BEDF prices (585)

|                                             | Fuel kWh/year | Fuel price p/kWh | Fuel cost £/year |        |
|---------------------------------------------|---------------|------------------|------------------|--------|
| Space heating - main system 1               | 973.8491      | 28.4300          | 276.8653         | (240)  |
| Space heating - main system 2               | 0.0000        | 28.4300          | 0.0000           | (241)  |
| Total CO2 associated with community systems |               |                  | 0.0000           | (473)  |
| Water heating (other fuel)                  | 675.2804      | 28.4300          | 191.9822         | (247)  |
| Energy for instantaneous electric shower(s) | 0.0000        | 28.4300          | 0.0000           | (247a) |
| Pumps, fans and electric keep-hot           | 101.2086      | 28.4300          | 28.7736          | (249)  |
| Energy for lighting                         | 137.3105      | 28.4300          | 39.0374          | (250)  |
| Additional standing charges                 |               |                  | 0.0000           | (251)  |
| Total energy cost                           |               |                  | 536.6585         | (255)  |

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## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|---------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1               | 973.8491           | 0.1566                        | 152.5473 (261)           |
| Space heating - main system 2               | 0.0000             | 0.0000                        | 0.0000 (262)             |
| Total CO2 associated with community systems |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                  | 675.2804           | 0.1412                        | 95.3686 (264)            |
| Space and water heating                     |                    |                               | 247.9158 (265)           |
| Pumps, fans and electric keep-hot           | 101.2086           | 0.1387                        | 14.0389 (267)            |
| Energy for lighting                         | 137.3105           | 0.1443                        | 19.8181 (268)            |
| Total CO2, kg/year                          |                    |                               | 281.7728 (272)           |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 973.8491           | 1.5799                              | 1538.5743 (275)            |
| Space heating - main system 2               | 0.0000             | 0.0000                              | 0.0000 (276)               |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 675.2804           | 1.5222                              | 1027.9298 (278)            |
| Space and water heating                     |                    |                                     | 2566.5041 (279)            |
| Pumps, fans and electric keep-hot           | 101.2086           | 1.5128                              | 153.1084 (281)             |
| Energy for lighting                         | 137.3105           | 1.5338                              | 210.6114 (282)             |
| Total Primary energy kWh/year               |                    |                                     | 2930.2238 (286)            |

## SAP 10 EPC IMPROVEMENTS

### Electric Panel Heaters HC

|                                      |      |
|--------------------------------------|------|
| Current energy efficiency rating:    | C 78 |
| Current environmental impact rating: | A 95 |

|                             |                |
|-----------------------------|----------------|
| N Solar water heating       | Not applicable |
| U Solar photovoltaic panels | Not applicable |
| V2 Wind turbine             | Not applicable |

|                                 |            |             |            |
|---------------------------------|------------|-------------|------------|
| Recommended measures:<br>(none) | SAP change | Cost change | CO2 change |
|---------------------------------|------------|-------------|------------|

|                                |                        |                   |                      |
|--------------------------------|------------------------|-------------------|----------------------|
| Recommended measures<br>(none) | Typical annual savings | Energy efficiency | Environmental impact |
|                                | Total Savings          | £0                | 0.00 kg/m²           |

|                                        |      |
|----------------------------------------|------|
| Potential energy efficiency rating:    | C 78 |
| Potential environmental impact rating: | A 95 |

Fuel prices for cost data on this page from database revision number 585 TEST (31 Oct 2025)  
Recommendation texts revision number 6.1 (11 Jun 2019)

### Typical heating and lighting costs of this home (per year, Thames Valley):

|                          | Current<br>£537 | Potential<br>£537 | Saving<br>£0 |
|--------------------------|-----------------|-------------------|--------------|
| Electricity              |                 |                   |              |
| Space heating            | £306            | £306              | £0           |
| Water heating            | £192            | £192              | £0           |
| Lighting                 | £39             | £39               | £0           |
| Total cost of fuels      | £537            | £537              | £0           |
| Total cost of uses       | £537            | £537              | £0           |
| Delivered energy         | 41 kWh/m²       | 41 kWh/m²         | 0 kWh/m²     |
| Carbon dioxide emissions | 0.3 tonnes      | 0.3 tonnes        | 0.0 tonnes   |
| CO2 emissions per m²     | 6 kg/m²         | 6 kg/m²           | 0 kg/m²      |
| Primary energy           | 64 kWh/m²       | 64 kWh/m²         | 0 kWh/m²     |

## SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

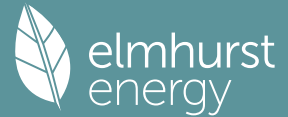
### 1. Overall dwelling characteristics

|                                                        | Area<br>(m²) | Storey height<br>(m)            | Volume<br>(m³)         |
|--------------------------------------------------------|--------------|---------------------------------|------------------------|
| Main dwelling                                          | 45.5000 (1b) | x 2.7500 (2b)                   | = 125.1250 (1b) - (3b) |
| Ground floor                                           |              |                                 |                        |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 45.5000      |                                 | = 125.1250 (4)         |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 125.1250 (5)         |

### 2. Ventilation rate

m³ per hour

# Full SAP Calculation Printout



|                                                    |          |             |
|----------------------------------------------------|----------|-------------|
| Number of open chimneys                            | 0 * 80 = | 0.0000 (6a) |
| Number of open flues                               | 0 * 20 = | 0.0000 (6b) |
| Number of chimneys / flues attached to closed fire | 0 * 10 = | 0.0000 (6c) |
| Number of flues attached to solid fuel boiler      | 0 * 20 = | 0.0000 (6d) |
| Number of flues attached to other heater           | 0 * 35 = | 0.0000 (6e) |
| Number of blocked chimneys                         | 0 * 20 = | 0.0000 (6f) |
| Number of intermittent extract fans                | 0 * 10 = | 0.0000 (7a) |
| Number of passive vents                            | 0 * 10 = | 0.0000 (7b) |
| Number of flueless gas fires                       | 0 * 40 = | 0.0000 (7c) |

|                                                      |                                                       |                |            |
|------------------------------------------------------|-------------------------------------------------------|----------------|------------|
| Infiltration due to chimneys, flues and fans         | = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 / (5) = | 0.0000 (8) |
| Pressure test                                        |                                                       | Yes            |            |
| Pressure Test Method                                 |                                                       | Blower Door    |            |
| Measured/design AP50                                 |                                                       | 3.0000         | (17)       |
| Infiltration rate                                    |                                                       | 0.1500         | (18)       |
| Number of sides sheltered                            |                                                       | 2              | (19)       |
| Shelter factor                                       | (20) = 1 - [0.075 x (19)] =                           | 0.8500         | (20)       |
| Infiltration rate adjusted to include shelter factor | (21) = (18) x (20) =                                  | 0.1275         | (21)       |

|                                                                                                         |        |        |        |        |        |        |        |        |        |        |        |        |              |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |              |
| Wind factor                                                                                             | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 | (22)         |
| Adj infilt rate                                                                                         | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 | (22a)        |
|                                                                                                         | 0.1626 | 0.1594 | 0.1562 | 0.1403 | 0.1371 | 0.1211 | 0.1211 | 0.1179 | 0.1275 | 0.1371 | 0.1434 | 0.1498 | (22b)        |
| Mechanical extract ventilation - centralised                                                            |        |        |        |        |        |        |        |        |        |        |        |        |              |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | (25)         |

## 3. Heat losses and heat loss parameter

| Element                                           | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2        | U-value<br>W/m2K | A x U<br>W/K | K-value<br>kJ/m2K                    | A x K<br>kJ/K |       |
|---------------------------------------------------|-------------|----------------|----------------------|------------------|--------------|--------------------------------------|---------------|-------|
| Main dwelling                                     |             |                |                      |                  |              |                                      |               |       |
| Windows / Glazed Doors                            |             |                | 7.7600               | 1.1450           | 8.8855       |                                      |               | (27)  |
| Heatloss Floor 1                                  |             |                | 45.5000              | 0.1200           | 5.4600       | 75.0000                              | 3412.5000     | (28a) |
| External Wall                                     | 41.9375     | 7.7600         | 34.1775              | 0.1500           | 5.1266       | 9.0000                               | 307.5975      | (29a) |
| Bay Roof                                          | 0.7000      |                | 0.7000               | 0.1400           | 0.0980       | 9.0000                               | 6.3000        | (30)  |
| Total net area of external elements Aum(A, m2)    |             |                | 88.1375              |                  |              |                                      |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)               |             |                | (26)...(30) + (32) = |                  | 19.5701      |                                      |               | (33)  |
| Main dwelling                                     |             |                |                      |                  |              |                                      |               |       |
| Party Wall 1                                      |             |                | 40.9800              | 0.0000           | 0.0000       | 45.0000                              | 1844.1000     | (32)  |
| Party Ceiling 1                                   |             |                | 44.8000              |                  |              | 0.0000                               | 0.0000        | (32b) |
| Internal Wall 1                                   |             |                | 58.8500              |                  |              | 9.0000                               | 529.6500      | (32c) |
| Heat capacity Cm = Sum(A x k)                     |             |                |                      |                  |              | (28)...(30) + (32) + (32a)...(32e) = | 6100.1475     | (34)  |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K |             |                |                      |                  |              |                                      | 134.0692      | (35)  |

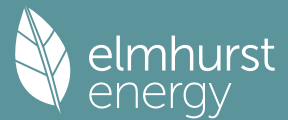
|                                                                           |  |  |  |  |  |         |           |        |  |  |  |         |                            |
|---------------------------------------------------------------------------|--|--|--|--|--|---------|-----------|--------|--|--|--|---------|----------------------------|
| List of Thermal Bridges                                                   |  |  |  |  |  |         |           |        |  |  |  |         |                            |
| K1 Element                                                                |  |  |  |  |  | Length  | Psi-value | Total  |  |  |  |         |                            |
| E2 Other lintels (including other steel lintels)                          |  |  |  |  |  | 4.6600  | 0.0840    | 0.3914 |  |  |  |         |                            |
| E3 Sill                                                                   |  |  |  |  |  | 1.6500  | 0.0340    | 0.0561 |  |  |  |         |                            |
| E4 Jamb                                                                   |  |  |  |  |  | 20.5800 | 0.0430    | 0.8849 |  |  |  |         |                            |
| E5 Ground floor (normal)                                                  |  |  |  |  |  | 15.2500 | 0.3200    | 4.8800 |  |  |  |         |                            |
| E16 Corner (normal)                                                       |  |  |  |  |  | 8.2500  | 0.0300    | 0.2475 |  |  |  |         |                            |
| E18 Party wall between dwellings                                          |  |  |  |  |  | 8.2500  | 0.0400    | 0.3300 |  |  |  |         |                            |
| E7 Party floor between dwellings (in blocks of flats)                     |  |  |  |  |  | 15.2500 | 0.0660    | 1.0065 |  |  |  |         |                            |
| E10 Eaves (insulation at ceiling level)                                   |  |  |  |  |  | 3.2000  | 0.0440    | 0.1408 |  |  |  |         |                            |
| E17 Corner (inverted - internal area greater than external area)          |  |  |  |  |  | 5.5000  | 0.0150    | 0.0825 |  |  |  |         |                            |
| P1 Party wall - Ground floor                                              |  |  |  |  |  | 14.9000 | 0.1600    | 2.3840 |  |  |  |         |                            |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) |  |  |  |  |  | 14.9000 | 0.0000    | 0.0000 |  |  |  |         |                            |
| E25 Staggered party wall between dwellings                                |  |  |  |  |  | 2.7500  | 0.1200    | 0.3300 |  |  |  |         |                            |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                |  |  |  |  |  |         |           |        |  |  |  | 10.7338 | (36)                       |
| Point Thermal bridges                                                     |  |  |  |  |  |         |           |        |  |  |  | 0.0000  | (36a) =                    |
| Total fabric heat loss                                                    |  |  |  |  |  |         |           |        |  |  |  | 30.3039 | (33) + (36) + (36a) = (37) |

|                                                                     |         |         |         |         |         |         |         |         |         |         |         |         |         |
|---------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) |         |         |         |         |         |         |         |         |         |         |         |         |         |
| (38)m                                                               | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |         |
| Heat transfer coeff                                                 | 20.6456 | 20.6456 | 20.6456 | 20.6456 | 20.6456 | 20.6456 | 20.6456 | 20.6456 | 20.6456 | 20.6456 | 20.6456 | 20.6456 | (38)    |
| Average = Sum(39)m / 12 =                                           | 50.9495 | 50.9495 | 50.9495 | 50.9495 | 50.9495 | 50.9495 | 50.9495 | 50.9495 | 50.9495 | 50.9495 | 50.9495 | 50.9495 | (39)    |
|                                                                     |         |         |         |         |         |         |         |         |         |         |         |         | 50.9495 |
| HLP                                                                 | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |         |
| HLP (average)                                                       | 1.1198  | 1.1198  | 1.1198  | 1.1198  | 1.1198  | 1.1198  | 1.1198  | 1.1198  | 1.1198  | 1.1198  | 1.1198  | 1.1198  | (40)    |
| Days in month                                                       | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31      |         |

## 4. Water heating energy requirements (kWh/year)

|                                                             |          |          |          |          |          |          |          |          |          |                    |          |          |               |
|-------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------------|----------|----------|---------------|
| Assumed occupancy                                           |          |          |          |          |          |          |          |          |          |                    |          |          | 1.5590 (42)   |
| Hot water usage for mixer showers                           |          |          |          |          |          |          |          |          |          |                    |          |          |               |
|                                                             | 69.2425  | 68.2019  | 66.6855  | 63.7843  | 61.6433  | 59.2556  | 57.8985  | 59.4034  | 61.0530  | 63.6166            | 66.5801  | 68.9772  | (42a)         |
| Hot water usage for baths                                   |          |          |          |          |          |          |          |          |          |                    |          |          |               |
|                                                             | 21.7789  | 21.4554  | 21.0000  | 20.1601  | 19.5313  | 18.8340  | 18.4573  | 18.9096  | 19.4021  | 20.1482            | 21.0054  | 21.7053  | (42b)         |
| Hot water usage for other uses                              |          |          |          |          |          |          |          |          |          |                    |          |          |               |
|                                                             | 30.5954  | 29.4828  | 28.3702  | 27.2577  | 26.1451  | 25.0326  | 25.0326  | 26.1451  | 27.2577  | 28.3702            | 29.4828  | 30.5954  | (42c)         |
| Average daily hot water use (litres/day)                    |          |          |          |          |          |          |          |          |          |                    |          |          | 111.8456 (43) |
|                                                             |          |          |          |          |          |          |          |          |          |                    |          |          |               |
| Daily hot water use                                         | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct                | Nov      | Dec      |               |
|                                                             | 121.6167 | 119.1401 | 116.0557 | 111.2021 | 107.3197 | 103.1222 | 101.3884 | 104.4581 | 107.7127 | 112.1350           | 117.0682 | 121.2778 | (44)          |
| Energy conte                                                | 192.6111 | 169.6539 | 178.3733 | 152.2302 | 144.4729 | 126.8008 | 122.6205 | 129.3410 | 132.8206 | 152.1662           | 166.7852 | 189.8917 | (45)          |
| Energy content (annual)                                     |          |          |          |          |          |          |          |          |          | Total = Sum(45)m = |          |          | 1857.7673     |
| Distribution loss (46)m = 0.15 x (45)m                      |          |          |          |          |          |          |          |          |          |                    |          |          |               |
|                                                             | 28.8917  | 25.4481  | 26.7560  | 22.8345  | 21.6709  | 19.0201  | 18.3931  | 19.4011  | 19.9231  | 22.8249            | 25.0178  | 28.4838  | (46)          |
| Water storage loss (or HIU loss):                           |          |          |          |          |          |          |          |          |          |                    |          |          |               |
| Store volume                                                |          |          |          |          |          |          |          |          |          |                    |          |          | 196.0000 (47) |
| a) If manufacturer declared loss factor is known (kWh/day): |          |          |          |          |          |          |          |          |          |                    |          |          | 1.3120 (48)   |
| Temperature factor from Table 2b                            |          |          |          |          |          |          |          |          |          |                    |          |          | 0.5400 (49)   |
| Enter (49) or (54) in (55)                                  |          |          |          |          |          |          |          |          |          |                    |          |          | 0.7085 (55)   |
| Total storage loss                                          |          |          |          |          |          |          |          |          |          |                    |          |          |               |

# Full SAP Calculation Printout



|                                                                 |                                                                                |          |          |          |          |          |          |          |          |          |          |                |
|-----------------------------------------------------------------|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| If cylinder contains dedicated solar storage                    | 21.9629                                                                        | 19.8374  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629 (56)   |
| Primary loss                                                    | 21.9629                                                                        | 19.8374  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629 (57)   |
| Combi loss                                                      | 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (59)    |
| Total heat required for water heating calculated for each month | 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (61)    |
| WWHRS                                                           | 214.5740                                                                       | 189.4914 | 200.3362 | 173.4846 | 166.4358 | 148.0552 | 144.5834 | 151.3038 | 154.0750 | 174.1291 | 188.0396 | 211.8546 (62)  |
| PV diverter                                                     | 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63a)   |
| Solar input                                                     | 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63b)   |
| FGHRS                                                           | 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63c)   |
| Output from w/h                                                 | 214.5740                                                                       | 189.4914 | 200.3362 | 173.4846 | 166.4358 | 148.0552 | 144.5834 | 151.3038 | 154.0750 | 174.1291 | 188.0396 | 211.8546 (64)  |
| Electric shower(s)                                              | Total per year (kWh/year) = Sum(64)m =                                         |          |          |          |          |          |          |          |          |          |          | 2116.3625 (64) |
| Heat gains from water heating, kWh/month                        | 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (64a)   |
|                                                                 | Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |          | 0.0000 (64a)   |
|                                                                 | 64.0432                                                                        | 56.4099  | 59.3091  | 50.6165  | 48.0373  | 42.1613  | 40.7713  | 43.0059  | 44.1628  | 50.5953  | 55.4561  | 63.1390 (65)   |

## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Metabolic gains (Table 5), Watts                                                    | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
| (66)m                                                                               | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378  | 93.5378 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 19.4377  | 17.2644  | 14.0404  | 10.6295  | 7.9456   | 6.7080   | 7.2483   | 9.4216   | 12.6456  | 16.0565  | 18.7404  | 19.9780 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 202.3439 | 204.4436 | 199.1525 | 187.8882 | 173.6691 | 160.3051 | 151.3771 | 149.2775 | 154.5686 | 165.8329 | 180.0520 | 193.4160 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127  | 45.9127 (69)  |
| Pumps, fans                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (70)   |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 | -62.3586 (71) |
| Water heating gains (Table 5)                                                       | 86.0796  | 83.9433  | 79.7166  | 70.3007  | 64.5662  | 58.5573  | 54.8001  | 57.8036  | 61.3373  | 68.0044  | 77.0223  | 84.8642 (72)  |
| Total internal gains                                                                | 384.9532 | 382.7434 | 370.0014 | 345.9104 | 323.2729 | 302.6625 | 290.5176 | 293.5947 | 305.6436 | 326.9858 | 352.9067 | 375.3502 (73) |

## 6. Solar gains

| [Jan]       |          |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c |          |          | Access<br>factor<br>Table 6d | Gains<br>W    |  |
|-------------|----------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|----------|----------|------------------------------|---------------|--|
| -----       |          |          |          |          |            |                                |                                   |                                    |          |          |                              |               |  |
| Northeast   |          |          |          |          | 0.7100     | 11.2829                        | 0.7600                            | 0.0000                             |          |          | 0.7700                       | 4.6880 (75)   |  |
| East        |          |          |          |          | 1.9300     | 19.6403                        | 0.7600                            | 0.0000                             |          |          | 0.7700                       | 22.1824 (76)  |  |
| Southeast   |          |          |          |          | 0.7100     | 36.7938                        | 0.7600                            | 0.0000                             |          |          | 0.7700                       | 15.2875 (77)  |  |
| West        |          |          |          |          | 4.4100     | 19.6403                        | 0.7600                            | 0.0000                             |          |          | 0.7700                       | 50.6863 (80)  |  |
| -----       |          |          |          |          |            |                                |                                   |                                    |          |          |                              |               |  |
| Solar gains | 92.8442  | 178.1294 | 287.5760 | 414.7564 | 506.9945   | 519.0809                       | 494.1084                          | 424.8126                           | 332.5572 | 209.5854 | 115.0683                     | 76.8350 (83)  |  |
| Total gains | 477.7974 | 560.8728 | 657.5774 | 760.6668 | 830.2674   | 821.7434                       | 784.6260                          | 718.4073                           | 638.2007 | 536.5712 | 467.9750                     | 452.1852 (84) |  |

## 7. Mean internal temperature (heating season)

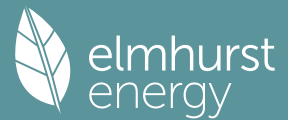
|                                                                             |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 33.2581 | 33.2581 | 33.2581 | 33.2581 | 33.2581 | 33.2581 | 33.2581 | 33.2581 | 33.2581 | 33.2581 | 33.2581 | 33.2581      |
| alpha                                                                       | 3.2172  | 3.2172  | 3.2172  | 3.2172  | 3.2172  | 3.2172  | 3.2172  | 3.2172  | 3.2172  | 3.2172  | 3.2172  | 3.2172       |
| util living area                                                            | 0.9249  | 0.8835  | 0.8052  | 0.6775  | 0.5262  | 0.3843  | 0.2821  | 0.3202  | 0.5113  | 0.7581  | 0.8917  | 0.9350 (86)  |
| MIT                                                                         | 19.4656 | 19.7814 | 20.2148 | 20.6206 | 20.8614 | 20.9615 | 20.9893 | 20.9837 | 20.9053 | 20.5380 | 19.9084 | 19.3748 (87) |
| Th 2                                                                        | 19.9847 | 19.9847 | 19.9847 | 19.9847 | 19.9847 | 19.9847 | 19.9847 | 19.9847 | 19.9847 | 19.9847 | 19.9847 | 19.9847 (88) |
| util rest of house                                                          | 0.9132  | 0.8666  | 0.7793  | 0.6399  | 0.4783  | 0.3273  | 0.2185  | 0.2519  | 0.4469  | 0.7172  | 0.8728  | 0.9247 (89)  |
| MIT 2                                                                       | 18.2380 | 18.6245 | 19.1442 | 19.6091 | 19.8644 | 19.9587 | 19.9798 | 19.9767 | 19.9145 | 19.5354 | 18.7907 | 18.1258 (90) |
| Living area fraction                                                        | 19.2687 | 19.5958 | 20.0430 | 20.4583 | 20.7014 | 20.8006 | 20.8273 | 20.8222 | 20.7464 | 20.3772 | 19.7291 | 19.1744 (92) |
| MIT                                                                         | 19.2687 | 19.5958 | 20.0430 | 20.4583 | 20.7014 | 20.8006 | 20.8273 | 20.8222 | 20.7464 | 20.3772 | 19.7291 | 19.1744 (93) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 19.2687 | 19.5958 | 20.0430 | 20.4583 | 20.7014 | 20.8006 | 20.8273 | 20.8222 | 20.7464 | 20.3772 | 19.7291 | 19.1744 (93) |

## 8. Space heating requirement

|                                                                                |               |          |          |          |          |          |          |          |          |          |          |                |
|--------------------------------------------------------------------------------|---------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Utilisation                                                                    | Jan           | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec            |
| Useful gains                                                                   | 0.9036        | 0.8594   | 0.7809   | 0.6580   | 0.5125   | 0.3733   | 0.2714   | 0.3084   | 0.4958   | 0.7338   | 0.8675   | 0.9149 (94)    |
| Ext temp.                                                                      | 431.7428      | 481.9899 | 513.5039 | 500.4820 | 425.4937 | 306.7776 | 212.9280 | 221.5706 | 316.4030 | 393.7338 | 405.9706 | 413.7209 (95)  |
| Heat loss rate W                                                               | 4.3000        | 4.9000   | 6.5000   | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000  | 7.1000   | 4.2000 (96)    |
| Space heating kWh                                                              | 762.6464      | 748.7433 | 690.0104 | 588.8924 | 458.6190 | 315.9177 | 215.3792 | 225.3069 | 338.6294 | 498.1426 | 643.4468 | 762.9397 (97)  |
| Space heating requirement - total per year (kWh/year)                          | 246.1923      | 179.2583 | 131.3208 | 63.6555  | 24.6452  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 77.6801  | 170.9828 | 259.8188 (98a) |
| Solar heating kWh                                                              | 0.0000        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         | 246.1923      | 179.2583 | 131.3208 | 63.6555  | 24.6452  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 77.6801  | 170.9828 | 259.8188 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |               |          |          |          |          |          |          |          |          |          |          | 1153.5539      |
| Space heating per m2                                                           | (98c) / (4) = |          |          |          |          |          |          |          |          |          |          | 25.3528 (99)   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

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|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |           |        |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|--------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (201)  |
| Fraction of space heat from main system(s)                                                           |          |          |          |          |          |          |          |          |          |          |          | 1.0000    | (202)  |
| Fraction of main heating from main system 2                                                          |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (203)  |
| Fraction of total heating from main system 1                                                         |          |          |          |          |          |          |          |          |          |          |          | 1.0000    | (204)  |
| Fraction of total heating from main system 2                                                         |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (205)  |
| Efficiency of main space heating system 1 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 100.0000  | (206)  |
| Efficiency of main space heating system 2 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (207)  |
| Efficiency of secondary/supplementary heating system, %                                              |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (208)  |
|                                                                                                      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec       |        |
| Space heating requirement                                                                            | 246.1923 | 179.2583 | 131.3208 | 63.6555  | 24.6452  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 77.6801  | 170.9828 | 259.8188  | (98)   |
| Space heating efficiency (main heating system 1)                                                     | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 100.0000 | 100.0000 | 100.0000  | (210)  |
| Space heating fuel (main heating system)                                                             | 246.1923 | 179.2583 | 131.3208 | 63.6555  | 24.6452  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 77.6801  | 170.9828 | 259.8188  | (211)  |
| Space heating efficiency (main heating system 2)                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (212)  |
| Space heating fuel (main heating system 2)                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (213)  |
| Space heating fuel (secondary)                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (215)  |
| Space heating fuel used, main system 2                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (213)  |
| Water heating                                                                                        |          |          |          |          |          |          |          |          |          |          |          |           |        |
| Water heating requirement                                                                            | 214.5740 | 189.4914 | 200.3362 | 173.4846 | 166.4358 | 148.0552 | 144.5834 | 151.3038 | 154.0750 | 174.1291 | 188.0396 | 211.8546  | (64)   |
| Efficiency of water heater                                                                           | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050  | (216)  |
| Fuel for water heating, kWh/month                                                                    | 68.4654  | 60.4621  | 63.9225  | 55.3548  | 53.1057  | 47.2408  | 46.1331  | 48.2774  | 49.1616  | 55.5604  | 59.9989  | 67.5977   | (217)  |
| Space cooling fuel requirement                                                                       |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (221)  |
| Pumps and Fa                                                                                         | 8.5958   | 7.7639   | 8.5958   | 8.3185   | 8.5958   | 8.3185   | 8.5958   | 8.5958   | 8.3185   | 8.5958   | 8.3185   | 8.5958    | (231)  |
| Lighting                                                                                             | 17.0137  | 13.6490  | 12.2894  | 9.0038   | 6.9548   | 5.6821   | 6.3444   | 8.2467   | 10.7116  | 14.0542  | 15.8742  | 17.4866   | (232)  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (233a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (234a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (234a) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (235a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235a) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (235c)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235c) |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (233b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (233b) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (234b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (234b) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (235b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235b) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (235d)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235d) |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |           |        |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 1153.5539 | (211)  |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (213)  |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (215)  |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 313.4050  |        |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          | 675.2804  | (219)  |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (221)  |
| Electricity for pumps and fans:                                                                      |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (MEVCentralised, Database: in-use factor = 1.3000, SFP = 0.6630)                                     |          |          |          |          |          |          |          |          |          |          |          |           |        |
| mechanical ventilation fans (SFP = 0.6630)                                                           |          |          |          |          |          |          |          |          |          |          |          | 101.2086  | (230a) |
| Total electricity for the above, kWh/year                                                            |          |          |          |          |          |          |          |          |          |          |          | 101.2086  | (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |          |          |          |          |          |          |          |          | 137.3105  | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |          |          |          |          |          |          |          |          |           |        |
| PV generation                                                                                        |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (233)  |
| Wind generation                                                                                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (234)  |
| Hydro-electric generation (Appendix N)                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (235a) |
| Electricity generated - Micro CHP (Appendix N)                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (235)  |
| Appendix Q - special features                                                                        |          |          |          |          |          |          |          |          |          |          |          |           |        |
| Energy saved or generated                                                                            |          |          |          |          |          |          |          |          |          |          |          | -0.0000   | (236)  |
| Energy used                                                                                          |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (237)  |
| Total delivered energy for all uses                                                                  |          |          |          |          |          |          |          |          |          |          |          | 2067.3533 | (238)  |

## 10a. Fuel costs - using Table 12 prices

|                                             | Fuel<br>kWh/year | Fuel price<br>p/kWh | Fuel cost<br>£/year |        |
|---------------------------------------------|------------------|---------------------|---------------------|--------|
| Space heating - main system 1               | 1153.5539        | 16.4900             | 190.2210            | (240)  |
| Space heating - main system 2               | 0.0000           | 16.4900             | 0.0000              | (241)  |
| Total CO2 associated with community systems |                  |                     | 0.0000              | (473)  |
| Water heating (other fuel)                  | 675.2804         | 16.4900             | 111.3537            | (247)  |
| Energy for instantaneous electric shower(s) | 0.0000           | 16.4900             | 0.0000              | (247a) |
| Pumps, fans and electric keep-hot           | 101.2086         | 16.4900             | 16.6893             | (249)  |
| Energy for lighting                         | 137.3105         | 16.4900             | 22.6425             | (250)  |
| Additional standing charges                 |                  |                     | 0.0000              | (251)  |
| Total energy cost                           |                  |                     | 340.9066            | (255)  |

## 11a. SAP rating - Individual heating systems

|                                  |                                  |         |       |
|----------------------------------|----------------------------------|---------|-------|
| Energy cost deflator (Table 12): |                                  | 0.3600  | (256) |
| Energy cost factor (ECF)         | [(255) x (256)] / [(4) + 45.0] = | 1.3561  | (257) |
| SAP value                        |                                  | 78.0177 |       |
| SAP rating (Section 12)          |                                  | 78      | (258) |
| SAP band                         |                                  | C       |       |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                               | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |       |
|-------------------------------|--------------------|-------------------------------|--------------------------|-------|
| Space heating - main system 1 | 1153.5539          | 0.1560                        | 179.9920                 | (261) |

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|                                             |          |        |                |
|---------------------------------------------|----------|--------|----------------|
| Space heating - main system 2               | 0.0000   | 0.0000 | 0.0000 (262)   |
| Total CO2 associated with community systems |          |        | 0.0000 (373)   |
| Water heating (other fuel)                  | 675.2804 | 0.1412 | 95.3686 (264)  |
| Space and water heating                     |          |        | 275.3606 (265) |
| Pumps, fans and electric keep-hot           | 101.2086 | 0.1387 | 14.0389 (267)  |
| Energy for lighting                         | 137.3105 | 0.1443 | 19.8181 (268)  |
| Total CO2, kg/year                          |          |        | 309.2176 (272) |
| CO2 emissions per m2                        |          |        | 6.8000 (273)   |
| EI value                                    |          |        | 95.4215        |
| EI rating                                   |          |        | 95 (274)       |
| EI band                                     |          |        | A              |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m)            | Volume<br>(m3)         |
|--------------------------------------------------------|--------------|---------------------------------|------------------------|
| Main dwelling                                          |              |                                 |                        |
| Ground floor                                           | 45.5000 (1b) | x 2.7500 (2b)                   | = 125.1250 (1b) - (3b) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 45.5000      |                                 | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 125.1250 (5)         |

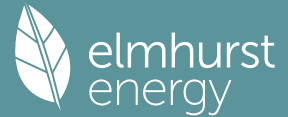
## 2. Ventilation rate

|                                                                                                         | m3 per hour                                                                                                                              |
|---------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Number of open chimneys                                                                                 | 0 * 80 = 0.0000 (6a)                                                                                                                     |
| Number of open flues                                                                                    | 0 * 20 = 0.0000 (6b)                                                                                                                     |
| Number of chimneys / flues attached to closed fire                                                      | 0 * 10 = 0.0000 (6c)                                                                                                                     |
| Number of flues attached to solid fuel boiler                                                           | 0 * 20 = 0.0000 (6d)                                                                                                                     |
| Number of flues attached to other heater                                                                | 0 * 35 = 0.0000 (6e)                                                                                                                     |
| Number of blocked chimneys                                                                              | 0 * 20 = 0.0000 (6f)                                                                                                                     |
| Number of intermittent extract fans                                                                     | 0 * 10 = 0.0000 (7a)                                                                                                                     |
| Number of passive vents                                                                                 | 0 * 10 = 0.0000 (7b)                                                                                                                     |
| Number of flueless gas fires                                                                            | 0 * 40 = 0.0000 (7c)                                                                                                                     |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =      | 0.0000 / (5) = 0.0000 (8)                                                                                                                |
| Pressure test                                                                                           | Yes                                                                                                                                      |
| Pressure Test Method                                                                                    | Blower Door                                                                                                                              |
| Measured/design AP50                                                                                    | 3.0000 (17)                                                                                                                              |
| Infiltration rate                                                                                       | 0.1500 (18)                                                                                                                              |
| Number of sides sheltered                                                                               | 2 (19)                                                                                                                                   |
| Shelter factor                                                                                          | (20) = 1 - [0.075 x (19)] = 0.8500 (20)                                                                                                  |
| Infiltration rate adjusted to include shelter factor                                                    | (21) = (18) x (20) = 0.1275 (21)                                                                                                         |
| Wind speed                                                                                              | Jan 4.3000 Feb 4.1000 Mar 4.1000 Apr 3.8000 May 3.9000 Jun 3.4000 Jul 3.4000 Aug 3.3000 Sep 3.4000 Oct 3.8000 Nov 3.7000 Dec 4.0000 (22) |
| Wind factor                                                                                             | 1.0750 1.0250 1.0250 0.9500 0.9750 0.8500 0.8500 0.8250 0.8500 0.9500 0.9250 1.0000 (22a)                                                |
| Adj infilt rate                                                                                         | 0.1371 0.1307 0.1307 0.1211 0.1243 0.1084 0.1084 0.1052 0.1084 0.1211 0.1179 0.1275 (22b)                                                |
| Mechanical extract ventilation - centralised                                                            |                                                                                                                                          |
| If mechanical ventilation                                                                               | 0.5000 (23a)                                                                                                                             |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) | 0.5000 (23b)                                                                                                                             |
| Effective ac                                                                                            | 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 (25)                                                 |

## 3. Heat losses and heat loss parameter

| Element                                                                   | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2        | U-value<br>W/m2K | A x U<br>W/K | K-value<br>kJ/m2K | A x K<br>kJ/K                                       |
|---------------------------------------------------------------------------|-------------|----------------|----------------------|------------------|--------------|-------------------|-----------------------------------------------------|
| Main dwelling                                                             |             |                |                      |                  |              |                   |                                                     |
| Windows / Glazed Doors                                                    |             |                | 7.7600               | 1.1450           | 8.8855       |                   | (27)                                                |
| Heatloss Floor 1                                                          |             |                | 45.5000              | 0.1200           | 5.4600       | 75.0000           | 3412.5000 (28a)                                     |
| External Wall                                                             | 41.9375     | 7.7600         | 34.1775              | 0.1500           | 5.1266       | 9.0000            | 307.5975 (29a)                                      |
| Bay Roof                                                                  | 0.7000      |                | 0.7000               | 0.1400           | 0.0980       | 9.0000            | 6.3000 (30)                                         |
| Total net area of external elements Aum(A, m2)                            |             |                | 88.1375              |                  |              |                   | (31)                                                |
| Fabric heat loss, W/K = Sum (A x U)                                       |             |                | (26)...(30) + (32) = |                  | 19.5701      |                   | (33)                                                |
| Main dwelling                                                             |             |                |                      |                  |              |                   |                                                     |
| Party Wall 1                                                              |             |                | 40.9800              | 0.0000           | 0.0000       | 45.0000           | 1844.1000 (32)                                      |
| Party Ceiling 1                                                           |             |                | 44.8000              |                  |              | 0.0000            | 0.0000 (32b)                                        |
| Internal Wall 1                                                           |             |                | 58.8500              |                  |              | 9.0000            | 529.6500 (32c)                                      |
| Heat capacity Cm = Sum(A x k)                                             |             |                |                      |                  |              |                   | (28)...(30) + (32) + (32a)...(32e) = 6100.1475 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K                         |             |                |                      |                  |              |                   | 134.0692 (35)                                       |
| List of Thermal Bridges                                                   |             |                |                      |                  |              |                   |                                                     |
| K1 Element                                                                |             |                |                      | Length           | Psi-value    |                   | Total                                               |
| E2 Other lintels (including other steel lintels)                          |             |                |                      | 4.6600           | 0.0840       |                   | 0.3914                                              |
| E3 Sill                                                                   |             |                |                      | 1.6500           | 0.0340       |                   | 0.0561                                              |
| E4 Jamb                                                                   |             |                |                      | 20.5800          | 0.0430       |                   | 0.8849                                              |
| E5 Ground floor (normal)                                                  |             |                |                      | 15.2500          | 0.3200       |                   | 4.8800                                              |
| E16 Corner (normal)                                                       |             |                |                      | 8.2500           | 0.0300       |                   | 0.2475                                              |
| E18 Party wall between dwellings                                          |             |                |                      | 8.2500           | 0.0400       |                   | 0.3300                                              |
| E7 Party floor between dwellings (in blocks of flats)                     |             |                |                      | 15.2500          | 0.0660       |                   | 1.0065                                              |
| E10 Eaves (insulation at ceiling level)                                   |             |                |                      | 3.2000           | 0.0440       |                   | 0.1408                                              |
| E17 Corner (inverted - internal area greater than external area)          |             |                |                      | 5.5000           | 0.0150       |                   | 0.0825                                              |
| P1 Party wall - Ground floor                                              |             |                |                      | 14.9000          | 0.1600       |                   | 2.3840                                              |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) |             |                |                      | 14.9000          | 0.0000       |                   | 0.0000                                              |
| E25 Staggered party wall between dwellings                                |             |                |                      | 2.7500           | 0.1200       |                   | 0.3300                                              |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                |             |                |                      |                  |              |                   | 10.7338 (36)                                        |

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Point Thermal bridges  
Total fabric heat loss (33) + (36) + (36a) = 0.0000  
30.3039 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)  
(38)m Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
Heat transfer coeff 20.6456 20.6456 20.6456 20.6456 20.6456 20.6456 20.6456 20.6456 20.6456 20.6456 20.6456 20.6456 (38)  
Average = Sum(39)m / 12 = 50.9495 50.9495 50.9495 50.9495 50.9495 50.9495 50.9495 50.9495 50.9495 50.9495 50.9495 50.9495 (39)  
50.9495  
HLP Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
HLP (average) 1.1198 1.1198 1.1198 1.1198 1.1198 1.1198 1.1198 1.1198 1.1198 1.1198 1.1198 1.1198 (40)  
Days in mont 31 28 31 30 31 30 31 31 30 31 30 31

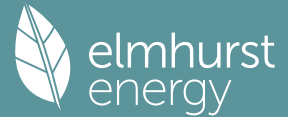
4. Water heating energy requirements (kWh/year)  
Assumed occupancy 1.5590 (42)  
Hot water usage for mixer showers 69.2425 68.2019 66.6855 63.7843 61.6433 59.2556 57.8985 59.4034 61.0530 63.6166 66.5801 68.9772 (42a)  
Hot water usage for baths 21.7789 21.4554 21.0000 20.1601 19.5313 18.8340 18.4573 18.9096 19.4021 20.1482 21.0054 21.7053 (42b)  
Hot water usage for other uses 30.5954 29.4828 28.3702 27.2577 26.1451 25.0326 25.0326 26.1451 27.2577 28.3702 29.4828 30.5954 (42c)  
Average daily hot water use (litres/day) 111.8456 (43)  
Daily hot water use Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
Energy conte 121.6167 119.1401 116.0557 111.2021 107.3197 103.1222 101.3884 104.4581 107.7127 112.1350 117.0682 121.2778 (44)  
Energy content (annual) 192.6111 169.6539 178.3733 152.2302 144.4729 126.8008 122.6205 129.3410 132.8206 152.1662 166.7852 189.8917 (45)  
Distribution loss (46)m = 0.15 x (45)m Total = Sum(45)m = 1857.7673  
28.8917 25.4481 26.7560 22.8345 21.6709 19.0201 18.3931 19.4011 19.9231 22.8249 25.0178 28.4838 (46)  
Water storage loss (or HIU loss):  
Store volume 196.0000 (47)  
a) If manufacturer declared loss factor is known (kWh/day):  
Temperature factor from Table 2b 1.3120 (48)  
Enter (49) or (54) in (55) 0.5400 (49)  
Total storage loss 0.7085 (55)  
21.9629 19.8374 21.9629 21.2544 21.9629 21.2544 21.9629 21.9629 21.2544 21.9629 21.2544 21.9629 (56)  
If cylinder contains dedicated solar storage  
21.9629 19.8374 21.9629 21.2544 21.9629 21.2544 21.9629 21.9629 21.2544 21.9629 21.2544 21.9629 (57)  
Primary loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (59)  
Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)  
Total heat required for water heating calculated for each month  
214.5740 189.4914 200.3362 173.4846 166.4358 148.0552 144.5834 151.3038 154.0750 174.1291 188.0396 211.8546 (62)  
WWHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63a)  
PV diverter 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63b)  
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63c)  
FGHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)  
Output from w/h 214.5740 189.4914 200.3362 173.4846 166.4358 148.0552 144.5834 151.3038 154.0750 174.1291 188.0396 211.8546 (64)  
Total per year (kWh/year) = Sum(64)m = 2116.3625 (64)  
Electric shower(s) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)  
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)  
Heat gains from water heating, kWh/month 64.0432 56.4099 59.3091 50.6165 48.0373 42.1613 40.7713 43.0059 44.1628 50.5953 55.4561 63.1390 (65)

5. Internal gains (see Table 5 and 5a)  
Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
(66)m 93.5378 93.5378 93.5378 93.5378 93.5378 93.5378 93.5378 93.5378 93.5378 93.5378 93.5378 93.5378 (66)  
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5  
19.4377 17.2644 14.0404 10.6295 7.9456 6.7080 7.2483 9.4216 12.6456 16.0565 18.7404 19.9780 (67)  
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5  
202.3439 204.4436 199.1525 187.8882 173.6691 160.3051 151.3771 149.2775 154.5686 165.8329 180.0520 193.4160 (68)  
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5  
45.9127 45.9127 45.9127 45.9127 45.9127 45.9127 45.9127 45.9127 45.9127 45.9127 45.9127 45.9127 (69)  
Pumps, fans 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (70)  
Losses e.g. evaporation (negative values) (Table 5)  
-62.3586 -62.3586 -62.3586 -62.3586 -62.3586 -62.3586 -62.3586 -62.3586 -62.3586 -62.3586 -62.3586 -62.3586 (71)  
Water heating gains (Table 5)  
86.0796 83.9433 79.7166 70.3007 64.5662 58.5573 54.8001 57.8036 61.3373 68.0044 77.0223 84.8642 (72)  
Total internal gains 384.9532 382.7434 370.0014 345.9104 323.2729 302.6625 290.5176 293.5947 305.6436 326.9858 352.9067 375.3502 (73)

6. Solar gains  
[Jan] Area Solar flux g FF Access Gains  
m2 Table 6a Specific data Specific data factor W  
W/m2 or Table 6b or Table 6c Table 6d  
Northeast 0.7100 13.7804 0.7600 0.0000 0.7700 5.7257 (75)  
East 1.9300 23.8018 0.7600 0.0000 0.7700 26.8826 (76)  
Southeast 0.7100 43.0593 0.7600 0.0000 0.7700 17.8908 (77)  
West 4.4100 23.8018 0.7600 0.0000 0.7700 61.4260 (80)  
Solar gains 111.9250 187.7506 300.8610 440.1107 523.7043 566.9794 534.4573 471.4426 370.7634 237.1121 136.6813 93.1365 (83)  
Total gains 496.8782 570.4940 670.8624 786.0211 846.9773 869.6418 824.9749 765.0373 676.4069 564.0979 489.5881 468.4867 (84)

7. Mean internal temperature (heating season)  
Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)  
Utilisation factor for gains for living area, nil,m (see Table 9a)  
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

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|                        |         |         |         |         |         |         |         |         |                           |         |         |              |
|------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|
| tau                    | 33.2581 | 33.2581 | 33.2581 | 33.2581 | 33.2581 | 33.2581 | 33.2581 | 33.2581 | 33.2581                   | 33.2581 | 33.2581 | 33.2581      |
| alpha                  | 3.2172  | 3.2172  | 3.2172  | 3.2172  | 3.2172  | 3.2172  | 3.2172  | 3.2172  | 3.2172                    | 3.2172  | 3.2172  | 3.2172       |
| util living area       | 0.9081  | 0.8658  | 0.7751  | 0.6262  | 0.4613  | 0.3000  | 0.2028  | 0.2250  | 0.4320                    | 0.7016  | 0.8631  | 0.9196 (86)  |
| MIT                    | 19.6534 | 19.9284 | 20.3511 | 20.7250 | 20.9175 | 20.9848 | 20.9970 | 20.9958 | 20.9494                   | 20.6688 | 20.1003 | 19.5769 (87) |
| Th 2                   | 19.9847 | 19.9847 | 19.9847 | 19.9847 | 19.9847 | 19.9847 | 19.9847 | 19.9847 | 19.9847                   | 19.9847 | 19.9847 | 19.9847 (88) |
| util rest of house     | 0.8937  | 0.8462  | 0.7453  | 0.5845  | 0.4100  | 0.2432  | 0.1409  | 0.1585  | 0.3653                    | 0.6536  | 0.8393  | 0.9066 (89)  |
| MIT 2                  | 18.4713 | 18.8048 | 19.3051 | 19.7229 | 19.9188 | 19.9763 | 19.9838 | 19.9834 | 19.9515                   | 19.6784 | 19.0233 | 18.3783 (90) |
| Living area fraction   |         |         |         |         |         |         |         |         | FLA = Living area / (4) = |         |         |              |
| MIT                    | 19.4637 | 19.7482 | 20.1832 | 20.5642 | 20.7572 | 20.8230 | 20.8344 | 20.8333 | 20.7893                   | 20.5099 | 19.9275 | 19.3846 (91) |
| Temperature adjustment |         |         |         |         |         |         |         |         |                           |         |         | 0.0000 (92)  |
| adjusted MIT           | 19.4637 | 19.7482 | 20.1832 | 20.5642 | 20.7572 | 20.8230 | 20.8344 | 20.8333 | 20.7893                   | 20.5099 | 19.9275 | 19.3846 (93) |

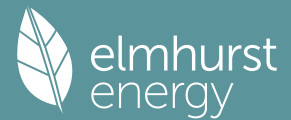
## 8. Space heating requirement

|                                                                                | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov      | Dec            |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|----------|----------------|
| Utilisation                                                                    | 0.8852   | 0.8411   | 0.7515   | 0.6088   | 0.4493   | 0.2902   | 0.1928   | 0.2141   | 0.4185   | 0.6793        | 0.8379   | 0.8977 (94)    |
| Useful gains                                                                   | 439.8333 | 479.8661 | 504.1311 | 478.5453 | 380.5408 | 252.3700 | 159.0435 | 163.8112 | 283.0851 | 383.1823      | 410.2024 | 420.5479 (95)  |
| Ext temp.                                                                      | 5.1000   | 5.7000   | 7.4000   | 9.9000   | 12.9000  | 15.8000  | 17.7000  | 17.6000  | 15.0000  | 11.5000       | 8.0000   | 5.1000 (96)    |
| Heat loss rate W                                                               | 731.8245 | 715.7474 | 651.2997 | 543.3368 | 400.3219 | 255.9192 | 159.6981 | 164.7372 | 294.9616 | 459.0512      | 607.6989 | 727.7938 (97)  |
| Space heating kWh                                                              | 217.2414 | 158.5122 | 109.4934 | 46.6499  | 14.7171  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 56.4465       | 142.1975 | 228.5910 (98a) |
| Space heating requirement - total per year (kWh/year)                          |          |          |          |          |          |          |          |          |          |               |          | 973.8491       |
| Solar heating kWh                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000   | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |          |          |          |          |          |          |          |          |          |               |          | 0.0000         |
| Space heating kWh                                                              | 217.2414 | 158.5122 | 109.4934 | 46.6499  | 14.7171  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 56.4465       | 142.1975 | 228.5910 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |          |          |          |          |          |          |          |          |          |               |          | 973.8491       |
| Space heating per m2                                                           |          |          |          |          |          |          |          |          |          | (98c) / (4) = |          | 21.4033 (99)   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

| Fraction of space heat from secondary/supplementary system (Table 11)                                |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)    |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from main system(s)                                                           |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)    |
| Fraction of main heating from main system 2                                                          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (203)    |
| Fraction of total heating from main system 1                                                         |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (204)    |
| Fraction of total heating from main system 2                                                         |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (205)    |
| Efficiency of main space heating system 1 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 100.0000 (206)  |
| Efficiency of main space heating system 2 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                              |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
|                                                                                                      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                                                            | 217.2414 | 158.5122 | 109.4934 | 46.6499  | 14.7171  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 56.4465  | 142.1975 | 228.5910 (98)   |
| Space heating efficiency (main heating system 1)                                                     | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 100.0000 | 100.0000 | 100.0000 (210)  |
| Space heating fuel (main heating system)                                                             | 217.2414 | 158.5122 | 109.4934 | 46.6499  | 14.7171  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 56.4465  | 142.1975 | 228.5910 (211)  |
| Space heating efficiency (main heating system 2)                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |
| Space heating fuel (secondary)                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Space heating fuel used, main system 2                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Water heating                                                                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| Water heating requirement                                                                            | 214.5740 | 189.4914 | 200.3362 | 173.4846 | 166.4358 | 148.0552 | 144.5834 | 151.3038 | 154.0750 | 174.1291 | 188.0396 | 211.8546 (64)   |
| Efficiency of water heater (217)m                                                                    | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 (216)  |
| Fuel for water heating, kWh/month                                                                    | 68.4654  | 60.4621  | 63.9225  | 55.3548  | 53.1057  | 47.2408  | 46.1331  | 48.2774  | 49.1616  | 55.5604  | 59.9989  | 67.5977 (219)   |
| Space cooling fuel requirement                                                                       |          |          |          |          |          |          |          |          |          |          |          |                 |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                                         | 8.5958   | 7.7639   | 8.5958   | 8.3185   | 8.5958   | 8.3185   | 8.5958   | 8.5958   | 8.3185   | 8.5958   | 8.3185   | 8.5958 (231)    |
| Lighting                                                                                             | 17.0137  | 13.6490  | 12.2894  | 9.0038   | 6.9548   | 5.6821   | 6.3444   | 8.2467   | 10.7116  | 14.0542  | 15.8742  | 17.4866 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (233a)   |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (233b)   |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 973.8491 (211)  |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 313.4050        |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          | 675.2804 (219)  |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (221)    |
| Electricity for pumps and fans:                                                                      |          |          |          |          |          |          |          |          |          |          |          |                 |
| (MEV)Centralised, Database: in-use factor = 1.3000, SFP = 0.6630)                                    |          |          |          |          |          |          |          |          |          |          |          |                 |
| mechanical ventilation fans (SFP = 0.6630)                                                           |          |          |          |          |          |          |          |          |          |          |          | 101.2086 (230a) |
| Total electricity for the above, kWh/year                                                            |          |          |          |          |          |          |          |          |          |          |          | 101.2086 (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |          |          |          |          |          |          |          |          | 137.3105 (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| PV generation                                                                                        |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (233)    |
| Wind generation                                                                                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (234)    |
| Hydro-electric generation (Appendix N)                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (235a)   |

# Full SAP Calculation Printout



|                                                |                 |
|------------------------------------------------|-----------------|
| Electricity generated - Micro CHP (Appendix N) | 0.0000 (235)    |
| Appendix Q - special features                  |                 |
| Energy saved or generated                      | -0.0000 (236)   |
| Energy used                                    | 0.0000 (237)    |
| Total delivered energy for all uses            | 1887.6485 (238) |

## 10a. Fuel costs - using BEDF prices (585)

|                                             | Fuel<br>kWh/year | Fuel price<br>p/kWh | Fuel cost<br>£/year |
|---------------------------------------------|------------------|---------------------|---------------------|
| Space heating - main system 1               | 973.8491         | 28.4300             | 276.8653 (240)      |
| Space heating - main system 2               | 0.0000           | 28.4300             | 0.0000 (241)        |
| Total CO2 associated with community systems |                  |                     | 0.0000 (473)        |
| Water heating (other fuel)                  | 675.2804         | 28.4300             | 191.9822 (247)      |
| Energy for instantaneous electric shower(s) | 0.0000           | 28.4300             | 0.0000 (247a)       |
| Pumps, fans and electric keep-hot           | 101.2086         | 28.4300             | 28.7736 (249)       |
| Energy for lighting                         | 137.3105         | 28.4300             | 39.0374 (250)       |
| Additional standing charges                 |                  |                     | 0.0000 (251)        |
| Total energy cost                           |                  |                     | 536.6585 (255)      |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|---------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1               | 973.8491           | 0.1566                        | 152.5473 (261)           |
| Space heating - main system 2               | 0.0000             | 0.0000                        | 0.0000 (262)             |
| Total CO2 associated with community systems |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                  | 675.2804           | 0.1412                        | 95.3686 (264)            |
| Space and water heating                     |                    |                               | 247.9158 (265)           |
| Pumps, fans and electric keep-hot           | 101.2086           | 0.1387                        | 14.0389 (267)            |
| Energy for lighting                         | 137.3105           | 0.1443                        | 19.8181 (268)            |
| Total CO2, kg/year                          |                    |                               | 281.7728 (272)           |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 973.8491           | 1.5799                              | 1538.5743 (275)            |
| Space heating - main system 2               | 0.0000             | 0.0000                              | 0.0000 (276)               |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 675.2804           | 1.5222                              | 1027.9298 (278)            |
| Space and water heating                     |                    |                                     | 2566.5041 (279)            |
| Pumps, fans and electric keep-hot           | 101.2086           | 1.5128                              | 153.1084 (281)             |
| Energy for lighting                         | 137.3105           | 1.5338                              | 210.6114 (282)             |
| Total Primary energy kWh/year               |                    |                                     | 2930.2238 (286)            |

# Predicted Energy Assessment



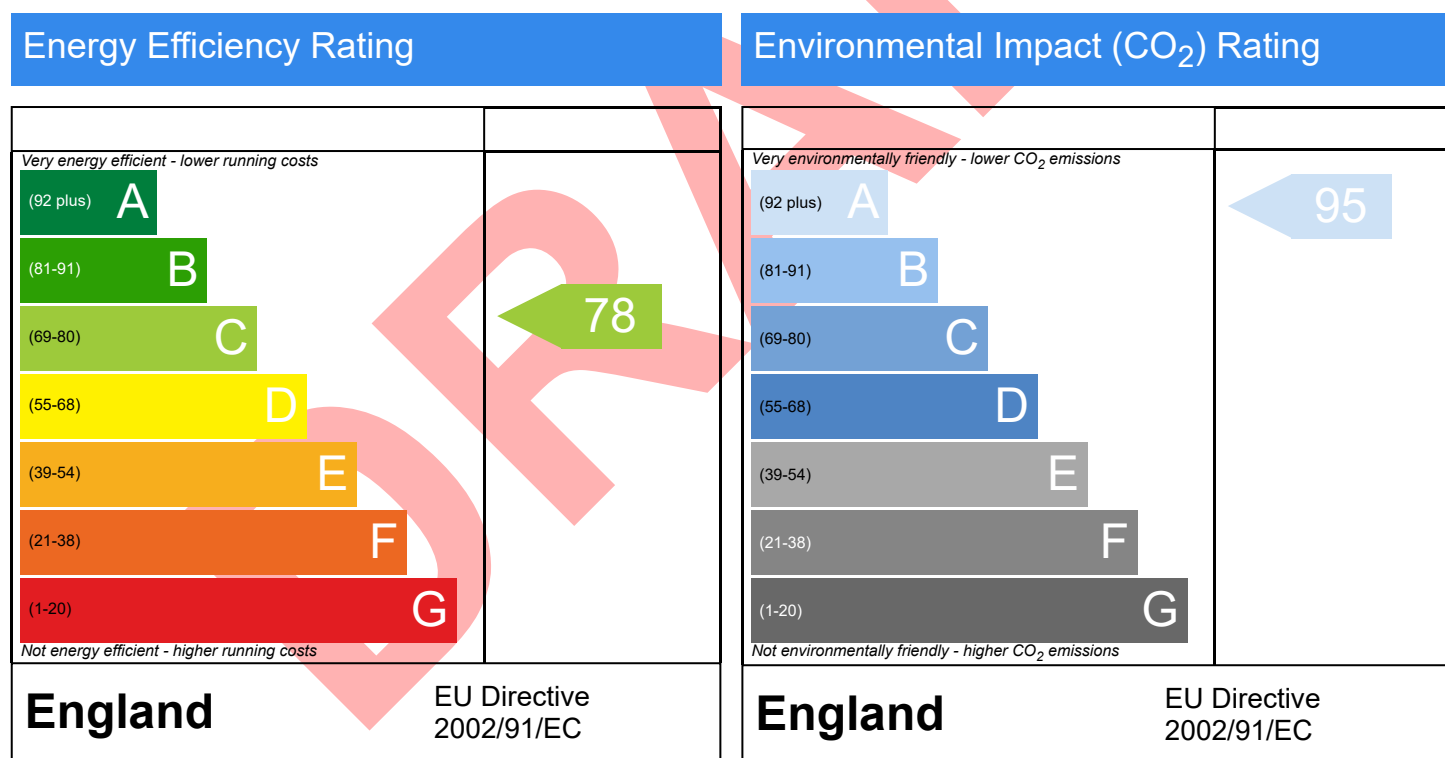
Flat 2, 85, Pell Street, Reading, RG1 2NP

Dwelling type:  
Date of assessment:  
SAP Version:  
Produced by:  
Total floor area:  
DRRN:

Flat, Mid-Terrace  
28/11/2025  
10.2  
Peter Yearsley  
45.5 m<sup>2</sup>

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO<sub>2</sub>) emissions.



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO<sub>2</sub>) emissions. The higher the rating the less impact it has on the environment.

# Summary for Input Data

|                      |                                           |               |                |            |
|----------------------|-------------------------------------------|---------------|----------------|------------|
| Plot Reference       | Flat 2, 85 Pell Street                    |               | Issued on Date | 28/11/2025 |
| Assessment Reference | Electric Panel Heaters HC                 | Plot Type Ref |                |            |
| Plot Address         | Flat 2, 85, Pell Street, Reading, RG1 2NP |               | SAP Version    | 10.2       |

|                                    |          |               |       |      |       |
|------------------------------------|----------|---------------|-------|------|-------|
| SAP Rating                         | 78 C     | DER           | 7.10  | TER  | 16.42 |
| Environmental                      | 95 A     | % DER < TER   |       |      | 56.76 |
| CO <sub>2</sub> Emissions (t/year) | 0.28     | DFEE          | 37.48 | TFEE | 39.69 |
| Compliance Check                   | See BREL | % DFEE < TFEE |       |      | 5.57  |
| % DPER < TPER                      | 15.47    | DPER          | 73.70 | TPER | 87.19 |

|                  |                    |             |           |
|------------------|--------------------|-------------|-----------|
| Assessor Details | Mr. Peter Yearsley | Assessor ID | R301-0001 |
| Client           |                    |             |           |

## SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

|                                |                     |        |
|--------------------------------|---------------------|--------|
| Orientation                    | South               |        |
| Property Tenture               | ND                  |        |
| Transaction Type               | 6                   |        |
| Terrain Type                   | Suburban            |        |
| 1.0 Property Type              | Flat, Mid-Terrace   |        |
| Position of Flat               | Ground-floor flat   |        |
| Which Floor                    | 0                   |        |
| 2.0 Number of Storeys          | 1                   |        |
| 3.0 Date Built                 | 2025                |        |
| 4.0 Sheltered Sides            | 2                   |        |
| 5.0 Sunlight/Shade             | Average or unknown  |        |
| 6.0 Thermal Mass Parameter     | Precise calculation |        |
| Thermal Mass                   | 134.07              | kJ/m²K |
|                                |                     |        |
| 7.0 Electricity Tariff         | Standard            |        |
| Smart electricity meter fitted | No                  |        |
| Smart gas meter fitted         | No                  |        |

|                  |               |                     |                      |                       |
|------------------|---------------|---------------------|----------------------|-----------------------|
| 7.0 Measurements |               | Heat Loss Perimeter | Internal Floor Area  | Average Storey Height |
|                  | Ground floor: | 15.25 m             | 45.50 m <sup>2</sup> | 2.75 m                |

|                 |       |                |
|-----------------|-------|----------------|
| 8.0 Living Area | 38.20 | m <sup>2</sup> |
|-----------------|-------|----------------|

| Description   | Type         | Construction                                   | U-Value (W/m <sup>2</sup> K) | Kappa (kJ/m <sup>2</sup> K) | Gross Area(m <sup>2</sup> ) | Nett Area (m <sup>2</sup> ) | Shelter Res | Shelter | Openings | Area Calculation Type |
|---------------|--------------|------------------------------------------------|------------------------------|-----------------------------|-----------------------------|-----------------------------|-------------|---------|----------|-----------------------|
| External Wall | Timber Frame | Timber framed wall (one layer of plasterboard) | 0.15                         | 9.00                        | 41.94                       | 34.18                       | 0.00        | None    | 7.76     | Calculate Wall Area   |

| Description  | Type                            | Construction | U-Value (W/m <sup>2</sup> K) | Kappa (kJ/m <sup>2</sup> K) | Area (m <sup>2</sup> ) | Shelter Res | Shelter |
|--------------|---------------------------------|--------------|------------------------------|-----------------------------|------------------------|-------------|---------|
| Party Wall 1 | Filled Cavity with Edge Sealing | Other        | 0.00                         | 45.00                       | 40.98                  |             | None    |

| Description     | Construction                 | Kappa (kJ/m <sup>2</sup> K) | Area (m <sup>2</sup> ) |
|-----------------|------------------------------|-----------------------------|------------------------|
| Internal Wall 1 | Plasterboard on timber frame | 9.00                        | 58.85                  |

| Description | Type                | Construction                             | U-Value (W/m <sup>2</sup> K) | Kappa (kJ/m <sup>2</sup> K) | Gross Area(m <sup>2</sup> ) | Nett Area (m <sup>2</sup> ) | Shelter Code | Shelter Factor | Calculation Type | Openings |
|-------------|---------------------|------------------------------------------|------------------------------|-----------------------------|-----------------------------|-----------------------------|--------------|----------------|------------------|----------|
| Bay Roof    | External Plane Roof | Plasterboard, insulated at ceiling level | 0.14                         | 9.00                        | 0.70                        | 0.70                        | None         | 0.00           | Enter Gross Area | 0.00     |

| Description     | Construction | Kappa (kJ/m <sup>2</sup> K) | Area (m <sup>2</sup> ) |
|-----------------|--------------|-----------------------------|------------------------|
| Party Ceiling 1 | Other        | 0.00                        | 44.80                  |

# Summary for Input Data

## 11.0 Heat Loss Floors

| Description      | Type                 | Storey Index    | Construction | U-Value (W/m²K) | Shelter Code | Shelter Factor | Kappa (kJ/m²K) | Area (m²) |
|------------------|----------------------|-----------------|--------------|-----------------|--------------|----------------|----------------|-----------|
| Heatloss Floor 1 | Ground Floor - Solid | Lowest occupied | Other        | 0.12            | None         | 0.00           | 75.00          | 45.50     |

## 12.0 Opening Types

| Description            | Data Source               | Type       | Glazing       | Glazing Gap | Filling Type | G-value | Frame Type | Frame Factor | U Value (W/m²K) |
|------------------------|---------------------------|------------|---------------|-------------|--------------|---------|------------|--------------|-----------------|
| Solid Door             | Manufacturer              | Solid Door |               |             |              | 0.00    |            |              | 1.20            |
| Windows / Glazed Doors | BFRC, BSI or CERTASS data | Window     | Double glazed |             |              | 0.76    |            |              | 1.20            |

## 13.0 Openings

| Name     | Opening Type           | Location      | Orientation | Area (m²) | Pitch |
|----------|------------------------|---------------|-------------|-----------|-------|
| Opening2 | Windows / Glazed Doors | External Wall | East        | 1.93      |       |
| Opening3 | Windows / Glazed Doors | External Wall | South East  | 0.71      |       |
| Opening4 | Windows / Glazed Doors | External Wall | North East  | 0.71      |       |
| Opening5 | Windows / Glazed Doors | External Wall | West        | 4.41      |       |

## 14.0 Conservatory

## 15.0 Draught Proofing

 %

## 16.0 Draught Lobby

## 17.0 Thermal Bridging

## 17.1 List of Bridges

| Bridge Type                                                               | Source Type            | Length | Psi  | Adjusted | Reference:           | Imported |
|---------------------------------------------------------------------------|------------------------|--------|------|----------|----------------------|----------|
| E2 Other lintels (including other steel lintels)                          | Independently assessed | 4.66   | 0.08 | 0.08     | R.O.I. Psi Value     | Yes      |
| E3 Sill                                                                   | Independently assessed | 1.65   | 0.03 | 0.03     | R.O.I. Psi Value     | No       |
| E4 Jamb                                                                   | Independently assessed | 20.58  | 0.04 | 0.04     | R.O.I. Psi Value     | Yes      |
| E5 Ground floor (normal)                                                  | Table K1 - Default     | 15.25  | 0.32 | 0.32     |                      | No       |
| E16 Corner (normal)                                                       | Independently assessed | 8.25   | 0.03 | 0.03     | R.O.I. Psi Value     | No       |
| E18 Party wall between dwellings                                          | Independently assessed | 8.25   | 0.04 | 0.04     | R.O.I. Psi Value     | No       |
| E7 Party floor between dwellings (in blocks of flats)                     | Independently assessed | 15.25  | 0.07 | 0.07     | R.O.I. Psi Value     | No       |
| E10 Eaves (insulation at ceiling level)                                   | Independently assessed | 3.20   | 0.04 | 0.04     | R.O.I. Psi Value     | No       |
| E17 Corner (inverted – internal area greater than external area)          | Independently assessed | 5.50   | 0.01 | 0.01     | R.O.I. Psi Value     | No       |
| P1 Party wall - Ground floor                                              | Independently assessed | 14.90  | 0.16 | 0.16     | Default Value Halved | No       |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | Table K1 - Default     | 14.90  | 0.00 | 0.00     |                      | No       |
| E25 Staggered party wall between dwellings                                | Independently assessed | 2.75   | 0.12 | 0.12     | Default Value Halved | No       |

Y-value  W/m²K

## 19.0 Mechanical Ventilation

### Mechanical Ventilation

|                                       |                                                                           |
|---------------------------------------|---------------------------------------------------------------------------|
| Mechanical Ventilation System Present | <input type="text" value="Yes"/>                                          |
| Approved Installation                 | <input type="text" value="Yes"/>                                          |
| Mechanical Ventilation data Type      | <input type="text" value="Database"/>                                     |
| Type                                  | <input type="text" value="Mechanical extract ventilation - centralised"/> |
| MV Reference Number                   | <input type="text" value="500735"/>                                       |
| Configuration                         | <input type="text" value="1"/>                                            |
| Manufacturer SFP                      | <input type="text" value="0.51"/>                                         |
| Duct Type                             | <input type="text" value="Rigid"/>                                        |
| Wet Rooms                             | <input type="text" value="1"/>                                            |

## 20.0 Fans, Open Fireplaces, Flues

|                                                  |                                |
|--------------------------------------------------|--------------------------------|
| Number of open chimneys                          | <input type="text" value="0"/> |
| Number of open flues                             | <input type="text" value="0"/> |
| Number of chimneys/flues attached to closed fire | <input type="text" value="0"/> |
| Number of flues attached to solid fuel boiler    | <input type="text" value="0"/> |
| Number of flues attached to other heater         | <input type="text" value="0"/> |
| Number of blocked chimneys                       | <input type="text" value="0"/> |
| Number of intermittent extract fans              | <input type="text" value="0"/> |
| Number of passive vents                          | <input type="text" value="0"/> |
| Number of flueless gas fires                     | <input type="text" value="0"/> |

## 21.0 Fixed Cooling System

# Summary for Input Data

## 22.0 Pressure Testing

|                           |             |                   |
|---------------------------|-------------|-------------------|
| Designed AP <sub>50</sub> | Yes         |                   |
| Test Method               | 3.00        | m³/(h.m²) @ 50 Pa |
|                           | Blower Door |                   |

## 22.0 Lighting

|                   |            |          |       |          |       |
|-------------------|------------|----------|-------|----------|-------|
| No Fixed Lighting | No         |          |       |          |       |
|                   | Name       | Efficacy | Power | Capacity | Count |
|                   | Lighting 1 | 90.00    | 5.00  | 450.00   | 6     |

## 24.0 Main Heating 1

|                      |                                      |   |
|----------------------|--------------------------------------|---|
| SAP table            |                                      |   |
| Percentage of Heat   | 100.00                               | % |
| Fuel Type            | Electricity                          |   |
| SAP Code             | 691                                  |   |
| In Winter            | 100.00                               |   |
| In Summer            | 313.40                               |   |
| Controls SAP Code    | 2603                                 |   |
| Controls description | Programmer and appliance thermostats |   |

## 25.0 Main Heating 2

|                      |                                            |   |
|----------------------|--------------------------------------------|---|
| Database             |                                            |   |
| Percentage of Heat   | 0.00                                       | % |
| Database Ref. No.    | 105943                                     |   |
| Fuel Type            | Electricity                                |   |
| In Winter            | 0.00                                       |   |
| In Summer            | 313.40                                     |   |
| Model Name           | KERS MEV-W200SL                            |   |
| Manufacturer         | KERS Innovations UK Ltd                    |   |
| Controls             | 2100                                       |   |
| Controls description | Not applicable (heating provides DHW only) |   |

## 26.0 Heat Networks

|      |  |
|------|--|
| None |  |
|------|--|

## 27.0 Secondary Heating

|      |  |
|------|--|
| None |  |
|------|--|

## 28.0 Water Heating

|                                                  |                |  |
|--------------------------------------------------|----------------|--|
| Water Heating                                    | Main Heating 2 |  |
| SAP Code                                         | 914            |  |
| Flue Gas Heat Recovery System                    | No             |  |
| Waste Water Heat Recovery Instantaneous System 1 | No             |  |
| Waste Water Heat Recovery Instantaneous System 2 | No             |  |
| Waste Water Heat Recovery Storage System         | No             |  |
| Solar Panel                                      | No             |  |
| Water use <= 125 litres/person/day               | Yes            |  |
| Cold Water Source                                | From mains     |  |
| Bath Count                                       | 1              |  |
| Immersion Only Heating Hot Water                 | No             |  |

## 28.1 Showers

| Description | Shower Type                               | Flow Rate [l/min] | Rated Power [kW] | Connected | Connected To |
|-------------|-------------------------------------------|-------------------|------------------|-----------|--------------|
| Shower      | Combi boiler or unvented hot water system | 11.00             |                  | No        |              |

## 28.3 Waste Water Heat Recovery System

## 29.0 Hot Water Cylinder

|                 |               |         |
|-----------------|---------------|---------|
| Internal Store  |               |         |
| Insulation Type | Measured Loss |         |
| Cylinder Volume | 196.00        | L       |
| Loss            | 1.31          | kWh/day |

# Summary for Input Data



## 34.0 Small-scale Hydro

None

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

### Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

|                     | Typical Cost | Typical savings per year | Ratings after improvement |                      |
|---------------------|--------------|--------------------------|---------------------------|----------------------|
|                     |              |                          | SAP rating                | Environmental Impact |
| Solar water heating |              |                          | 0                         | 0                    |
| Photovoltaic        |              |                          | 0                         | 0                    |
| Wind turbine        |              |                          | 0                         | 0                    |

# Thermal Bridging

|                      |                                           |               |                  |            |
|----------------------|-------------------------------------------|---------------|------------------|------------|
| Plot Reference       | Flat 2, 85 Pell Street                    |               | Issued on Date   | 28/11/2025 |
| Assessment Reference | Electric Panel Heaters HC                 | Plot Type Ref | Mid-Terrace Flat |            |
| Plot Address         | Flat 2, 85, Pell Street, Reading, RG1 2NP |               | SAP Version      | 10.2       |

|                                    |          |               |       |      |       |
|------------------------------------|----------|---------------|-------|------|-------|
| SAP Rating                         | 78 C     | DER           | 7.10  | TER  | 16.42 |
| Environmental                      | 95 A     | % DER < TER   |       |      | 56.76 |
| CO <sub>2</sub> Emissions (t/year) | 0.28     | DFEE          | 37.48 | TFEE | 39.69 |
| Compliance Check                   | See BREL | % DFEE < TFEE |       |      | 5.57  |
| % DPER < TPER                      | 15.47    | DPER          | 73.70 | TPER | 87.19 |

|                  |                    |             |           |
|------------------|--------------------|-------------|-----------|
| Assessor Details | Mr. Peter Yearsley | Assessor ID | R301-0001 |
| Client           |                    |             |           |

|               | Junction details                                                          | Source Type            | Psi (W/mK) | Length (m) | Result | Reference            |
|---------------|---------------------------------------------------------------------------|------------------------|------------|------------|--------|----------------------|
| External wall | E2 Other lintels (including other steel lintels)                          | Independently assessed | 0.084      | 4.66       | 0.39   | R.O.I. Psi Value     |
| External wall | E3 Sill                                                                   | Independently assessed | 0.034      | 1.65       | 0.06   | R.O.I. Psi Value     |
| External wall | E4 Jamb                                                                   | Independently assessed | 0.043      | 20.58      | 0.88   | R.O.I. Psi Value     |
| External wall | E5 Ground floor (normal)                                                  | Table K1 - Default     | 0.320      | 15.25      | 4.88   |                      |
| External wall | E16 Corner (normal)                                                       | Independently assessed | 0.030      | 8.25       | 0.25   | R.O.I. Psi Value     |
| External wall | E18 Party wall between dwellings                                          | Independently assessed | 0.040      | 8.25       | 0.33   | R.O.I. Psi Value     |
| External wall | E7 Party floor between dwellings (in blocks of flats)                     | Independently assessed | 0.066      | 15.25      | 1.01   | R.O.I. Psi Value     |
| External wall | E10 Eaves (insulation at ceiling level)                                   | Independently assessed | 0.044      | 3.20       | 0.14   | R.O.I. Psi Value     |
| External wall | E17 Corner (inverted – internal area greater than external area)          | Independently assessed | 0.015      | 5.50       | 0.08   | R.O.I. Psi Value     |
| Party wall    | P1 Party wall - Ground floor                                              | Independently assessed | 0.160      | 14.90      | 2.38   | Default Value Halved |
| Party wall    | P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | Table K1 - Default     | 0.000      | 14.90      | 0.00   |                      |
| External wall | E25 Staggered party wall between dwellings                                | Independently assessed | 0.120      | 2.75       | 0.33   | Default Value Halved |

Total: 115.14 W/mK:  
Y-Value: 0.12 W/m²K:

# Energy Report



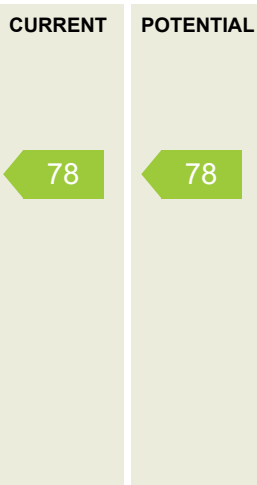
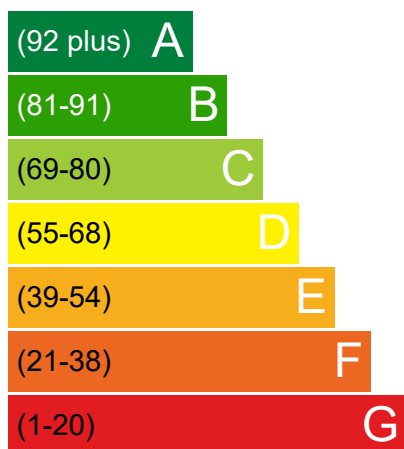
|                  |                                                  |
|------------------|--------------------------------------------------|
| Dwelling Address | Flat 2, 85, Pell Street, Reading, RG1 2NP        |
| Reference        | Flat 2, 85 Pell Street-Electric Panel Heaters HC |
| SAP Version      | 10.2                                             |
| Assessment Date  | 28/11/2025                                       |
| Submission Date  |                                                  |
| Property Type    | Flat, Mid-Terrace                                |
| Total Floor Area | 46                                               |

This Energy Report has been generated using the UK's National Calculation Methodology for dwellings, Standard Assessment Procedure (SAP). This methodology is used to assess the energy efficiency of dwellings which is calculated based on a dwelling's heating, hot water, ventilation and lighting usage.

This document is not an Energy Performance Certificate (EPC) as required by the Energy Performance of Buildings Regulations

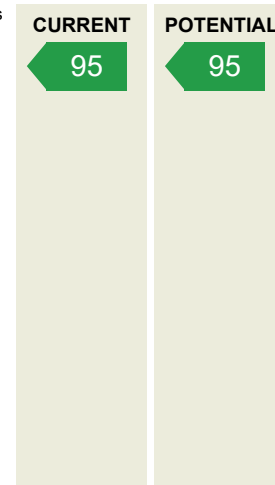
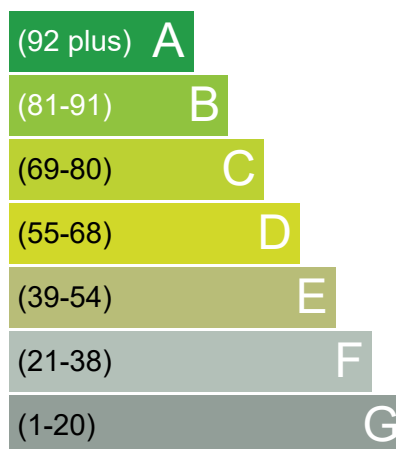
## Energy Efficiency Rating

Most energy efficient - lower running costs



## Carbon Dioxide (CO2) Emissions Rating

Very environmentally friendly - lower CO2 emissions



## Additional ratings for your home

|           | Primary<br>Energy | Energy      | Carbon    | Cost        | HTC       |
|-----------|-------------------|-------------|-----------|-------------|-----------|
| CURRENT   | 64.40<br>kWh      | 1888<br>kWh | 282<br>kg | 536.66<br>£ | 51<br>W/K |
| POTENTIAL | 64.40<br>kWh      | 1888<br>kWh | 282<br>kg | 536.66<br>£ | 51<br>W/K |

## Breakdown of property's energy performance

Each feature is assessed as one of the following:

|           |      |         |      |           |
|-----------|------|---------|------|-----------|
| Very Poor | Poor | Average | Good | Very Good |
|-----------|------|---------|------|-----------|

| Feature               | Description                                                              | Energy Performance |
|-----------------------|--------------------------------------------------------------------------|--------------------|
| Walls                 | Average thermal transmittance 0.15 W/m <sup>2</sup> K                    | Very Good          |
| Roof                  | Average thermal transmittance 0.14 W/m <sup>2</sup> K                    | Very Good          |
| Floor                 | Average thermal transmittance 0.12 W/m <sup>2</sup> K                    | Very Good          |
| Windows               | High performance glazing                                                 | Very Good          |
| Main heating          | Room heaters, electric                                                   | Very Poor          |
| Main heating controls | Programmer and appliance thermostats                                     | Good               |
| Secondary heating     | None                                                                     |                    |
| Hot water             | From main system                                                         | Very Good          |
| Lighting              | Good lighting efficiency                                                 | Good               |
| Air tightness         | Air permeability [AP50] = 3.0 m <sup>3</sup> /h.m <sup>2</sup> (assumed) | Good               |

## Recommendations

The recommended measures provided below will help to improve the energy efficiency of the dwelling. To reach the dwelling's potential energy rating all of the recommended measures shown below would need to be installed. Having these measures installed individually or in any other order may give a different result when compared with the cumulative potential rating.

| Recommended measures | Cumulative savings (per year) | Cumulative rating | Typical costs | Incremental savings (per year) | Cumulative CO2 rating |
|----------------------|-------------------------------|-------------------|---------------|--------------------------------|-----------------------|
|----------------------|-------------------------------|-------------------|---------------|--------------------------------|-----------------------|

The typical cost is based on average installation prices across the country so may not be representative of the actual costs in your area.

## Estimated energy costs of the dwelling

# Energy Report

The table below shows the estimated running costs of the space and water heating and lighting within the dwelling. It does not include the energy used from household appliances. The estimated annual costs after potential improvements indicates the total energy cost if all recommended measures named above were installed.

|                                    |                                                                                   | Estimated annual costs | Estimated annual costs after potential improvements | Potential future savings                                                            |
|------------------------------------|-----------------------------------------------------------------------------------|------------------------|-----------------------------------------------------|-------------------------------------------------------------------------------------|
| Lighting                           |  | £39                    | £39                                                 |  |
| Heating                            |  | £306                   | £306                                                |                                                                                     |
| Hot Water                          |  | £192                   | £192                                                |                                                                                     |
| New Technologies e.g. Impact of PV |                                                                                   | £0                     | £0                                                  |                                                                                     |
| TOTAL                              |                                                                                   | £537                   | £537                                                |                                                                                     |

## Estimated energy use and potential savings



Space Heating

**974**

kWh per year



Water Heating

**675**

kWh per year

## About this document

Created by:

Company/Trading name:

Phone number:

Email address:

### Disclaimer

This Energy Report should not under any circumstances be treated as a Condition Survey and cannot be used to indicate that any element of the dwelling (e.g. heating system) is working correctly.

This Energy Report must not be used in situations where an Energy Performance Certificate (EPC) is required.

This Energy Report is generated from a set of data inputs which may not reflect the actual dimensions, services or construction of the dwelling.

The calculation used to generate this report reflects the SAP Methodology current at the time of report generation.

## Glossary terms for additional metrics

|                           |                                                                                                                                                                                                                                                                       |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Primary Energy            | The measure of the energy required for lighting, heating and hot water in a property. This includes the efficiency of the property's heating system, power station efficiency for electricity and the energy used to produce the fuel and deliver it to the property. |
| Energy Used               | The estimated amount of fuel energy for lighting, heating and hot water for the property. The estimate is based on typical usage which is likely to be different to actual consumption.                                                                               |
| Carbon (CO2)              | The current emissions based on the energy estimates.                                                                                                                                                                                                                  |
| Cost                      | The estimated cost of energy. The cost of each unit of fuel is based on an industry standard which is likely to be different to those the occupier actually pays.                                                                                                     |
| Heat Transfer Coefficient | Heat flow through the property envelope where internal and external temperatures are different.                                                                                                                                                                       |

# Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Fri 28 Nov 2025 14:02:05

| Project Information |                |                 |                   |
|---------------------|----------------|-----------------|-------------------|
| Assessed By         | Peter Yearsley | Building Type   | Flat, End-terrace |
| OCDEA Registration  | EES/017088     | Assessment Date | 2025-11-28        |

| Dwelling Details |                                         |                  |                           |
|------------------|-----------------------------------------|------------------|---------------------------|
| Assessment Type  | As designed                             | Total Floor Area | 74 m <sup>2</sup>         |
| Site Reference   | Flat 3, 85 Pell Street                  | Plot Reference   | Electric Panel Heaters HC |
| Address          | 85 Flat 3 Pell Street, Reading, RG1 2NP |                  |                           |

| Client Details |       |
|----------------|-------|
| Name           | Array |
| Company        | Array |
| Address        |       |

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

## 1a Target emission rate and dwelling emission rate

|                                       |                                          |
|---------------------------------------|------------------------------------------|
| Fuel for main heating system          | Electricity                              |
| Target carbon dioxide emission rate   | 13.47 kgCO <sub>2</sub> /m <sup>2</sup>  |
| Dwelling carbon dioxide emission rate | 6.5 kgCO <sub>2</sub> /m <sup>2</sup> OK |

## 1b Target primary energy rate and dwelling primary energy

|                         |                                            |
|-------------------------|--------------------------------------------|
| Target primary energy   | 71.04 kWh <sub>PE</sub> /m <sup>2</sup>    |
| Dwelling primary energy | 67.45 kWh <sub>PE</sub> /m <sup>2</sup> OK |

## 1c Target fabric energy efficiency and dwelling fabric energy efficiency

|                                   |                            |
|-----------------------------------|----------------------------|
| Target fabric energy efficiency   | 39.4 kWh/m <sup>2</sup>    |
| Dwelling fabric energy efficiency | 36.7 kWh/m <sup>2</sup> OK |

## 2a Fabric U-values

| Element                          | Maximum permitted average U-Value [W/m <sup>2</sup> K] | Dwelling average U-Value [W/m <sup>2</sup> K] | Element with highest individual U-Value |     |
|----------------------------------|--------------------------------------------------------|-----------------------------------------------|-----------------------------------------|-----|
| External walls                   | 0.26                                                   | 0.15                                          | Walls (1) (0.15)                        | OK  |
| Party walls                      | 0.2                                                    | 0                                             | Party Wall (1) (0)                      | N/A |
| Curtain walls                    | 1.6                                                    | 0                                             | N/A                                     | N/A |
| Floors                           | 0.18                                                   | N/A                                           | N/A                                     | N/A |
| Roofs                            | 0.16                                                   | 0.14                                          | Roof (1) (0.14)                         | OK  |
| Windows, doors, and roof windows | 1.6                                                    | 1.2                                           | Opening2 (1.2)                          | OK  |
| Rooflights                       | 2.2                                                    | N/A                                           | N/A                                     | N/A |

## 2b Envelope elements (better than typically expected values are flagged with a subsequent (!))

| Name                       | Net area [m <sup>2</sup> ] | U-Value [W/m <sup>2</sup> K] |
|----------------------------|----------------------------|------------------------------|
| Exposed wall: Walls (1)    | 65.213                     | 0.15                         |
| Exposed wall: Walls (2)    | 25.38                      | 0.15                         |
| Exposed wall: Walls (3)    | 5.6                        | 0.15                         |
| Party wall: Party Wall (1) | 44.23                      | 0 (!)                        |
| Exposed roof: Roof (1)     | 16.05                      | 0.14                         |
| Exposed roof: Roof (2)     | 37.99                      | 0.14                         |

## 2c Openings (better than typically expected values are flagged with a subsequent (!))

| Name                             | Area [m <sup>2</sup> ] | Orientation | Frame factor | U-Value [W/m <sup>2</sup> K] |
|----------------------------------|------------------------|-------------|--------------|------------------------------|
| Opening2, Windows / Glazed Doors | 1.3195                 | East        | 1.0          | 1.2                          |
| Opening2, Windows / Glazed Doors | 1.3195                 | East        | 1.0          | 1.2                          |
| Opening2, Windows / Glazed Doors | 1.3195                 | East        | 1.0          | 1.2                          |
| Opening2, Windows / Glazed Doors | 1                      | East        | 1.0          | 1.2                          |
| Opening3, Windows / Glazed Doors | 1.3195                 | West        | 1.0          | 1.2                          |
| Opening3, Windows / Glazed Doors | 1.3195                 | West        | 1.0          | 1.2                          |
| Opening3, Windows / Glazed Doors | 1.3195                 | West        | 1.0          | 1.2                          |
| Opening4, Windows / Glazed Doors | 1                      | West        | 1.0          | 1.2                          |

## 2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

|                                                                                                   |
|---------------------------------------------------------------------------------------------------|
| Building part 1: Thermal bridging calculated from linear thermal transmittances for each junction |
|---------------------------------------------------------------------------------------------------|

| Main element  | Junction detail                                                   | Source                                       | Psi value [W/mK] | Drawing / reference  |
|---------------|-------------------------------------------------------------------|----------------------------------------------|------------------|----------------------|
| External wall | E2: Other lintels (including other steel lintels)                 | Calculated by person with suitable expertise | 0.084            | R.O.I. Psi Value     |
| External wall | E3: Sill                                                          | Calculated by person with suitable expertise | 0.034 (!)        | R.O.I. Psi Value     |
| External wall | E4: Jamb                                                          | Calculated by person with suitable expertise | 0.043            | R.O.I. Psi Value     |
| External wall | E16: Corner (normal)                                              | Calculated by person with suitable expertise | 0.03 (!)         | R.O.I. Psi Value     |
| External wall | E18: Party wall between dwellings                                 | Calculated by person with suitable expertise | 0.04             | R.O.I. Psi Value     |
| External wall | E7: Party floor between dwellings (in blocks of flats)            | Calculated by person with suitable expertise | 0.066            | R.O.I. Psi Value     |
| External wall | E11: Eaves (insulation at rafter level)                           | Calculated by person with suitable expertise | 0.013 (!)        | R.O.I. Psi Value     |
| External wall | E17: Corner (inverted - internal area greater than external area) | Calculated by person with suitable expertise | 0.015 (!)        | R.O.I. Psi Value     |
| Party wall    | P3: Intermediate floor between dwellings (in blocks of flats)     | SAP table default                            | 0 (!)            |                      |
| External wall | E13: Gable (insulation at rafter level)                           | Calculated by person with suitable expertise | 0.024 (!)        | R.O.I. Psi Value     |
| External wall | E6: Intermediate floor within a dwelling                          | Calculated by person with suitable expertise | 0.08             | R.O.I. Psi Value     |
| Party wall    | P5: Roof (insulation at rafter level)                             | Calculated by person with suitable expertise | 0.24             | Default Value Halved |
| Party wall    | P2: Intermediate floor within a dwelling                          | SAP table default                            | 0 (!)            |                      |
| Roof          | R4: Ridge (vaulted ceiling)                                       | SAP table default                            | 0.12             |                      |

### 3 Air permeability (better than typically expected values are flagged with a subsequent (!))

|                                             |                                                  |    |
|---------------------------------------------|--------------------------------------------------|----|
| Maximum permitted air permeability at 50Pa  | 8 m <sup>3</sup> /hm <sup>2</sup>                |    |
| Dwelling air permeability at 50Pa           | 4 m <sup>3</sup> /hm <sup>2</sup> , Design value | OK |
| Air permeability test certificate reference |                                                  |    |

### 4 Space heating

|                                                                                            |                                     |  |
|--------------------------------------------------------------------------------------------|-------------------------------------|--|
| <b>Main heating system 1: Room heaters - Electricity</b>                                   |                                     |  |
| Efficiency                                                                                 | 100.0%                              |  |
| Emitter type                                                                               |                                     |  |
| Flow temperature                                                                           |                                     |  |
| System type                                                                                | Panel, convector or radiant heaters |  |
| Manufacturer                                                                               |                                     |  |
| Model                                                                                      |                                     |  |
| Commissioning                                                                              |                                     |  |
| <b>Main heating system 2: Heat pump with radiators or underfloor heating - Electricity</b> |                                     |  |
| Efficiency                                                                                 | 0.0%                                |  |
| Emitter type                                                                               |                                     |  |
| Flow temperature                                                                           |                                     |  |
| System type                                                                                | Heat Pump                           |  |
| Manufacturer                                                                               | KERS Innovations UK Ltd             |  |
| Model                                                                                      | KERS MEV-W200SL                     |  |
| Commissioning                                                                              |                                     |  |
| <b>Secondary heating system: N/A</b>                                                       |                                     |  |
| Fuel                                                                                       | N/A                                 |  |
| Efficiency                                                                                 | N/A                                 |  |
| Commissioning                                                                              |                                     |  |

### 5 Hot water

|                                   |     |  |
|-----------------------------------|-----|--|
| <b>Cylinder/store - type: N/A</b> |     |  |
| Capacity                          | N/A |  |
| Declared heat loss                | N/A |  |
| Primary pipework insulated        | N/A |  |
| Manufacturer                      |     |  |
| Model                             |     |  |
| Commissioning                     |     |  |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                   |                        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|------------------------|
| <b>Waste water heat recovery system 1</b> - type: N/A                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                        |
| Efficiency                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                   |                        |
| Manufacturer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                   |                        |
| Model                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                        |
| <b>6 Controls</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                   |                        |
| <b>Main heating 1</b> - type: Programmer and appliance thermostats                                                                                                                                                                                                                                                                                                                                                                                                                               |                   |                        |
| Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                   |                        |
| Ecodesign class                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                   |                        |
| Manufacturer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                   |                        |
| Model                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                        |
| <b>Main heating 2</b> - type: Not applicable                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                   |                        |
| Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                   |                        |
| Ecodesign class                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                   |                        |
| Manufacturer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                   |                        |
| Model                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                        |
| <b>Water heating</b> - type: N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                   |                        |
| Manufacturer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                   |                        |
| Model                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                        |
| <b>7 Lighting</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                   |                        |
| Minimum permitted light source efficacy                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 75 lm/W           |                        |
| Lowest light source efficacy                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 90 lm/W           | OK                     |
| External lights control                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | N/A               |                        |
| <b>8 Mechanical ventilation</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                   |                        |
| <b>System type:</b> Centralised mechanical extract                                                                                                                                                                                                                                                                                                                                                                                                                                               |                   |                        |
| Maximum permitted specific fan power                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0.7 W/(l/s)       |                        |
| Specific fan power                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 0.51 W/(l/s)      | OK                     |
| Minimum permitted heat recovery efficiency                                                                                                                                                                                                                                                                                                                                                                                                                                                       | N/A               |                        |
| Heat recovery efficiency                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | N/A               | N/A                    |
| Manufacturer/Model                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | KERS MEV-W200SL   |                        |
| Commissioning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                   |                        |
| <b>9 Local generation</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                   |                        |
| N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                   |                        |
| <b>10 Heat networks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                   |                        |
| N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                   |                        |
| <b>11 Supporting documentary evidence</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                   |                        |
| N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                   |                        |
| <b>12 Declarations</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                   |                        |
| <b>a. Assessor Declaration</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                   |                        |
| This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report. |                   |                        |
| Signed:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>P Yearsley</b> | Assessor ID: R301-0001 |
| Name:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Peter Yearsley    | Date: 28/11/2025       |
| <b>b. Client Declaration</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                   |                        |
| N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                   |                        |

# Full SAP Calculation Printout



|                                    |                                           |               |       |                |            |
|------------------------------------|-------------------------------------------|---------------|-------|----------------|------------|
| Plot Reference                     | Flat 3, 85 Pell Street                    |               |       | Issued on Date | 28/11/2025 |
| Assessment Reference               | Electric Panel Heaters HC                 | Plot Type Ref |       |                |            |
| Plot Address                       | Flat 3, 85, Pell Street, Reading, RG1 2NP |               |       | SAP Version    | 10.2       |
|                                    |                                           |               |       |                |            |
| SAP Rating                         | 75 C                                      | DER           | 6.50  | TER            | 13.47      |
| Environmental                      | 95 A                                      | % DER < TER   |       |                | 51.74      |
| CO <sub>2</sub> Emissions (t/year) | 0.43                                      | DFEE          | 36.67 | TFEE           | 39.42      |
| Compliance Check                   | See BREL                                  | % DFEE < TFEE |       |                | 6.98       |
| % DPER < TPER                      | 5.06                                      | DPER          | 67.45 | TPER           | 71.04      |
|                                    |                                           |               |       |                |            |
| Assessor Details                   | Mr. Peter Yearsley                        |               |       | Assessor ID    | R301-0001  |
| Client                             |                                           |               |       |                |            |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                 |                             |
| Ground floor                                           | 45.3000 (1b)              | x 2.7500 (2b)                   | = 124.5750 (1b) - (3b)      |
| First floor                                            | 29.1000 (1c)              | x 3.2600 (2c)                   | = 94.8660 (1c) - (3c)       |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 74.4000                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 219.4410 (5)              |

## 2. Ventilation rate

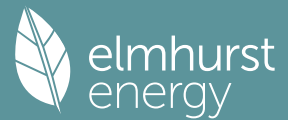
|                                                                                                    | m <sup>3</sup> per hour                 |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 0 * 10 = 0.0000 (7a)                    |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 / (5) = 0.0000 (8)               |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 4.0000 (17)                             |
| Infiltration rate                                                                                  | 0.2000 (18)                             |
| Number of sides sheltered                                                                          | 1 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.9250 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.1850 (21)        |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate                                                                                         | 0.2359 | 0.2313 | 0.2266 | 0.2035 | 0.1989 | 0.1758 | 0.1758 | 0.1711 | 0.1850 | 0.1989 | 0.2081 | 0.2174 (22b) |
| Mechanical extract ventilation - centralised                                                            |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        |              |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                                     | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K   |
|-------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|-----------------|
| Main dwelling                                               |                         |                            |                           |                               |              |                                |                 |
| Windows / Glazed Doors                                      |                         |                            | 9.9200                    | 1.1450                        | 11.3588      |                                | (27)            |
| External Wall                                               | 74.1300                 | 8.9200                     | 65.2100                   | 0.1500                        | 9.7815       | 9.0000                         | 586.8900 (29a)  |
| RIR Stud Wall                                               | 25.3800                 |                            | 25.3800                   | 0.1500                        | 3.8070       | 9.0000                         | 228.4200 (29a)  |
| Dormer Walls                                                | 6.6000                  | 1.0000                     | 5.6000                    | 0.1500                        | 0.8400       | 9.0000                         | 50.4000 (29a)   |
| Adj To RIR Ins At Slope                                     | 16.0500                 |                            | 16.0500                   | 0.1400                        | 2.2470       | 9.0000                         | 144.4500 (30)   |
| Slope Roof                                                  | 37.9900                 |                            | 37.9900                   | 0.1400                        | 5.3186       | 9.0000                         | 341.9100 (30)   |
| Total net area of external elements Aum(A, m <sup>2</sup> ) |                         |                            | 160.1500                  |                               |              |                                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                         |                         |                            |                           | (26)...(30) + (32) =          | 33.3529      |                                | (33)            |
| Main dwelling                                               |                         |                            |                           |                               |              |                                |                 |
| Party Wall 1                                                |                         |                            | 44.2300                   | 0.0000                        | 0.0000       | 45.0000                        | 1990.3500 (32)  |
| Party Floor 1                                               |                         |                            | 45.3000                   |                               |              | 30.0000                        | 1359.0000 (32d) |
| Internal Wall 1                                             |                         |                            | 113.1500                  |                               |              | 9.0000                         | 1018.3500 (32c) |
| Internal Floor 1                                            |                         |                            | 29.1000                   |                               |              | 18.0000                        | 523.8000 (32d)  |
| Internal Ceiling 1                                          |                         |                            | 29.1000                   |                               |              | 9.0000                         | 261.9000 (32e)  |

# Full SAP Calculation Printout



Heat capacity  $C_m = \text{Sum}(A \times k)$   
Thermal mass parameter (TMP =  $C_m / \text{TFA}$ ) in  $\text{kJ/m}^2\text{K}$  (28)...(30) + (32) + (32a)...(32e) = 6505.4700 (34)  
List of Thermal Bridges 87.4391 (35)

|                                                                           | Length  | Psi-value | Total  |
|---------------------------------------------------------------------------|---------|-----------|--------|
| K1 Element                                                                |         |           |        |
| E2 Other lintels (including other steel lintels)                          | 7.9700  | 0.0840    | 0.6695 |
| E3 Sill                                                                   | 7.0600  | 0.0340    | 0.2400 |
| E4 Jamb                                                                   | 26.6000 | 0.0430    | 1.1438 |
| E16 Corner (normal)                                                       | 17.5000 | 0.0300    | 0.5250 |
| E18 Party wall between dwellings                                          | 9.5000  | 0.0400    | 0.3800 |
| E7 Party floor between dwellings (in blocks of flats)                     | 20.1000 | 0.0660    | 1.3266 |
| E11 Eaves (insulation at rafter level)                                    | 9.6000  | 0.0130    | 0.1248 |
| E17 Corner (inverted - internal area greater than external area)          | 8.0000  | 0.0150    | 0.1200 |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | 10.7000 | 0.0000    | 0.0000 |
| E13 Gable (insulation at rafter level)                                    | 16.1000 | 0.0240    | 0.3864 |
| E6 Intermediate floor within a dwelling                                   | 22.2000 | 0.0800    | 1.7760 |
| P5 Party wall - Roof (insulation at rafter level)                         | 6.4000  | 0.2400    | 1.5360 |
| P2 Party wall - Intermediate floor within a dwelling                      | 4.0000  | 0.0000    | 0.0000 |
| R4 Ridge (vaulted ceiling)                                                | 11.1000 | 0.1200    | 1.3320 |

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.5601 (36)  
Point Thermal bridges (36a) = 0.0000  
Total fabric heat loss (33) + (36) + (36a) = 42.9130 (37)

Ventilation heat loss calculated monthly (38)m =  $0.33 \times (25)\text{m} \times (5)$   
(38)m Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
Heat transfer coeff 36.2078 36.2078 36.2078 36.2078 36.2078 36.2078 36.2078 36.2078 36.2078 36.2078 36.2078 36.2078 (38)  
Average =  $\text{Sum}(39)\text{m} / 12 =$  79.1208 79.1208 79.1208 79.1208 79.1208 79.1208 79.1208 79.1208 79.1208 79.1208 79.1208 79.1208 (39)

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec         |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
| HLP           | 1.0635 | 1.0635 | 1.0635 | 1.0635 | 1.0635 | 1.0635 | 1.0635 | 1.0635 | 1.0635 | 1.0635 | 1.0635 | 1.0635 (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 1.0635      |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31          |

## 4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.3480 (42)  
Hot water usage for mixer showers 87.4344 86.1204 84.2057 80.5423 77.8387 74.8238 73.1101 75.0103 77.0933 80.3304 84.0726 87.0994 (42a)  
Hot water usage for baths 27.4684 27.0605 26.4860 25.4268 24.6337 23.7542 23.2792 23.8496 24.4707 25.4118 26.4928 27.3756 (42b)  
Hot water usage for other uses 38.6763 37.2699 35.8635 34.4571 33.0507 31.6443 31.6443 33.0507 34.4571 35.8635 37.2699 38.6763 (42c)  
Average daily hot water use (litres/day) 141.2394 (43)

Daily hot water use Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
Energy conte 153.5791 150.4508 146.5552 140.4261 135.5230 130.2222 128.0335 131.9106 136.0211 141.6057 147.8353 153.1513 (44)  
Energy content (annual) 243.2318 214.2399 225.2499 192.2364 182.4401 160.1234 154.8454 163.3328 167.7276 192.1576 210.6185 239.7979 (45)  
Distribution loss (46)m =  $0.15 \times (45)\text{m}$  Total = Sum(45)m = 2346.0013  
Water storage loss (or HIU loss): 36.4848 32.1360 33.7875 28.8355 27.3660 24.0185 23.2268 24.4999 25.1591 28.8236 31.5928 35.9697 (46)  
Store volume 196.0000 (47)  
a) If manufacturer declared loss factor is known (kWh/day): 1.3120 (48)  
Temperature factor from Table 2b 0.5400 (49)  
Enter (49) or (54) in (55) 0.7085 (55)  
Total storage loss 21.9629 19.8374 21.9629 21.2544 21.9629 21.2544 21.9629 21.9629 21.2544 21.9629 21.2544 21.9629 (56)

If cylinder contains dedicated solar storage 21.9629 19.8374 21.9629 21.2544 21.9629 21.2544 21.9629 21.9629 21.2544 21.9629 21.2544 21.9629 (57)  
Primary loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (59)  
Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)  
Total heat required for water heating calculated for each month 265.1947 234.0774 247.2128 213.4908 204.4030 181.3778 176.8083 185.2957 188.9820 214.1205 231.8729 261.7608 (62)  
WWHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63a)  
PV diverter 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63b)  
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63c)  
FGHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)  
Output from w/h 265.1947 234.0774 247.2128 213.4908 204.4030 181.3778 176.8083 185.2957 188.9820 214.1205 231.8729 261.7608 (64)  
Total per year (kWh/year) = Sum(64)m = 2604.5965 (64)  
2605 (64)

12Total per year (kWh/year)  
Electric shower(s) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)  
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)  
Heat gains from water heating, kWh/month 80.8746 71.2348 74.8956 63.9186 60.6613 53.2410 51.4861 54.3082 55.7694 63.8924 70.0306 79.7328 (65)

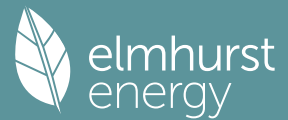
## 5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
(66)m 117.4022 117.4022 117.4022 117.4022 117.4022 117.4022 117.4022 117.4022 117.4022 117.4022 117.4022 117.4022 (66)  
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 113.4015 125.5517 113.4015 117.1815 113.4015 117.1815 113.4015 113.4015 117.1815 113.4015 117.1815 113.4015 (67)  
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 207.3413 209.4929 204.0710 192.5286 177.9583 164.2642 155.1158 152.9642 158.3861 169.9285 184.4988 198.1929 (68)  
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 34.7402 34.7402 34.7402 34.7402 34.7402 34.7402 34.7402 34.7402 34.7402 34.7402 34.7402 34.7402 (69)  
Pumps, fans 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (70)  
Losses e.g. evaporation (negative values) (Table 5) -93.9218 -93.9218 -93.9218 -93.9218 -93.9218 -93.9218 -93.9218 -93.9218 -93.9218 -93.9218 -93.9218 -93.9218 (71)  
Water heating gains (Table 5) 108.7024 106.0041 100.6661 88.7758 81.5340 73.9459 69.2017 72.9948 77.4575 85.8769 97.2648 107.1677 (72)  
Total internal gains 487.6659 499.2693 476.3593 456.7066 431.1144 413.6123 395.9397 397.5812 411.2458 427.4276 457.1658 476.9828 (73)

## 6. Solar gains

| [Jan] | Area | Solar flux | g | FF | Access | Gains |
|-------|------|------------|---|----|--------|-------|
|-------|------|------------|---|----|--------|-------|

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|                                                                                                              |           | m2        |          | Table 6a<br>W/m2 |           | Specific data<br>or Table 6b |           | Specific data<br>or Table 6c |          | factor<br>Table 6d |          | W              |
|--------------------------------------------------------------------------------------------------------------|-----------|-----------|----------|------------------|-----------|------------------------------|-----------|------------------------------|----------|--------------------|----------|----------------|
| East                                                                                                         |           | 4.9600    |          | 19.6403          |           | 0.7600                       |           | 0.0000                       |          | 0.7700             |          | 57.0077 (76)   |
| West                                                                                                         |           | 4.9600    |          | 19.6403          |           | 0.7600                       |           | 0.0000                       |          | 0.7700             |          | 57.0077 (80)   |
|                                                                                                              |           |           |          |                  |           |                              |           |                              |          |                    |          |                |
| Solar gains                                                                                                  | 114.0153  | 223.0382  | 367.3122 | 535.7029         | 656.5240  | 672.0691                     | 639.8372  | 549.6107                     | 427.1992 | 264.6536           | 142.1637 | 93.7607 (83)   |
| Total gains                                                                                                  | 601.6812  | 722.3075  | 843.6714 | 992.4094         | 1087.6384 | 1085.6814                    | 1035.7769 | 947.1919                     | 838.4451 | 692.0812           | 599.3296 | 570.7434 (84)  |
|                                                                                                              |           |           |          |                  |           |                              |           |                              |          |                    |          |                |
| 7. Mean internal temperature (heating season)                                                                |           |           |          |                  |           |                              |           |                              |          |                    |          |                |
| Temperature during heating periods in the living area from Table 9, Th1 (C)                                  |           |           |          |                  |           |                              |           |                              |          |                    |          | 21.0000 (85)   |
| Utilisation factor for gains for living area, nil,m (see Table 9a)                                           |           |           |          |                  |           |                              |           |                              |          |                    |          |                |
|                                                                                                              | Jan       | Feb       | Mar      | Apr              | May       | Jun                          | Jul       | Aug                          | Sep      | Oct                | Nov      | Dec            |
| tau                                                                                                          | 22.8395   | 22.8395   | 22.8395  | 22.8395          | 22.8395   | 22.8395                      | 22.8395   | 22.8395                      | 22.8395  | 22.8395            | 22.8395  | 22.8395        |
| alpha                                                                                                        | 2.5226    | 2.5226    | 2.5226   | 2.5226           | 2.5226    | 2.5226                       | 2.5226    | 2.5226                       | 2.5226   | 2.5226             | 2.5226   | 2.5226         |
| util living area                                                                                             | 0.9201    | 0.8803    | 0.8157   | 0.7031           | 0.5673    | 0.4274                       | 0.3215    | 0.3623                       | 0.5524   | 0.7750             | 0.8885   | 0.9287 (86)    |
| MIT                                                                                                          | 18.6476   | 19.0449   | 19.5933  | 20.2046          | 20.6359   | 20.8703                      | 20.9538   | 20.9363                      | 20.7463  | 20.1221            | 19.2616  | 18.5511 (87)   |
| Th 2                                                                                                         | 20.0308   | 20.0308   | 20.0308  | 20.0308          | 20.0308   | 20.0308                      | 20.0308   | 20.0308                      | 20.0308  | 20.0308            | 20.0308  | 20.0308 (88)   |
| util rest of house                                                                                           | 0.9105    | 0.8666    | 0.7953   | 0.6722           | 0.5246    | 0.3718                       | 0.2554    | 0.2927                       | 0.4942   | 0.7425             | 0.8733   | 0.9200 (89)    |
| MIT 2                                                                                                        | 17.2910   | 17.7848   | 18.4597  | 19.1909          | 19.6825   | 19.9284                      | 20.0037   | 19.9914                      | 19.8150  | 19.1174            | 18.0658  | 17.1704 (90)   |
| Living area fraction                                                                                         | 17.7450   | 18.2065   | 18.8391  | 19.5302          | 20.0016   | 20.2436                      | 20.3217   | 20.3076                      | 20.1267  | 19.4537            | 18.4660  | 17.6325 (92)   |
| MIT                                                                                                          | 17.7450   | 18.2065   | 18.8391  | 19.5302          | 20.0016   | 20.2436                      | 20.3217   | 20.3076                      | 20.1267  | 19.4537            | 18.4660  | 17.6325 (93)   |
| Temperature adjustment                                                                                       |           |           |          |                  |           |                              |           |                              |          |                    |          | 0.0000         |
| adjusted MIT                                                                                                 | 17.7450   | 18.2065   | 18.8391  | 19.5302          | 20.0016   | 20.2436                      | 20.3217   | 20.3076                      | 20.1267  | 19.4537            | 18.4660  | 17.6325 (93)   |
|                                                                                                              |           |           |          |                  |           |                              |           |                              |          |                    |          |                |
| 8. Space heating requirement                                                                                 |           |           |          |                  |           |                              |           |                              |          |                    |          |                |
|                                                                                                              | Jan       | Feb       | Mar      | Apr              | May       | Jun                          | Jul       | Aug                          | Sep      | Oct                | Nov      | Dec            |
| Utilisation                                                                                                  | 0.8808    | 0.8348    | 0.7662   | 0.6547           | 0.5232    | 0.3844                       | 0.2757    | 0.3131                       | 0.5003   | 0.7204             | 0.8424   | 0.8914 (94)    |
| Useful gains                                                                                                 | 529.9696  | 603.0172  | 646.4525 | 649.7790         | 569.0819  | 417.2979                     | 285.5267  | 296.5713                     | 419.4504 | 498.6042           | 504.8968 | 508.7402 (95)  |
| Ext temp.                                                                                                    | 4.3000    | 4.9000    | 6.5000   | 8.9000           | 11.7000   | 14.6000                      | 16.6000   | 16.4000                      | 14.1000  | 10.6000            | 7.1000   | 4.2000 (96)    |
| Heat loss rate W                                                                                             | 1063.7770 | 1052.8242 | 976.2791 | 841.0691         | 656.8267  | 446.5258                     | 294.4599  | 309.1752                     | 476.8335 | 700.5091           | 899.2885 | 1062.7915 (97) |
| Space heating kWh                                                                                            | 397.1527  | 302.2703  | 245.3910 | 137.7289         | 65.2821   | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 150.2173           | 283.9621 | 412.2142 (98a) |
| Space heating requirement - total per year (kWh/year)                                                        |           |           |          |                  |           |                              |           |                              |          |                    |          | 1994.2186      |
| Solar heating kWh                                                                                            | 0.0000    | 0.0000    | 0.0000   | 0.0000           | 0.0000    | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 0.0000             | 0.0000   | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                                                       |           |           |          |                  |           |                              |           |                              |          |                    |          | 0.0000         |
| Space heating kWh                                                                                            | 397.1527  | 302.2703  | 245.3910 | 137.7289         | 65.2821   | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 150.2173           | 283.9621 | 412.2142 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year)                               |           |           |          |                  |           |                              |           |                              |          |                    |          | 1994.2186      |
| Space heating per m2                                                                                         |           |           |          |                  |           |                              |           |                              |          | (98c) / (4) =      |          | 26.8040 (99)   |
|                                                                                                              |           |           |          |                  |           |                              |           |                              |          |                    |          |                |
| 9a. Energy requirements - Individual heating systems, including micro-CHP                                    |           |           |          |                  |           |                              |           |                              |          |                    |          |                |
| Fraction of space heat from secondary/supplementary system (Table 11)                                        |           |           |          |                  |           |                              |           |                              |          |                    |          | 0.0000 (201)   |
| Fraction of space heat from main system(s)                                                                   |           |           |          |                  |           |                              |           |                              |          |                    |          | 1.0000 (202)   |
| Fraction of main heating from main system 2                                                                  |           |           |          |                  |           |                              |           |                              |          |                    |          | 0.0000 (203)   |
| Fraction of total heating from main system 1                                                                 |           |           |          |                  |           |                              |           |                              |          |                    |          | 1.0000 (204)   |
| Fraction of total heating from main system 2                                                                 |           |           |          |                  |           |                              |           |                              |          |                    |          | 0.0000 (205)   |
| Efficiency of main space heating system 1 (in %)                                                             |           |           |          |                  |           |                              |           |                              |          |                    |          | 100.0000 (206) |
| Efficiency of main space heating system 2 (in %)                                                             |           |           |          |                  |           |                              |           |                              |          |                    |          | 0.0000 (207)   |
| Efficiency of secondary/supplementary heating system, %                                                      |           |           |          |                  |           |                              |           |                              |          |                    |          | 0.0000 (208)   |
|                                                                                                              | Jan       | Feb       | Mar      | Apr              | May       | Jun                          | Jul       | Aug                          | Sep      | Oct                | Nov      | Dec            |
| Space heating requirement                                                                                    | 397.1527  | 302.2703  | 245.3910 | 137.7289         | 65.2821   | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 150.2173           | 283.9621 | 412.2142 (98)  |
| Space heating efficiency (main heating system 1)                                                             | 100.0000  | 100.0000  | 100.0000 | 100.0000         | 100.0000  | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 100.0000           | 100.0000 | 100.0000 (210) |
| Space heating fuel (main heating system)                                                                     | 397.1527  | 302.2703  | 245.3910 | 137.7289         | 65.2821   | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 150.2173           | 283.9621 | 412.2142 (211) |
| Space heating efficiency (main heating system 2)                                                             | 0.0000    | 0.0000    | 0.0000   | 0.0000           | 0.0000    | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 0.0000             | 0.0000   | 0.0000 (212)   |
| Space heating fuel (main heating system 2)                                                                   | 0.0000    | 0.0000    | 0.0000   | 0.0000           | 0.0000    | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 0.0000             | 0.0000   | 0.0000 (213)   |
| Space heating fuel (secondary)                                                                               | 0.0000    | 0.0000    | 0.0000   | 0.0000           | 0.0000    | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 0.0000             | 0.0000   | 0.0000 (215)   |
| Space heating fuel used, main system 2                                                                       | 0.0000    | 0.0000    | 0.0000   | 0.0000           | 0.0000    | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 0.0000             | 0.0000   | 0.0000 (213)   |
| Water heating                                                                                                |           |           |          |                  |           |                              |           |                              |          |                    |          |                |
| Water heating requirement                                                                                    | 265.1947  | 234.0774  | 247.2128 | 213.4908         | 204.4030  | 181.3778                     | 176.8083  | 185.2957                     | 188.9820 | 214.1205           | 231.8729 | 261.7608 (64)  |
| Efficiency of water heater (217)m                                                                            | 313.4050  | 313.4050  | 313.4050 | 313.4050         | 313.4050  | 313.4050                     | 313.4050  | 313.4050                     | 313.4050 | 313.4050           | 313.4050 | 313.4050 (216) |
| Fuel for water heating, kWh/month                                                                            | 84.6172   | 74.6885   | 78.8797  | 68.1198          | 65.2201   | 57.8733                      | 56.4153   | 59.1234                      | 60.2996  | 68.3207            | 73.9851  | 83.5216 (219)  |
| Space cooling fuel requirement (221)m                                                                        | 0.0000    | 0.0000    | 0.0000   | 0.0000           | 0.0000    | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 0.0000             | 0.0000   | 0.0000 (221)   |
| Pumps and Fa                                                                                                 | 15.0751   | 13.6162   | 15.0751  | 14.5888          | 15.0751   | 14.5888                      | 15.0751   | 15.0751                      | 14.5888  | 15.0751            | 14.5888  | 15.0751 (231)  |
| Lighting                                                                                                     | 27.8306   | 22.3267   | 20.1027  | 14.7281          | 11.3764   | 9.2946                       | 10.3780   | 13.4897                      | 17.5217  | 22.9895            | 25.9666  | 28.6041 (232)  |
| Electricity generated by PVs (Appendix M) (negative quantity) (233a)m                                        | 0.0000    | 0.0000    | 0.0000   | 0.0000           | 0.0000    | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 0.0000             | 0.0000   | 0.0000 (233a)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m                              | 0.0000    | 0.0000    | 0.0000   | 0.0000           | 0.0000    | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 0.0000             | 0.0000   | 0.0000 (234a)  |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m                  | 0.0000    | 0.0000    | 0.0000   | 0.0000           | 0.0000    | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 0.0000             | 0.0000   | 0.0000 (235a)  |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m | 0.0000    | 0.0000    | 0.0000   | 0.0000           | 0.0000    | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 0.0000             | 0.0000   | 0.0000 (235c)  |
| Electricity generated by PVs (Appendix M) (negative quantity) (233b)m                                        | 0.0000    | 0.0000    | 0.0000   | 0.0000           | 0.0000    | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 0.0000             | 0.0000   | 0.0000 (233b)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m                              | 0.0000    | 0.0000    | 0.0000   | 0.0000           | 0.0000    | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 0.0000             | 0.0000   | 0.0000 (234b)  |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m                  | 0.0000    | 0.0000    | 0.0000   | 0.0000           | 0.0000    | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 0.0000             | 0.0000   | 0.0000 (235b)  |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m | 0.0000    | 0.0000    | 0.0000   | 0.0000           | 0.0000    | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 0.0000             | 0.0000   | 0.0000 (235d)  |

# Full SAP Calculation Printout



|                                                                  |                 |
|------------------------------------------------------------------|-----------------|
| Annual totals kWh/year                                           |                 |
| Space heating fuel - main system 1                               | 1994.2186 (211) |
| Space heating fuel - main system 2                               | 0.0000 (213)    |
| Space heating fuel - secondary                                   | 0.0000 (215)    |
| Efficiency of water heater                                       | 313.4050        |
| Water heating fuel used                                          | 831.0641 (219)  |
| Space cooling fuel                                               | 0.0000 (221)    |
| Electricity for pumps and fans:                                  |                 |
| (MEVCentralised, Database: in-use factor = 1.3000, SFP = 0.6630) |                 |
| mechanical ventilation fans (SFP = 0.6630)                       | 177.4970 (230a) |
| Total electricity for the above, kWh/year                        | 177.4970 (231)  |
| Electricity for lighting (calculated in Appendix L)              | 224.6087 (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)    |                 |
| PV generation                                                    | 0.0000 (233)    |
| Wind generation                                                  | 0.0000 (234)    |
| Hydro-electric generation (Appendix N)                           | 0.0000 (235a)   |
| Electricity generated - Micro CHP (Appendix N)                   | 0.0000 (235)    |
| Appendix Q - special features                                    |                 |
| Energy saved or generated                                        | -0.0000 (236)   |
| Energy used                                                      | 0.0000 (237)    |
| Total delivered energy for all uses                              | 3227.3885 (238) |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                                 | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|-------------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1                   | 1994.2186          | 0.1552                        | 309.4552 (261)           |
| Space heating - main system 2                   | 0.0000             | 0.0000                        | 0.0000 (262)             |
| Total CO2 associated with community systems     |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                      | 831.0641           | 0.1413                        | 117.4242 (264)           |
| Space and water heating                         |                    |                               | 426.8793 (265)           |
| Pumps, fans and electric keep-hot               | 177.4970           | 0.1387                        | 24.6210 (267)            |
| Energy for lighting                             | 224.6087           | 0.1443                        | 32.4180 (268)            |
| Total CO2, kg/year                              |                    |                               | 483.9184 (272)           |
| EPC Dwelling Carbon Dioxide Emission Rate (DER) |                    |                               | 6.5000 (273)             |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 1994.2186          | 1.5745                              | 3139.8593 (275)            |
| Space heating - main system 2               | 0.0000             | 0.0000                              | 0.0000 (276)               |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 831.0641           | 1.5225                              | 1265.2724 (278)            |
| Space and water heating                     |                    |                                     | 4405.1318 (279)            |
| Pumps, fans and electric keep-hot           | 177.4970           | 1.5128                              | 268.5175 (281)             |
| Energy for lighting                         | 224.6087           | 1.5338                              | 344.5124 (282)             |
| Total Primary energy kWh/year               |                    |                                     | 5018.1617 (286)            |
| Dwelling Primary energy Rate (DPER)         |                    |                                     | 67.4500 (287)              |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF TARGET EMISSIONS

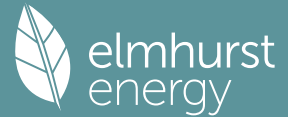
## 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m)            | Volume<br>(m3)         |
|--------------------------------------------------------|--------------|---------------------------------|------------------------|
| Main dwelling                                          |              |                                 |                        |
| Ground floor                                           | 45.3000 (1b) | x 2.7500 (2b)                   | = 124.5750 (1b) - (3b) |
| First floor                                            | 29.1000 (1c) | x 3.2600 (2c)                   | = 94.8660 (1c) - (3c)  |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 74.4000      |                                 | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 219.4410 (5)         |

## 2. Ventilation rate

|                                                      | m3 per hour                                                                      |
|------------------------------------------------------|----------------------------------------------------------------------------------|
| Number of open chimneys                              | 0 * 80 = 0.0000 (6a)                                                             |
| Number of open flues                                 | 0 * 20 = 0.0000 (6b)                                                             |
| Number of chimneys / flues attached to closed fire   | 0 * 10 = 0.0000 (6c)                                                             |
| Number of flues attached to solid fuel boiler        | 0 * 20 = 0.0000 (6d)                                                             |
| Number of flues attached to other heater             | 0 * 35 = 0.0000 (6e)                                                             |
| Number of blocked chimneys                           | 0 * 20 = 0.0000 (6f)                                                             |
| Number of intermittent extract fans                  | 3 * 10 = 30.0000 (7a)                                                            |
| Number of passive vents                              | 0 * 10 = 0.0000 (7b)                                                             |
| Number of flueless gas fires                         | 0 * 40 = 0.0000 (7c)                                                             |
| Infiltration due to chimneys, flues and fans         | = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 30.0000 / (5) = 0.1367 (8) |
| Pressure test                                        | Yes                                                                              |
| Pressure Test Method                                 | Blower Door                                                                      |
| Measured/design AP50                                 | 5.0000 (17)                                                                      |
| Infiltration rate                                    | 0.3867 (18)                                                                      |
| Number of sides sheltered                            | 1 (19)                                                                           |
| Shelter factor                                       | (20) = 1 - [0.075 x (19)] = 0.9250 (20)                                          |
| Infiltration rate adjusted to include shelter factor | (21) = (18) x (20) = 0.3577 (21)                                                 |

# Full SAP Calculation Printout



|                 |               |               |               |               |               |               |               |               |               |               |               |                    |
|-----------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|--------------------|
| Wind speed      | Jan<br>5.1000 | Feb<br>5.0000 | Mar<br>4.9000 | Apr<br>4.4000 | May<br>4.3000 | Jun<br>3.8000 | Jul<br>3.8000 | Aug<br>3.7000 | Sep<br>4.0000 | Oct<br>4.3000 | Nov<br>4.5000 | Dec<br>4.7000 (22) |
| Wind factor     | 1.2750        | 1.2500        | 1.2250        | 1.1000        | 1.0750        | 0.9500        | 0.9500        | 0.9250        | 1.0000        | 1.0750        | 1.1250        | 1.1750 (22a)       |
| Adj infilt rate |               |               |               |               |               |               |               |               |               |               |               |                    |
| Effective ac    | 0.4561        | 0.4471        | 0.4382        | 0.3935        | 0.3845        | 0.3398        | 0.3398        | 0.3309        | 0.3577        | 0.3845        | 0.4024        | 0.4203 (22b)       |
|                 | 0.6040        | 0.6000        | 0.5960        | 0.5774        | 0.5739        | 0.5577        | 0.5577        | 0.5547        | 0.5640        | 0.5739        | 0.5810        | 0.5883 (25)        |

## 3. Heat losses and heat loss parameter

| Element                                           | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K | A x U<br>W/K         | K-value<br>kJ/m2K | A x K<br>kJ/K |
|---------------------------------------------------|-------------|----------------|---------------|------------------|----------------------|-------------------|---------------|
| Main dwelling                                     |             |                |               |                  |                      |                   |               |
| TER Opening Type                                  |             |                | 9.9200        | 1.1450           | 11.3588              |                   | (27)          |
| External Wall                                     | 74.1300     | 8.9200         | 65.2100       | 0.1800           | 11.7378              |                   | (29a)         |
| RIR Stud Wall                                     | 25.3800     |                | 25.3800       | 0.1800           | 4.5684               |                   | (29a)         |
| Dormer Walls                                      | 6.6000      | 1.0000         | 5.6000        | 0.1800           | 1.0080               |                   | (29a)         |
| Adj To RIR Ins At Slope                           | 16.0500     |                | 16.0500       | 0.1100           | 1.7655               |                   | (30)          |
| Slope Roof                                        | 37.9900     |                | 37.9900       | 0.1100           | 4.1789               |                   | (30)          |
| Total net area of external elements Aum(A, m2)    |             |                | 160.1500      |                  |                      |                   | (31)          |
| Fabric heat loss, W/K = Sum (A x U)               |             |                |               |                  | (26)...(30) + (32) = | 34.6174           | (33)          |
| Main dwelling                                     |             |                |               |                  |                      |                   |               |
| Party Wall 1                                      |             |                | 44.2300       | 0.0000           | 0.0000               |                   | (32)          |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K |             |                |               |                  |                      |                   | 87.4391 (35)  |

## List of Thermal Bridges

| K1 Element                                                                | Length  | Psi-value | Total                              |
|---------------------------------------------------------------------------|---------|-----------|------------------------------------|
| E2 Other lintels (including other steel lintels)                          | 7.9700  | 0.0500    | 0.3985                             |
| E3 Sill                                                                   | 7.0600  | 0.0500    | 0.3530                             |
| E4 Jamb                                                                   | 26.6000 | 0.0500    | 1.3300                             |
| E16 Corner (normal)                                                       | 17.5000 | 0.0900    | 1.5750                             |
| E18 Party wall between dwellings                                          | 9.5000  | 0.0600    | 0.5700                             |
| E7 Party floor between dwellings (in blocks of flats)                     | 20.1000 | 0.0700    | 1.4070                             |
| E11 Eaves (insulation at rafter level)                                    | 9.6000  | 0.0400    | 0.3840                             |
| E17 Corner (inverted - internal area greater than external area)          | 8.0000  | -0.0900   | -0.7200                            |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | 10.7000 | 0.0000    | 0.0000                             |
| E13 Gable (insulation at rafter level)                                    | 16.1000 | 0.0800    | 1.2880                             |
| E6 Intermediate floor within a dwelling                                   | 22.2000 | 0.0000    | 0.0000                             |
| P5 Party wall - Roof (insulation at rafter level)                         | 6.4000  | 0.0800    | 0.5120                             |
| P2 Party wall - Intermediate floor within a dwelling                      | 4.0000  | 0.0000    | 0.0000                             |
| R4 Ridge (vaulted ceiling)                                                | 11.1000 | 0.0800    | 0.8880                             |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                |         |           | 7.9855 (36)                        |
| Point Thermal Bridges                                                     |         |           | (36a) = 0.0000                     |
| Total fabric heat loss                                                    |         |           | (33) + (36) + (36a) = 42.6029 (37) |

## Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

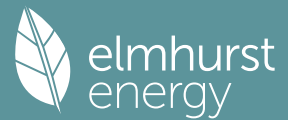
|                           |                |                |                |                |                |                |                |                |                |                |                |                     |
|---------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|---------------------|
| (38)m                     | Jan<br>43.7392 | Feb<br>43.4468 | Mar<br>43.1601 | Apr<br>41.8136 | May<br>41.5617 | Jun<br>40.3890 | Jul<br>40.3890 | Aug<br>40.1718 | Sep<br>40.8407 | Oct<br>41.5617 | Nov<br>42.0714 | Dec<br>42.6041 (38) |
| Heat transfer coeff       | 86.3421        | 86.0496        | 85.7630        | 84.4165        | 84.1646        | 82.9919        | 82.9919        | 82.7747        | 83.4436        | 84.1646        | 84.6742        | 85.2070 (39)        |
| Average = Sum(39)m / 12 = |                |                |                |                |                |                |                |                |                |                |                | 84.4153             |
| HLP                       | Jan<br>1.1605  | Feb<br>1.1566  | Mar<br>1.1527  | Apr<br>1.1346  | May<br>1.1312  | Jun<br>1.1155  | Jul<br>1.1155  | Aug<br>1.1126  | Sep<br>1.1216  | Oct<br>1.1312  | Nov<br>1.1381  | Dec<br>1.1453 (40)  |
| HLP (average)             |                |                |                |                |                |                |                |                |                |                |                | 1.1346              |
| Days in mont              | 31             | 28             | 31             | 30             | 31             | 30             | 31             | 31             | 30             | 31             | 30             | 31                  |

## 4. Water heating energy requirements (kWh/year)

|                                                                                |          |          |          |          |          |          |          |          |          |          |          |                |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |          |          | 2.3480 (42)    |
| Hot water usage for mixer showers                                              | 63.5886  | 62.6330  | 61.2405  | 58.5762  | 56.6100  | 54.4173  | 53.1710  | 54.5529  | 56.0678  | 58.4221  | 61.1437  | 63.3450 (42a)  |
| Hot water usage for baths                                                      | 27.4684  | 27.0605  | 26.4860  | 25.4268  | 24.6337  | 23.7542  | 23.2792  | 23.8496  | 24.4707  | 25.4118  | 26.4928  | 27.3756 (42b)  |
| Hot water usage for other uses                                                 | 38.6763  | 37.2699  | 35.8635  | 34.4571  | 33.0507  | 31.6443  | 31.6443  | 33.0507  | 34.4571  | 35.8635  | 37.2699  | 38.6763 (42c)  |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |          |          | 119.2545 (43)  |
| Daily hot water use                                                            | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec            |
| Energy content (annual)                                                        | 129.7334 | 126.9634 | 123.5900 | 118.4601 | 114.2943 | 109.8157 | 108.0944 | 111.4532 | 114.9956 | 119.6974 | 124.9064 | 129.3969 (44)  |
| Distribution loss (46)m = 0.15 x (45)m                                         | 205.4660 | 180.7942 | 189.9533 | 162.1659 | 153.8621 | 135.0313 | 130.7308 | 138.0024 | 141.8011 | 162.4282 | 177.9521 | 202.6043 (45)  |
| Water storage loss (or HIU loss):                                              |          |          |          |          |          |          |          |          |          |          |          |                |
| Store volume                                                                   |          |          |          |          |          |          |          |          |          |          |          | 150.0000 (47)  |
| a) If manufacturer declared loss factor is known (kWh/day):                    |          |          |          |          |          |          |          |          |          |          |          | 1.3938 (48)    |
| Temperature factor from Table 2b                                               |          |          |          |          |          |          |          |          |          |          |          | 0.5400 (49)    |
| Enter (49) or (54) in (55)                                                     |          |          |          |          |          |          |          |          |          |          |          | 0.7527 (55)    |
| Total storage loss                                                             | 23.3325  | 21.0745  | 23.3325  | 22.5798  | 23.3325  | 22.5798  | 23.3325  | 23.3325  | 22.5798  | 23.3325  | 22.5798  | 23.3325 (56)   |
| If cylinder contains dedicated solar storage                                   | 23.3325  | 21.0745  | 23.3325  | 22.5798  | 23.3325  | 22.5798  | 23.3325  | 23.3325  | 22.5798  | 23.3325  | 22.5798  | 23.3325 (57)   |
| Primary loss                                                                   | 23.2624  | 21.0112  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624 (59)   |
| Combi loss                                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (61)    |
| Total heat required for water heating calculated for each month                | 252.0609 | 222.8799 | 236.5482 | 207.2577 | 200.4570 | 180.1231 | 177.3257 | 184.5973 | 186.8930 | 209.0231 | 223.0439 | 249.1992 (62)  |
| WWHRS                                                                          | -29.0701 | -25.7098 | -26.9218 | -22.2923 | -20.7757 | -17.7779 | -16.6639 | -17.7204 | -18.3937 | -21.6841 | -24.5655 | -28.5317 (63a) |
| PV diverter                                                                    | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000 (63b)  |
| Solar input                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63c)   |
| FGHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63d)   |
| Output from w/h                                                                | 222.9908 | 197.1701 | 209.6263 | 184.9654 | 179.6813 | 162.3452 | 160.6617 | 166.8768 | 168.4993 | 187.3390 | 198.4784 | 220.6674 (64)  |
| 12Total per year (kWh/year)                                                    |          |          |          |          |          |          |          |          |          |          |          | 2259.3020 (64) |
| Electric shower(s)                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (64a)   |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (64a)   |
| Heat gains from water heating, kWh/month                                       | 105.5934 | 93.7827  | 100.4354 | 89.9936  | 88.4351  | 80.9714  | 80.7439  | 83.1617  | 83.2223  | 91.2833  | 95.2425  | 104.6418 (65)  |

## 5. Internal gains (see Table 5 and 5a)

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| Metabolic gains (Table 5), Watts                                                    |          |          |          |          |          |          |          |          |          |          |          |          |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
|                                                                                     | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |
| (66)m                                                                               | 117.4022 | 117.4022 | 117.4022 | 117.4022 | 117.4022 | 117.4022 | 117.4022 | 117.4022 | 117.4022 | 117.4022 | 117.4022 | 117.4022 |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 113.4015 | 125.5517 | 113.4015 | 117.1815 | 113.4015 | 117.1815 | 113.4015 | 113.4015 | 117.1815 | 113.4015 | 117.1815 | 113.4015 |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 207.3413 | 209.4929 | 204.0710 | 192.5286 | 177.9583 | 164.2642 | 155.1158 | 152.9642 | 158.3861 | 169.9285 | 184.4988 | 198.1929 |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 34.7402  | 34.7402  | 34.7402  | 34.7402  | 34.7402  | 34.7402  | 34.7402  | 34.7402  | 34.7402  | 34.7402  | 34.7402  | 34.7402  |
| Pumps, fans                                                                         | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 0.0000   | 0.0000   | 0.0000   | 3.0000   | 3.0000   | 3.0000   |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 |
| Water heating gains (Table 5)                                                       | 141.9266 | 139.5575 | 134.9938 | 124.9912 | 118.8643 | 112.4602 | 108.5268 | 111.7765 | 115.5866 | 122.6926 | 132.2813 | 140.6476 |
| Total internal gains                                                                | 523.8900 | 535.8227 | 513.6870 | 495.9219 | 471.4448 | 452.1267 | 435.2647 | 436.3629 | 449.3749 | 467.2433 | 495.1824 | 513.4627 |

## 6. Solar gains

| [Jan]       | Area<br>m <sup>2</sup> | Solar flux<br>Table 6a<br>W/m <sup>2</sup> | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W |
|-------------|------------------------|--------------------------------------------|-----------------------------------|------------------------------------|------------------------------|------------|
| East        | 4.9600                 | 19.6403                                    | 0.6300                            | 0.7000                             | 0.7700                       | 29.7715    |
| West        | 4.9600                 | 19.6403                                    | 0.6300                            | 0.7000                             | 0.7700                       | 29.7715    |
| Solar gains | 59.5430                | 116.4788                                   | 191.8239                          | 279.7638                           | 342.8610                     | 350.9793   |
| Total gains | 583.4330               | 652.3015                                   | 705.5109                          | 775.6857                           | 814.3058                     | 803.1059   |

## 7. Mean internal temperature (heating season)

| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         |         |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |         |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |
| tau                                                                         | 20.9292 | 21.0004 | 21.0706 | 21.4067 | 21.4707 | 21.7741 | 21.7741 | 21.8312 | 21.6562 | 21.4707 | 21.3415 | 21.2081 |
| alpha                                                                       | 2.3953  | 2.4000  | 2.4047  | 2.4271  | 2.4314  | 2.4516  | 2.4516  | 2.4554  | 2.4437  | 2.4314  | 2.4228  | 2.4139  |
| util living area                                                            | 0.9285  | 0.9059  | 0.8705  | 0.7980  | 0.6944  | 0.5544  | 0.4312  | 0.4685  | 0.6528  | 0.8247  | 0.9030  | 0.9336  |
| MIT                                                                         | 18.3415 | 18.6503 | 19.1357 | 19.7998 | 20.3513 | 20.7420 | 20.8996 | 20.8741 | 20.5900 | 19.8773 | 19.0262 | 18.3078 |
| Th 2                                                                        | 19.9517 | 19.9549 | 19.9580 | 19.9727 | 19.9754 | 19.9882 | 19.9882 | 19.9906 | 19.9833 | 19.9754 | 19.9698 | 19.9640 |
| util rest of house                                                          | 0.9194  | 0.8941  | 0.8536  | 0.7709  | 0.6514  | 0.4891  | 0.3452  | 0.3823  | 0.5920  | 0.7953  | 0.8889  | 0.9251  |
| MIT 2                                                                       | 16.8631 | 17.2517 | 17.8601 | 18.6841 | 19.3393 | 19.7786 | 19.9280 | 19.9108 | 19.6262 | 18.7970 | 17.7396 | 16.8277 |
| Living area fraction                                                        | 17.3579 | 17.7198 | 18.2870 | 19.0575 | 19.6780 | 20.1011 | 20.2532 | 20.2332 | 19.9488 | 19.1586 | 18.1702 | 17.3230 |
| MIT                                                                         | 17.3579 | 17.7198 | 18.2870 | 19.0575 | 19.6780 | 20.1011 | 20.2532 | 20.2332 | 19.9488 | 19.1586 | 18.1702 | 17.3230 |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000  |
| adjusted MIT                                                                | 17.3579 | 17.7198 | 18.2870 | 19.0575 | 19.6780 | 20.1011 | 20.2532 | 20.2332 | 19.9488 | 19.1586 | 18.1702 | 17.3230 |

## 8. Space heating requirement

|                                                                                | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov      | Dec       |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|---------------|----------|-----------|
| Utilisation                                                                    | 0.8885    | 0.8609    | 0.8198    | 0.7428   | 0.6376   | 0.4968   | 0.3687   | 0.4041   | 0.5897   | 0.7672        | 0.8566   | 0.8954    |
| Useful gains                                                                   | 518.3817  | 561.5519  | 578.4093  | 576.1671 | 519.2343 | 399.0225 | 283.6699 | 292.3000 | 396.5601 | 464.5180      | 487.7910 | 503.5781  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000   | 4.2000    |
| Heat loss rate W                                                               | 1127.4461 | 1103.1379 | 1010.8904 | 857.4593 | 671.4623 | 456.5428 | 303.1867 | 317.2942 | 488.0451 | 720.3281      | 937.3572 | 1118.1749 |
| Space heating kWh                                                              | 453.1439  | 363.9458  | 321.7660  | 202.5304 | 113.2576 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 190.3227      | 323.6876 | 457.2600  |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |          |          |          |          |          |          |               |          | 2425.9141 |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000   | 0.0000    |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |          |          |          |          |          |          |               |          | 0.0000    |
| Space heating kWh                                                              | 453.1439  | 363.9458  | 321.7660  | 202.5304 | 113.2576 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 190.3227      | 323.6876 | 457.2600  |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |               |          | 2425.9141 |
| Space heating per m <sup>2</sup>                                               |           |           |           |          |          |          |          |          |          | (98c) / (4) = |          | 32.6064   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

| Fraction of space heat from secondary/supplementary system (Table 11) |          |          |          |          |          |          |          |          |          |          |          |          |
|-----------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Efficiency of main space heating system 1 (in %)                      |          |          |          |          |          |          |          |          |          |          |          |          |
| Efficiency of main space heating system 2 (in %)                      |          |          |          |          |          |          |          |          |          |          |          |          |
| Efficiency of secondary/supplementary heating system, %               |          |          |          |          |          |          |          |          |          |          |          |          |
|                                                                       | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |
| Space heating requirement                                             | 453.1439 | 363.9458 | 321.7660 | 202.5304 | 113.2576 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 190.3227 | 323.6876 | 457.2600 |
| Space heating efficiency (main heating system 1)                      | 92.3000  | 92.3000  | 92.3000  | 92.3000  | 92.3000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 92.3000  | 92.3000  | 92.3000  |
| Space heating fuel (main heating system)                              | 490.9469 | 394.3075 | 348.6088 | 219.4262 | 122.7060 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 206.2001 | 350.6908 | 495.4063 |
| Space heating efficiency (main heating system 2)                      | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   |
| Space heating fuel (main heating system 2)                            | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   |
| Space heating fuel (secondary)                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   |
| Water heating                                                         |          |          |          |          |          |          |          |          |          |          |          |          |
| Water heating requirement                                             | 222.9908 | 197.1701 | 209.6263 | 184.9654 | 179.6813 | 162.3452 | 160.6617 | 166.8768 | 168.4993 | 187.3390 | 198.4784 | 220.6674 |
| Efficiency of water heater                                            | 85.6155  | 85.4150  | 85.0175  | 84.2637  | 83.0545  | 79.8000  | 79.8000  | 79.8000  | 79.8000  | 84.0953  | 85.1497  | 85.6555  |
| Fuel for water heating, kWh/month                                     |          |          |          |          |          |          |          |          |          |          |          |          |

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|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |            |        |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------------|--------|
|                                                                                                      | 260.4562 | 230.8379 | 246.5684 | 219.5079 | 216.3415 | 203.4401 | 201.3305 | 209.1188 | 211.1520 | 222.7700 | 233.0935 | 257.6220   | (219)  |
| Space cooling fuel requirement                                                                       |          |          |          |          |          |          |          |          |          |          |          |            |        |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | (221)  |
| Pumps and Fa                                                                                         | 7.3041   | 6.5973   | 7.3041   | 7.0685   | 7.3041   | 7.0685   | 7.3041   | 7.3041   | 7.0685   | 7.3041   | 7.0685   | 7.3041     | (231)  |
| Lighting                                                                                             | 23.5626  | 18.9028  | 17.0199  | 12.4695  | 9.6318   | 7.8693   | 8.7864   | 11.4209  | 14.8347  | 19.4639  | 21.9844  | 24.2175    | (232)  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |            |        |
| (233a)m                                                                                              | -25.2647 | -36.7386 | -54.4445 | -63.1701 | -69.8028 | -65.7652 | -64.9678 | -60.5140 | -52.9184 | -42.8956 | -28.1747 | -21.7145   | (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |            |        |
| (234a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | (234a) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |            |        |
| (235a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | (235a) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |            |        |
| (235c)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | (235c) |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |            |        |
| (233b)m                                                                                              | -11.0474 | -23.5513 | -47.3940 | -72.0402 | -96.0929 | -96.8566 | -95.7086 | -80.6422 | -58.5969 | -33.9516 | -14.8373 | -8.7121    | (233b) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |            |        |
| (234b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | (234b) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |            |        |
| (235b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | (235b) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |            |        |
| (235d)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | (235d) |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |            |        |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 2628.2926  | (211)  |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000     | (213)  |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000     | (215)  |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 79.8000    |        |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          | 2712.2389  | (219)  |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000     | (221)  |
| Electricity for pumps and fans:                                                                      |          |          |          |          |          |          |          |          |          |          |          |            |        |
| Total electricity for the above, kWh/year                                                            |          |          |          |          |          |          |          |          |          |          |          | 86.0000    | (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |          |          |          |          |          |          |          |          | 190.1636   | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |          |          |          |          |          |          |          |          |            |        |
| PV generation                                                                                        |          |          |          |          |          |          |          |          |          |          |          | -1225.8021 | (233)  |
| Wind generation                                                                                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000     | (234)  |
| Hydro-electric generation (Appendix N)                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000     | (235a) |
| Electricity generated - Micro CHP (Appendix N)                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000     | (235)  |
| Appendix Q - special features                                                                        |          |          |          |          |          |          |          |          |          |          |          |            |        |
| Energy saved or generated                                                                            |          |          |          |          |          |          |          |          |          |          |          | -0.0000    | (236)  |
| Energy used                                                                                          |          |          |          |          |          |          |          |          |          |          |          | 0.0000     | (237)  |
| Total delivered energy for all uses                                                                  |          |          |          |          |          |          |          |          |          |          |          | 4390.8929  | (238)  |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                               | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|-----------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1                 | 2628.2926          | 0.2100                        | 551.9414 (261)           |
| Total CO2 associated with community systems   |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                    | 2712.2389          | 0.2100                        | 569.5702 (264)           |
| Space and water heating                       |                    |                               | 1121.5116 (265)          |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293 (267)            |
| Energy for lighting                           | 190.1636           | 0.1443                        | 27.4465 (268)            |
| Energy saving/generation technologies         |                    |                               |                          |
| PV Unit electricity used in dwelling          | -586.3710          | 0.1339                        | -78.5381                 |
| PV Unit electricity exported                  | -639.4311          | 0.1255                        | -80.2786                 |
| Total                                         |                    |                               | -158.8168 (269)          |
| Total CO2, kg/year                            |                    |                               | 1002.0706 (272)          |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 13.4700 (273)            |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 2628.2926          | 1.1300                              | 2969.9706 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2712.2389          | 1.1300                              | 3064.8299 (278)            |
| Space and water heating                     |                    |                                     | 6034.8006 (279)            |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008 (281)             |
| Energy for lighting                         | 190.1636           | 1.5338                              | 291.6793 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -586.3710          | 1.4950                              | -876.6133                  |
| PV Unit electricity exported                | -639.4311          | 0.4608                              | -294.6672                  |
| Total                                       |                    |                                     | -1171.2805 (283)           |
| Total Primary energy kWh/year               |                    |                                     | 5285.3002 (286)            |
| Target Primary Energy Rate (TPER)           |                    |                                     | 71.0400 (287)              |

## SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF FABRIC ENERGY EFFICIENCY

### 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m)              | Volume<br>(m3)         |
|--------------------------------------------------------|--------------|-----------------------------------|------------------------|
| Main dwelling                                          |              |                                   |                        |
| Ground floor                                           | 45.3000 (1b) | x 2.7500 (2b)                     | = 124.5750 (1b) - (3b) |
| First floor                                            | 29.1000 (1c) | x 3.2600 (2c)                     | = 94.8660 (1c) - (3c)  |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 74.4000      |                                   | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 219.4410 (5)           |

# Full SAP Calculation Printout



## 2. Ventilation rate

|                                                                                                         |        |        |        |        |        |        |        |        |        |        |                             |              |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-----------------------------|--------------|
|                                                                                                         |        |        |        |        |        |        |        |        |        |        | m3 per hour                 |              |
| Number of open chimneys                                                                                 |        |        |        |        |        |        |        |        |        |        | 0 * 80 =                    | 0.0000 (6a)  |
| Number of open flues                                                                                    |        |        |        |        |        |        |        |        |        |        | 0 * 20 =                    | 0.0000 (6b)  |
| Number of chimneys / flues attached to closed fire                                                      |        |        |        |        |        |        |        |        |        |        | 0 * 10 =                    | 0.0000 (6c)  |
| Number of flues attached to solid fuel boiler                                                           |        |        |        |        |        |        |        |        |        |        | 0 * 20 =                    | 0.0000 (6d)  |
| Number of flues attached to other heater                                                                |        |        |        |        |        |        |        |        |        |        | 0 * 35 =                    | 0.0000 (6e)  |
| Number of blocked chimneys                                                                              |        |        |        |        |        |        |        |        |        |        | 0 * 20 =                    | 0.0000 (6f)  |
| Number of intermittent extract fans                                                                     |        |        |        |        |        |        |        |        |        |        | 3 * 10 =                    | 30.0000 (7a) |
| Number of passive vents                                                                                 |        |        |        |        |        |        |        |        |        |        | 0 * 10 =                    | 0.0000 (7b)  |
| Number of flueless gas fires                                                                            |        |        |        |        |        |        |        |        |        |        | 0 * 40 =                    | 0.0000 (7c)  |
|                                                                                                         |        |        |        |        |        |        |        |        |        |        | Air changes per hour        |              |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =      |        |        |        |        |        |        |        |        |        |        | 30.0000 / (5) =             | 0.1367 (8)   |
| Pressure test                                                                                           |        |        |        |        |        |        |        |        |        |        | Yes                         |              |
| Pressure Test Method                                                                                    |        |        |        |        |        |        |        |        |        |        | Blower Door                 |              |
| Measured/design AP50                                                                                    |        |        |        |        |        |        |        |        |        |        | 4.0000 (17)                 |              |
| Infiltration rate                                                                                       |        |        |        |        |        |        |        |        |        |        | 0.3367 (18)                 |              |
| Number of sides sheltered                                                                               |        |        |        |        |        |        |        |        |        |        | 1 (19)                      |              |
| Shelter factor                                                                                          |        |        |        |        |        |        |        |        |        |        | (20) = 1 - [0.075 x (19)] = | 0.9250 (20)  |
| Infiltration rate adjusted to include shelter factor                                                    |        |        |        |        |        |        |        |        |        |        | (21) = (18) x (20) =        | 0.3115 (21)  |
|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov                         | Dec          |
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000                      | 4.7000 (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250                      | 1.1750 (22a) |
| Adj infilt rate                                                                                         | 0.3971 | 0.3893 | 0.3815 | 0.3426 | 0.3348 | 0.2959 | 0.2959 | 0.2881 | 0.3115 | 0.3348 | 0.3504                      | 0.3660 (22b) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        | 0.0000 (23b)                |              |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =            |        |        |        |        |        |        |        |        |        |        | 0.0000 (23c)                |              |
| Effective ac                                                                                            | 0.5788 | 0.5758 | 0.5728 | 0.5587 | 0.5561 | 0.5438 | 0.5438 | 0.5415 | 0.5485 | 0.5561 | 0.5614                      | 0.5670 (25)  |

## 3. Heat losses and heat loss parameter

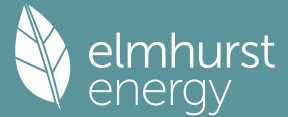
|                                                                           |             |                |               |                  |                                      |                   |               |       |
|---------------------------------------------------------------------------|-------------|----------------|---------------|------------------|--------------------------------------|-------------------|---------------|-------|
| Element                                                                   | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K | A x U<br>W/K                         | K-value<br>kJ/m2K | A x K<br>kJ/K |       |
| Main dwelling                                                             |             |                |               |                  |                                      |                   |               |       |
| Windows / Glazed Doors                                                    |             |                | 9.9200        | 1.1450           | 11.3588                              |                   |               | (27)  |
| External Wall                                                             | 74.1300     | 8.9200         | 65.2100       | 0.1500           | 9.7815                               | 9.0000            | 586.8900      | (29a) |
| RIR Stud Wall                                                             | 25.3800     |                | 25.3800       | 0.1500           | 3.8070                               | 9.0000            | 228.4200      | (29a) |
| Dormer Walls                                                              | 6.6000      | 1.0000         | 5.6000        | 0.1500           | 0.8400                               | 9.0000            | 50.4000       | (29a) |
| Adj To RIR Ins At Slope                                                   | 16.0500     |                | 16.0500       | 0.1400           | 2.2470                               | 9.0000            | 144.4500      | (30)  |
| Slope Roof                                                                | 37.9900     |                | 37.9900       | 0.1400           | 5.3186                               | 9.0000            | 341.9100      | (30)  |
| Total net area of external elements Aum(A, m2)                            |             |                | 160.1500      |                  |                                      |                   |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)                                       |             |                |               |                  | (26)...(30) + (32) =                 | 33.3529           |               | (33)  |
| Main dwelling                                                             |             |                |               |                  |                                      |                   |               |       |
| Party Wall 1                                                              |             |                | 44.2300       | 0.0000           | 0.0000                               | 45.0000           | 1990.3500     | (32)  |
| Party Floor 1                                                             |             |                | 45.3000       |                  |                                      | 30.0000           | 1359.0000     | (32d) |
| Internal Wall 1                                                           |             |                | 113.1500      |                  |                                      | 9.0000            | 1018.3500     | (32c) |
| Internal Floor 1                                                          |             |                | 29.1000       |                  |                                      | 18.0000           | 523.8000      | (32d) |
| Internal Ceiling 1                                                        |             |                | 29.1000       |                  |                                      | 9.0000            | 261.9000      | (32e) |
| Heat capacity Cm = Sum(A x k)                                             |             |                |               |                  | (28)...(30) + (32) + (32a)...(32e) = |                   | 6505.4700     | (34)  |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K                         |             |                |               |                  |                                      |                   | 87.4391       | (35)  |
| List of Thermal Bridges                                                   |             |                |               |                  |                                      |                   |               |       |
| K1 Element                                                                |             |                |               | Length           | Psi-value                            | Total             |               |       |
| E2 Other lintels (including other steel lintels)                          |             |                |               | 7.9700           | 0.0840                               | 0.6695            |               |       |
| E3 Sill                                                                   |             |                |               | 7.0600           | 0.0340                               | 0.2400            |               |       |
| E4 Jamb                                                                   |             |                |               | 26.6000          | 0.0430                               | 1.1438            |               |       |
| E16 Corner (normal)                                                       |             |                |               | 17.5000          | 0.0300                               | 0.5250            |               |       |
| E18 Party wall between dwellings                                          |             |                |               | 9.5000           | 0.0400                               | 0.3800            |               |       |
| E7 Party floor between dwellings (in blocks of flats)                     |             |                |               | 20.1000          | 0.0660                               | 1.3266            |               |       |
| E11 Eaves (insulation at rafter level)                                    |             |                |               | 9.6000           | 0.0130                               | 0.1248            |               |       |
| E17 Corner (inverted - internal area greater than external area)          |             |                |               | 8.0000           | 0.0150                               | 0.1200            |               |       |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) |             |                |               | 10.7000          | 0.0000                               | 0.0000            |               |       |
| E13 Gable (insulation at rafter level)                                    |             |                |               | 16.1000          | 0.0240                               | 0.3864            |               |       |
| E6 Intermediate floor within a dwelling                                   |             |                |               | 22.2000          | 0.0800                               | 1.7760            |               |       |
| P5 Party wall - Roof (insulation at rafter level)                         |             |                |               | 6.4000           | 0.2400                               | 1.5360            |               |       |
| P2 Party wall - Intermediate floor within a dwelling                      |             |                |               | 4.0000           | 0.0000                               | 0.0000            |               |       |
| R4 Ridge (vaulted ceiling)                                                |             |                |               | 11.1000          | 0.1200                               | 1.3320            |               |       |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                |             |                |               |                  |                                      |                   | 9.5601        | (36)  |
| Point Thermal bridges                                                     |             |                |               |                  |                                      | (36a) =           | 0.0000        |       |
| Total fabric heat loss                                                    |             |                |               |                  | (33) + (36) + (36a) =                |                   | 42.9130       | (37)  |

|                                                                     |         |         |         |         |         |         |         |         |         |         |         |              |
|---------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) |         |         |         |         |         |         |         |         |         |         |         |              |
| (38)m                                                               | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| Heat transfer coeff                                                 | 41.9176 | 41.6958 | 41.4785 | 40.4577 | 40.2667 | 39.3777 | 39.3777 | 39.2130 | 39.7201 | 40.2667 | 40.6531 | 41.0570 (38) |
| Average = Sum(39)m / 12 =                                           | 84.8306 | 84.6088 | 84.3915 | 83.3707 | 83.1797 | 82.2907 | 82.2907 | 82.1260 | 82.6331 | 83.1797 | 83.5661 | 83.9700 (39) |
|                                                                     |         |         |         |         |         |         |         |         |         |         |         | 83.3698      |
| HLP                                                                 | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| HLP (average)                                                       | 1.1402  | 1.1372  | 1.1343  | 1.1206  | 1.1180  | 1.1061  | 1.1061  | 1.1038  | 1.1107  | 1.1180  | 1.1232  | 1.1286 (40)  |
| Days in mont                                                        | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31           |

## 4. Water heating energy requirements (kWh/year)

|                                          |          |         |         |         |         |         |         |         |         |         |         |          |              |
|------------------------------------------|----------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------|--------------|
| Assumed occupancy                        |          |         |         |         |         |         |         |         |         |         |         |          | 2.3480 (42)  |
| Hot water usage for mixer showers        | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | (42a)        |
| Hot water usage for baths                | 27.4684  | 27.0605 | 26.4860 | 25.4268 | 24.6337 | 23.7542 | 23.2792 | 23.8496 | 24.4707 | 25.4118 | 26.4928 | 27.3756  | (42b)        |
| Hot water usage for other uses           | 38.6763  | 37.2699 | 35.8635 | 34.4571 | 33.0507 | 31.6443 | 31.6443 | 33.0507 | 34.4571 | 35.8635 | 37.2699 | 38.6763  | (42c)        |
| Average daily hot water use (litres/day) |          |         |         |         |         |         |         |         |         |         |         |          | 60.6278 (43) |
| Daily hot water use                      | Jan      | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec      |              |
| Energy conte                             | 66.1447  | 64.3304 | 62.3495 | 59.8839 | 57.6843 | 55.3985 | 54.9234 | 56.9003 | 58.9278 | 61.2753 | 63.7627 | 66.0519  | (44)         |
|                                          | 104.7571 | 91.6056 | 95.8289 | 81.9780 | 77.6542 | 68.1189 | 66.4251 | 70.4544 | 72.6639 | 83.1500 | 90.8417 | 103.4213 | (45)         |

# Full SAP Calculation Printout



|                                                                                         |                              |  |  |  |  |  |  |  |  |  |
|-----------------------------------------------------------------------------------------|------------------------------|--|--|--|--|--|--|--|--|--|
| Energy content (annual)                                                                 | Total = Sum(45)m = 1006.8990 |  |  |  |  |  |  |  |  |  |
| Distribution loss (46)m = 0.15 x (45)m                                                  |                              |  |  |  |  |  |  |  |  |  |
| 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000                   |                              |  |  |  |  |  |  |  |  |  |
| Water storage loss (or HIU loss):                                                       |                              |  |  |  |  |  |  |  |  |  |
| Total storage loss                                                                      |                              |  |  |  |  |  |  |  |  |  |
| 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000                   |                              |  |  |  |  |  |  |  |  |  |
| If cylinder contains dedicated solar storage                                            |                              |  |  |  |  |  |  |  |  |  |
| 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000                   |                              |  |  |  |  |  |  |  |  |  |
| Primary loss                                                                            |                              |  |  |  |  |  |  |  |  |  |
| 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000                   |                              |  |  |  |  |  |  |  |  |  |
| Combi loss                                                                              |                              |  |  |  |  |  |  |  |  |  |
| 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000                   |                              |  |  |  |  |  |  |  |  |  |
| Total heat required for water heating calculated for each month                         |                              |  |  |  |  |  |  |  |  |  |
| 89.0435 77.8648 81.4545 69.6813 66.0061 57.9010 56.4613 59.8863 61.7643 70.6775 77.2154 |                              |  |  |  |  |  |  |  |  |  |
| WWHRS                                                                                   |                              |  |  |  |  |  |  |  |  |  |
| 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000                   |                              |  |  |  |  |  |  |  |  |  |
| PV diverter                                                                             |                              |  |  |  |  |  |  |  |  |  |
| 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000                   |                              |  |  |  |  |  |  |  |  |  |
| Solar input                                                                             |                              |  |  |  |  |  |  |  |  |  |
| 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000                   |                              |  |  |  |  |  |  |  |  |  |
| FGHRS                                                                                   |                              |  |  |  |  |  |  |  |  |  |
| 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000                   |                              |  |  |  |  |  |  |  |  |  |
| Output from w/h                                                                         |                              |  |  |  |  |  |  |  |  |  |
| 89.0435 77.8648 81.4545 69.6813 66.0061 57.9010 56.4613 59.8863 61.7643 70.6775 77.2154 |                              |  |  |  |  |  |  |  |  |  |
| 12Total per year (kWh/year)                                                             |                              |  |  |  |  |  |  |  |  |  |
| Electric shower(s)                                                                      |                              |  |  |  |  |  |  |  |  |  |
| 50.9239 45.3736 49.5463 47.2814 48.1686 45.9482 47.4798 48.1686 47.2814 49.5463 48.6146 |                              |  |  |  |  |  |  |  |  |  |
| Heat gains from water heating, kWh/month                                                |                              |  |  |  |  |  |  |  |  |  |
| 34.9919 30.8096 32.7502 29.2407 28.5437 25.9623 25.9853 27.0137 27.2614 30.0559 31.4575 |                              |  |  |  |  |  |  |  |  |  |

## 5. Internal gains (see Table 5 and 5a)

| Metabolic gains (Table 5), Watts                                                    |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
|                                                                                     | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
| (66)m                                                                               | 117.4022 | 117.4022 | 117.4022 | 117.4022 | 117.4022 | 117.4022 | 117.4022 | 117.4022 | 117.4022 | 117.4022 | 117.4022 | 117.4022 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 113.4015 | 125.5517 | 113.4015 | 117.1815 | 113.4015 | 117.1815 | 113.4015 | 113.4015 | 117.1815 | 113.4015 | 117.1815 | 113.4015 (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 207.3413 | 209.4929 | 204.0710 | 192.5286 | 177.9583 | 164.2642 | 155.1158 | 152.9642 | 158.3861 | 169.9285 | 184.4988 | 198.1929 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 34.7402  | 34.7402  | 34.7402  | 34.7402  | 34.7402  | 34.7402  | 34.7402  | 34.7402  | 34.7402  | 34.7402  | 34.7402  | 34.7402 (69)  |
| Pumps, fans                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (70)   |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 (71) |
| Water heating gains (Table 5)                                                       | 47.0321  | 45.8476  | 44.0191  | 40.6121  | 38.3651  | 36.0588  | 34.9265  | 36.3088  | 37.8631  | 40.3978  | 43.6910  | 46.6505 (72)  |
| Total internal gains                                                                | 425.9955 | 439.1128 | 419.7123 | 408.5428 | 387.9456 | 375.7252 | 361.6644 | 360.8951 | 371.6514 | 381.9485 | 403.5920 | 416.4656 (73) |

## 6. Solar gains

| [Jan]       |          |          |          |          |            |           |               |               |          |          |               |
|-------------|----------|----------|----------|----------|------------|-----------|---------------|---------------|----------|----------|---------------|
|             |          |          |          | Area     | Solar flux | g         | FF            |               |          | Access   | Gains         |
|             |          |          |          | m2       | Table 6a   | W/m2      | Specific data | Specific data |          | factor   | W             |
|             |          |          |          |          |            |           | or Table 6b   | or Table 6c   |          | Table 6d |               |
| East        |          |          |          | 4.9600   | 19.6403    |           | 0.7600        | 0.0000        |          | 0.7700   | 57.0077 (76)  |
| West        |          |          |          | 4.9600   | 19.6403    |           | 0.7600        | 0.0000        |          | 0.7700   | 57.0077 (80)  |
|             |          |          |          |          |            |           |               |               |          |          |               |
| Solar gains | 114.0153 | 223.0382 | 367.3122 | 535.7029 | 656.5240   | 672.0691  | 639.8372      | 549.6107      | 427.1992 | 264.6536 | 142.1637      |
| Total gains | 540.0109 | 662.1510 | 787.0244 | 944.2457 | 1044.4695  | 1047.7943 | 1001.5016     | 910.5058      | 798.8506 | 646.6021 | 545.7558      |
|             |          |          |          |          |            |           |               |               |          |          | 93.7607 (83)  |
|             |          |          |          |          |            |           |               |               |          |          | 510.2262 (84) |

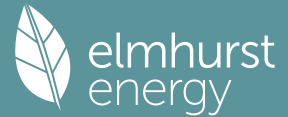
## 7. Mean internal temperature (heating season)

|                                                                             |                                       |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |                                       |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |                                       |         |         |         |         |         |         |         |         |         |         |              |
|                                                                             | Jan                                   | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 21.3022                               | 21.3580 | 21.4130 | 21.6752 | 21.7249 | 21.9597 | 21.9597 | 22.0037 | 21.8687 | 21.7249 | 21.6245 | 21.5205      |
| alpha                                                                       | 2.4201                                | 2.4239  | 2.4275  | 2.4450  | 2.4483  | 2.4640  | 2.4640  | 2.4669  | 2.4579  | 2.4483  | 2.4416  | 2.4347       |
| util living area                                                            | 0.9377                                | 0.9023  | 0.8432  | 0.7328  | 0.5978  | 0.4521  | 0.3421  | 0.3858  | 0.5842  | 0.8045  | 0.9094  | 0.9447 (86)  |
| MIT                                                                         | 18.2911                               | 18.7217 | 19.3297 | 20.0501 | 20.5524 | 20.8403 | 20.9415 | 20.9201 | 20.6886 | 19.9651 | 19.0076 | 18.2242 (87) |
| Th 2                                                                        | 19.9681                               | 19.9706 | 19.9729 | 19.9841 | 19.9862 | 19.9959 | 19.9959 | 19.9977 | 19.9921 | 19.9862 | 19.9819 | 19.9775 (88) |
| util rest of house                                                          | 0.9296                                | 0.8902  | 0.8242  | 0.7020  | 0.5534  | 0.3927  | 0.2703  | 0.3106  | 0.5235  | 0.7734  | 0.8961  | 0.9374 (89)  |
| MIT 2                                                                       | 17.5068                               | 17.9278 | 18.5164 | 19.2010 | 19.6523 | 19.8979 | 19.9694 | 19.9594 | 19.7854 | 19.1440 | 18.2225 | 17.4473 (90) |
| Living area fraction                                                        | fLA = Living area / (4) = 0.3347 (91) |         |         |         |         |         |         |         |         |         |         |              |
| MIT                                                                         | 17.7693                               | 18.1935 | 18.7886 | 19.4852 | 19.9535 | 20.2133 | 20.2947 | 20.2809 | 20.0877 | 19.4188 | 18.4853 | 17.7073 (92) |
| Temperature adjustment                                                      | 0.0000                                |         |         |         |         |         |         |         |         |         |         |              |
| adjusted MIT                                                                | 17.7693                               | 18.1935 | 18.7886 | 19.4852 | 19.9535 | 20.2133 | 20.2947 | 20.2809 | 20.0877 | 19.4188 | 18.4853 | 17.7073 (93) |

## 8. Space heating requirement

|                                                                                     |           |           |           |          |          |          |          |          |          |          |          |           |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|
| Utilisation                                                                         | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec       |
| 0.9068 0.8640 0.7982 0.6854 0.5519 0.4060 0.2922 0.3325 0.5296 0.7533 0.8712 0.9159 |           |           |           |          |          |          |          |          |          |          |          |           |
| Useful gains                                                                        | 489.7060  | 572.0663  | 628.2071  | 647.1444 | 576.3995 | 425.4567 | 292.6346 | 302.7569 | 423.0851 | 487.0786 | 475.4755 | 467.3272  |
| Ext temp.                                                                           | 4.3000    | 4.9000    | 6.5000    | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000  | 7.1000   | 4.2000    |
| Heat loss rate W                                                                    | 1142.6060 | 1124.7454 | 1037.0521 | 882.4933 | 686.5257 | 461.9202 | 304.0425 | 318.7260 | 494.7795 | 733.5460 | 951.4237 | 1134.2100 |
| Space heating kWh                                                                   | 485.7576  | 371.4003  | 304.1807  | 169.4512 | 81.9339  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 183.3718 | 342.6827 | 496.1608  |
| Space heating requirement - total per year (kWh/year)                               |           |           |           |          |          |          |          |          |          |          |          |           |
| Solar heating kWh                                                                   | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    |
| Solar heating contribution - total per year (kWh/year)                              |           |           |           |          |          |          |          |          |          |          |          |           |
| Space heating kWh                                                                   | 485.7576  | 371.4003  | 304.1807  | 169.4512 | 81.9339  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 183.3718 | 342.6827 | 496.1608  |
| Space heating requirement after solar contribution - total per year (kWh/year)      |           |           |           |          |          |          |          |          |          |          |          |           |
| Space heating per m2                                                                |           |           |           |          |          |          |          |          |          |          |          |           |
|                                                                                     |           |           |           |          |          |          |          |          |          |          |          |           |

# Full SAP Calculation Printout



## 8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

|                                  | Jan    | Feb    | Mar    | Apr    | May     | Jun       | Jul       | Aug       | Sep     | Oct     | Nov    | Dec            |
|----------------------------------|--------|--------|--------|--------|---------|-----------|-----------|-----------|---------|---------|--------|----------------|
| Ext. temp.                       | 4.3000 | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000   | 16.6000   | 16.4000   | 14.1000 | 10.6000 | 7.1000 | 4.2000         |
| Heat loss rate W                 |        |        |        |        |         |           |           |           |         |         |        |                |
| Utilisation                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 773.5323  | 608.9510  | 624.1578  | 0.0000  | 0.0000  | 0.0000 | 0.0000 (100)   |
| Useful loss                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.8406    | 0.8849    | 0.8586    | 0.0000  | 0.0000  | 0.0000 | 0.0000 (101)   |
| Total gains                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 650.2144  | 538.8808  | 535.8884  | 0.0000  | 0.0000  | 0.0000 | 0.0000 (102)   |
| Space cooling kWh                | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 1175.0839 | 1123.4227 | 1019.3488 | 0.0000  | 0.0000  | 0.0000 | 0.0000 (103)   |
| Cooled fraction                  | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 377.9061  | 434.8992  | 359.6945  | 0.0000  | 0.0000  | 0.0000 | 0.0000 (104)   |
| Intermittency factor (Table 10b) | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500  | 0.2500    | 0.2500    | 0.2500    | 0.2500  | 0.2500  | 0.2500 | 0.2500 (105)   |
| Space cooling kWh                | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 94.4765   | 108.7248  | 89.9236   | 0.0000  | 0.0000  | 0.0000 | 0.0000 (107)   |
| Space cooling requirement        |        |        |        |        |         |           |           |           |         |         |        | 293.1249 (107) |
| Energy for space heating         |        |        |        |        |         |           |           |           |         |         |        | 32.7277 (99)   |
| Energy for space cooling         |        |        |        |        |         |           |           |           |         |         |        | 3.9399 (108)   |
| Total                            |        |        |        |        |         |           |           |           |         |         |        | 36.6675 (109)  |
| Fabric Energy Efficiency (DFEE)  |        |        |        |        |         |           |           |           |         |         |        | 36.7 (109)     |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)              | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|-----------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                   |                             |
| Ground floor                                           | 45.3000 (1b)              | x 2.7500 (2b)                     | = 124.5750 (1b) - (3b)      |
| First floor                                            | 29.1000 (1c)              | x 3.2600 (2c)                     | = 94.8660 (1c) - (3c)       |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 74.4000                   |                                   | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 219.4410 (5)                |

## 2. Ventilation rate

|                                                                                                    | m <sup>3</sup> per hour                 |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 3 * 10 = 30.0000 (7a)                   |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 30.0000 / (5) = 0.1367 (8)              |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 5.0000 (17)                             |
| Infiltration rate                                                                                  | 0.3867 (18)                             |
| Number of sides sheltered                                                                          | 1 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.9250 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.3577 (21)        |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate                                                                                         | 0.4561 | 0.4471 | 0.4382 | 0.3935 | 0.3845 | 0.3398 | 0.3398 | 0.3309 | 0.3577 | 0.3845 | 0.4024 | 0.4203 (22b) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.0000 (23b) |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =            |        |        |        |        |        |        |        |        |        |        |        | 0.0000 (23c) |
| Effective ac                                                                                            | 0.6040 | 0.6000 | 0.5960 | 0.5774 | 0.5739 | 0.5577 | 0.5577 | 0.5547 | 0.5640 | 0.5739 | 0.5810 | 0.5883 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                                        | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K |
|----------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|---------------|
| Main dwelling                                                  |                         |                            |                           |                               |              |                                |               |
| TER Opening Type                                               |                         |                            | 9.9200                    | 1.1450                        | 11.3588      |                                | (27)          |
| External Wall                                                  | 74.1300                 | 8.9200                     | 65.2100                   | 0.1800                        | 11.7378      |                                | (29a)         |
| RIR Stud Wall                                                  | 25.3800                 |                            | 25.3800                   | 0.1800                        | 4.5684       |                                | (29a)         |
| Dormer Walls                                                   | 6.6000                  | 1.0000                     | 5.6000                    | 0.1800                        | 1.0080       |                                | (29a)         |
| Adj To RIR Ins At Slope                                        | 16.0500                 |                            | 16.0500                   | 0.1100                        | 1.7655       |                                | (30)          |
| Slope Roof                                                     | 37.9900                 |                            | 37.9900                   | 0.1100                        | 4.1789       |                                | (30)          |
| Total net area of external elements Aum(A, m <sup>2</sup> )    |                         |                            | 160.1500                  |                               |              |                                | (31)          |
| Fabric heat loss, W/K = Sum (A x U)                            |                         |                            | (26)...(30) + (32) =      |                               | 34.6174      |                                | (33)          |
| Main dwelling                                                  |                         |                            |                           |                               |              |                                |               |
| Party Wall 1                                                   |                         |                            | 44.2300                   | 0.0000                        | 0.0000       |                                | (32)          |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K |                         |                            |                           |                               |              |                                | 87.4391 (35)  |
| List of Thermal Bridges                                        |                         |                            |                           |                               |              |                                |               |
| K1 Element                                                     |                         |                            |                           | Length                        | Psi-value    |                                | Total         |
| E2 Other lintels (including other steel lintels)               |                         |                            |                           | 7.9700                        | 0.0500       |                                | 0.3985        |
| E3 Sill                                                        |                         |                            |                           | 7.0600                        | 0.0500       |                                | 0.3530        |

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## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)

21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

|                        | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
|------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| tau                    | 20.9292 | 21.0004 | 21.0706 | 21.4067 | 21.4707 | 21.7741 | 21.7741 | 21.8312 | 21.6562 | 21.4707 | 21.3415 | 21.2081      |
| alpha                  | 2.3953  | 2.4000  | 2.4047  | 2.4271  | 2.4314  | 2.4516  | 2.4516  | 2.4554  | 2.4437  | 2.4314  | 2.4228  | 2.4139       |
| util living area       | 0.9498  | 0.9300  | 0.8987  | 0.8313  | 0.7325  | 0.5929  | 0.4673  | 0.5095  | 0.6980  | 0.8625  | 0.9299  | 0.9542 (86)  |
| MIT                    | 18.1036 | 18.4308 | 18.9446 | 19.6602 | 20.2612 | 20.6989 | 20.8797 | 20.8478 | 20.5187 | 19.7259 | 18.8181 | 18.0673 (87) |
| Th 2                   | 19.9517 | 19.9549 | 19.9580 | 19.9727 | 19.9754 | 19.9882 | 19.9882 | 19.9906 | 19.9833 | 19.9754 | 19.9698 | 19.9640 (88) |
| util rest of house     | 0.9431  | 0.9207  | 0.8847  | 0.8069  | 0.6913  | 0.5268  | 0.3768  | 0.4194  | 0.6389  | 0.8373  | 0.9190  | 0.9480 (89)  |
| MIT 2                  | 17.3129 | 17.6363 | 18.1418 | 18.8415 | 19.4043 | 19.7949 | 19.9311 | 19.9140 | 19.6509 | 18.9198 | 18.0322 | 17.2850 (90) |
| Living area fraction   | 17.5776 | 17.9022 | 18.4105 | 19.1155 | 19.6911 | 20.0974 | 20.2486 | 20.2265 | 19.9413 | 19.1896 | 18.2952 | 17.5468 (91) |
| MIT                    | 17.5776 | 17.9022 | 18.4105 | 19.1155 | 19.6911 | 20.0974 | 20.2486 | 20.2265 | 19.9413 | 19.1896 | 18.2952 | 17.5468 (92) |
| Temperature adjustment |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT           | 17.5776 | 17.9022 | 18.4105 | 19.1155 | 19.6911 | 20.0974 | 20.2486 | 20.2265 | 19.9413 | 19.1896 | 18.2952 | 17.5468 (93) |

## 8. Space heating requirement

|                                                                                | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov      | Dec            |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|---------------|----------|----------------|
| Utilisation                                                                    | 0.9222    | 0.8966    | 0.8585    | 0.7830   | 0.6786   | 0.5345   | 0.4013   | 0.4418   | 0.6362   | 0.8139        | 0.8957   | 0.9282 (94)    |
| Useful gains                                                                   | 447.7437  | 498.1494  | 524.9733  | 538.9544 | 495.9323 | 388.3965 | 279.2236 | 286.2383 | 378.3984 | 423.3377      | 427.9833 | 432.0310 (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000   | 4.2000 (96)    |
| Heat loss rate W                                                               | 1146.4125 | 1118.8317 | 1021.4780 | 862.3573 | 672.5677 | 456.2437 | 302.8031 | 316.7393 | 487.4203 | 722.9412      | 947.9450 | 1137.2434 (97) |
| Space heating kWh                                                              | 519.8096  | 417.0985  | 369.3995  | 232.8501 | 131.4167 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 222.9050      | 374.3724 | 524.6780 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |          |          |          |          |          |          |               |          | 2792.5297      |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000   | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |          |          |          |          |          |          |               |          | 0.0000         |
| Space heating kWh                                                              | 519.8096  | 417.0985  | 369.3995  | 232.8501 | 131.4167 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 222.9050      | 374.3724 | 524.6780 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |               |          | 2792.5297      |
| Space heating per m2                                                           |           |           |           |          |          |          |          |          |          | (98c) / (4) = |          | 37.5340 (99)   |

## 8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

|                                  | Jan    | Feb    | Mar    | Apr    | May     | Jun      | Jul      | Aug      | Sep                      | Oct     | Nov    | Dec            |
|----------------------------------|--------|--------|--------|--------|---------|----------|----------|----------|--------------------------|---------|--------|----------------|
| Ext. temp.                       | 4.3000 | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000  | 16.6000  | 16.4000  | 14.1000                  | 10.6000 | 7.1000 | 4.2000         |
| Heat loss rate W                 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 780.1237 | 614.1400 | 629.0878 | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (100)   |
| Utilisation                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.7191   | 0.7839   | 0.7533   | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (101)   |
| Useful loss                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 560.9595 | 481.4232 | 473.9151 | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (102)   |
| Total gains                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 799.7841 | 766.1219 | 712.4327 | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (103)   |
| Space cooling kWh                | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 171.9537 | 211.8159 | 177.4571 | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (104)   |
| Cooled fraction                  |        |        |        |        |         |          |          |          | fc = cooled area / (4) = |         |        | 1.0000 (105)   |
| Intermittency factor (Table 10b) | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500  | 0.2500   | 0.2500   | 0.2500   | 0.2500                   | 0.2500  | 0.2500 | 0.2500 (106)   |
| Space cooling kWh                | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 42.9884  | 52.9540  | 44.3643  | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (107)   |
| Space cooling requirement        |        |        |        |        |         |          |          |          |                          |         |        | 140.3067 (107) |
| Energy for space heating         |        |        |        |        |         |          |          |          |                          |         |        | 37.5340 (99)   |
| Energy for space cooling         |        |        |        |        |         |          |          |          |                          |         |        | 1.8858 (108)   |
| Total                            |        |        |        |        |         |          |          |          |                          |         |        | 39.4198 (109)  |
| Fabric Energy Efficiency (TFEE)  |        |        |        |        |         |          |          |          |                          |         |        | 39.4 (109)     |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF ENERGY RATING

## 1. Overall dwelling characteristics

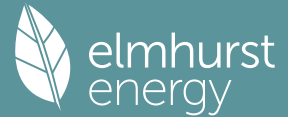
|                                                        | Area (m2)    | Storey height (m)                 | Volume (m3)            |
|--------------------------------------------------------|--------------|-----------------------------------|------------------------|
| Main dwelling                                          |              |                                   |                        |
| Ground floor                                           | 45.3000 (1b) | x 2.7500 (2b)                     | = 124.5750 (1b) - (3b) |
| First floor                                            | 29.1000 (1c) | x 3.2600 (2c)                     | = 94.8660 (1c) - (3c)  |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 74.4000      |                                   | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 219.4410 (5)           |

## 2. Ventilation rate

m3 per hour

|                                                    |          |             |
|----------------------------------------------------|----------|-------------|
| Number of open chimneys                            | 0 * 80 = | 0.0000 (6a) |
| Number of open flues                               | 0 * 20 = | 0.0000 (6b) |
| Number of chimneys / flues attached to closed fire | 0 * 10 = | 0.0000 (6c) |
| Number of flues attached to solid fuel boiler      | 0 * 20 = | 0.0000 (6d) |
| Number of flues attached to other heater           | 0 * 35 = | 0.0000 (6e) |
| Number of blocked chimneys                         | 0 * 20 = | 0.0000 (6f) |
| Number of intermittent extract fans                | 0 * 10 = | 0.0000 (7a) |
| Number of passive vents                            | 0 * 10 = | 0.0000 (7b) |

# Full SAP Calculation Printout



Number of flueless gas fires 0 \* 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = Air changes per hour  
0.0000 / (5) = 0.0000 (8)  
Pressure test Yes  
Pressure Test Method Blower Door  
Measured/design AP50 4.0000 (17)  
Infiltration rate 0.2000 (18)  
Number of sides sheltered 1 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.9250 (20)  
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1850 (21)

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |       |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 | (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 | (22a) |
| Adj infilt rate                                                                                         | 0.2359 | 0.2313 | 0.2266 | 0.2035 | 0.1989 | 0.1758 | 0.1758 | 0.1711 | 0.1850 | 0.1989 | 0.2081 | 0.2174 | (22b) |
| Mechanical extract ventilation - centralised                                                            |        |        |        |        |        |        |        |        |        |        |        |        |       |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 | (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.5000 | (23b) |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | (25)  |

## 3. Heat losses and heat loss parameter

| Element                                        | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K     | A x U<br>W/K | K-value<br>kJ/m2K | A x K<br>kJ/K |       |
|------------------------------------------------|-------------|----------------|---------------|----------------------|--------------|-------------------|---------------|-------|
| Main dwelling                                  |             |                |               |                      |              |                   |               |       |
| Windows / Glazed Doors                         |             |                | 9.9200        | 1.1450               | 11.3588      |                   |               | (27)  |
| External Wall                                  | 74.1300     | 8.9200         | 65.2100       | 0.1500               | 9.7815       | 9.0000            | 586.8900      | (29a) |
| RIR Stud Wall                                  | 25.3800     |                | 25.3800       | 0.1500               | 3.8070       | 9.0000            | 228.4200      | (29a) |
| Dormer Walls                                   | 6.6000      | 1.0000         | 5.6000        | 0.1500               | 0.8400       | 9.0000            | 50.4000       | (29a) |
| Adj To RIR Ins At Slope                        | 16.0500     |                | 16.0500       | 0.1400               | 2.2470       | 9.0000            | 144.4500      | (30)  |
| Slope Roof                                     | 37.9900     |                | 37.9900       | 0.1400               | 5.3186       | 9.0000            | 341.9100      | (30)  |
| Total net area of external elements Aum(A, m2) |             |                | 160.1500      |                      |              |                   |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)            |             |                |               | (26)...(30) + (32) = | 33.3529      |                   |               | (33)  |
| Main dwelling                                  |             |                |               |                      |              |                   |               |       |
| Party Wall 1                                   |             |                | 44.2300       | 0.0000               | 0.0000       | 45.0000           | 1990.3500     | (32)  |
| Party Floor 1                                  |             |                | 45.3000       |                      |              | 30.0000           | 1359.0000     | (32d) |
| Internal Wall 1                                |             |                | 113.1500      |                      |              | 9.0000            | 1018.3500     | (32c) |
| Internal Floor 1                               |             |                | 29.1000       |                      |              | 18.0000           | 523.8000      | (32d) |
| Internal Ceiling 1                             |             |                | 29.1000       |                      |              | 9.0000            | 261.9000      | (32e) |

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 6505.4700 (34)  
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 87.4391 (35)

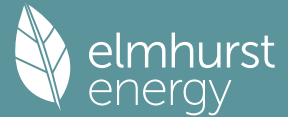
| List of Thermal Bridges                                                   | Length  | Psi-value | Total                 |              |
|---------------------------------------------------------------------------|---------|-----------|-----------------------|--------------|
| K1 Element                                                                | 7.9700  | 0.0840    | 0.6695                |              |
| E2 Other lintels (including other steel lintels)                          | 7.0600  | 0.0340    | 0.2400                |              |
| E3 Sill                                                                   | 26.6000 | 0.0430    | 1.1438                |              |
| E4 Jamb                                                                   | 17.5000 | 0.0300    | 0.5250                |              |
| E16 Corner (normal)                                                       | 9.5000  | 0.0400    | 0.3800                |              |
| E18 Party wall between dwellings                                          | 20.1000 | 0.0660    | 1.3266                |              |
| E7 Party floor between dwellings (in blocks of flats)                     | 9.6000  | 0.0130    | 0.1248                |              |
| E11 Eaves (insulation at rafter level)                                    | 8.0000  | 0.0150    | 0.1200                |              |
| E17 Corner (inverted - internal area greater than external area)          | 10.7000 | 0.0000    | 0.0000                |              |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | 16.1000 | 0.0240    | 0.3864                |              |
| E13 Gable (insulation at rafter level)                                    | 22.2000 | 0.0800    | 1.7760                |              |
| E6 Intermediate floor within a dwelling                                   | 6.4000  | 0.2400    | 1.5360                |              |
| P5 Party wall - Roof (insulation at rafter level)                         | 4.0000  | 0.0000    | 0.0000                |              |
| P2 Party wall - Intermediate floor within a dwelling                      | 11.1000 | 0.1200    | 1.3320                |              |
| R4 Ridge (vaulted ceiling)                                                |         |           |                       | 9.5601 (36)  |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                |         |           |                       | 0.0000       |
| Point Thermal Bridges                                                     |         |           | (36a) =               |              |
| Total fabric heat loss                                                    |         |           | (33) + (36) + (36a) = | 42.9130 (37) |

|                                                                     |         |         |         |         |         |         |         |         |         |         |         |         |      |
|---------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) |         |         |         |         |         |         |         |         |         |         |         |         |      |
| (38)m                                                               | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |      |
| Heat transfer coeff                                                 | 36.2078 | 36.2078 | 36.2078 | 36.2078 | 36.2078 | 36.2078 | 36.2078 | 36.2078 | 36.2078 | 36.2078 | 36.2078 | 36.2078 | (38) |
| Average = Sum(39)m / 12 =                                           | 79.1208 | 79.1208 | 79.1208 | 79.1208 | 79.1208 | 79.1208 | 79.1208 | 79.1208 | 79.1208 | 79.1208 | 79.1208 | 79.1208 | (39) |
| HLP                                                                 | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |      |
| HLP (average)                                                       | 1.0635  | 1.0635  | 1.0635  | 1.0635  | 1.0635  | 1.0635  | 1.0635  | 1.0635  | 1.0635  | 1.0635  | 1.0635  | 1.0635  | (40) |
| Days in mont                                                        | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31      |      |

## 4. Water heating energy requirements (kWh/year)

|                                                             |          |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Assumed occupancy                                           |          |          |          |          |          |          |          |          |          |          |          |          | 2.3480 (42)   |
| Hot water usage for mixer showers                           | 87.4344  | 86.1204  | 84.2057  | 80.5423  | 77.8387  | 74.8238  | 73.1101  | 75.0103  | 77.0933  | 80.3304  | 84.0726  | 87.0994  | (42a)         |
| Hot water usage for baths                                   | 27.4684  | 27.0605  | 26.4860  | 25.4268  | 24.6337  | 23.7542  | 23.2792  | 23.8496  | 24.4707  | 25.4118  | 26.4928  | 27.3756  | (42b)         |
| Hot water usage for other uses                              | 38.6763  | 37.2699  | 35.8635  | 34.4571  | 33.0507  | 31.6443  | 31.6443  | 33.0507  | 34.4571  | 35.8635  | 37.2699  | 38.6763  | (42c)         |
| Average daily hot water use (litres/day)                    |          |          |          |          |          |          |          |          |          |          |          |          | 141.2394 (43) |
| Daily hot water use                                         | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |               |
| Energy conte                                                | 153.5791 | 150.4508 | 146.5552 | 140.4261 | 135.5230 | 130.2222 | 128.0335 | 131.9106 | 136.0211 | 141.6057 | 147.8353 | 153.1513 | (44)          |
| Energy content (annual)                                     | 243.2318 | 214.2399 | 225.2499 | 192.2364 | 182.4401 | 160.1234 | 154.8454 | 163.3328 | 167.7276 | 192.1576 | 210.6185 | 239.7979 | (45)          |
| Distribution loss (46)m = 0.15 x (45)m                      |          |          |          |          |          |          |          |          |          |          |          |          |               |
| Water storage loss (or HIU loss):                           | 36.4848  | 32.1360  | 33.7875  | 28.8355  | 27.3660  | 24.0185  | 23.2268  | 24.4999  | 25.1591  | 28.8236  | 31.5928  | 35.9697  | (46)          |
| Store volume                                                |          |          |          |          |          |          |          |          |          |          |          |          | 196.0000 (47) |
| a) If manufacturer declared loss factor is known (kWh/day): |          |          |          |          |          |          |          |          |          |          |          |          | 1.3120 (48)   |
| Temperature factor from Table 2b                            |          |          |          |          |          |          |          |          |          |          |          |          | 0.5400 (49)   |
| Enter (49) or (54) in (55)                                  |          |          |          |          |          |          |          |          |          |          |          |          | 0.7085 (55)   |
| Total storage loss                                          | 21.9629  | 19.8374  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  | (56)          |
| If cylinder contains dedicated solar storage                |          |          |          |          |          |          |          |          |          |          |          |          |               |

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|                                                                 |          |          |          |          |          |          |          |          |          |          |          |          |       |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-------|
| Primary loss                                                    | 21.9629  | 19.8374  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  | (57)  |
| Combi loss                                                      | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (59)  |
| Total heat required for water heating calculated for each month | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (61)  |
| WWHRS                                                           | 265.1947 | 234.0774 | 247.2128 | 213.4908 | 204.4030 | 181.3778 | 176.8083 | 185.2957 | 188.9820 | 214.1205 | 231.8729 | 261.7608 | (62)  |
| PV diverter                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (63a) |
| Solar input                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (63b) |
| FGHRS                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (63c) |
| Output from w/h                                                 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (63d) |
|                                                                 | 265.1947 | 234.0774 | 247.2128 | 213.4908 | 204.4030 | 181.3778 | 176.8083 | 185.2957 | 188.9820 | 214.1205 | 231.8729 | 261.7608 | (64)  |
| Electric shower(s)                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (64a) |
| Heat gains from water heating, kWh/month                        | 80.8746  | 71.2348  | 74.8956  | 63.9186  | 60.6613  | 53.2410  | 51.4861  | 54.3082  | 55.7694  | 63.8924  | 70.0306  | 79.7328  | (65)  |

## 5. Internal gains (see Table 5 and 5a)

| Metabolic gains (Table 5), Watts                                                    | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |      |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| (66)m                                                                               | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 31.7957  | 28.2406  | 22.9668  | 17.3874  | 12.9973  | 10.9728  | 11.8565  | 15.4116  | 20.6854  | 26.2649  | 30.6550  | 32.6794  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 309.4646 | 312.6759 | 304.5836 | 287.3560 | 265.6093 | 245.1705 | 231.5161 | 228.3048 | 236.3971 | 253.6247 | 275.3714 | 295.8102 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | (69) |
| Pumps, fans                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | (71) |
| Water heating gains (Table 5)                                                       | 108.7024 | 106.0041 | 100.6661 | 88.7758  | 81.5340  | 73.9459  | 69.2017  | 72.9948  | 77.4575  | 85.8769  | 97.2648  | 107.1677 | (72) |
| Total internal gains                                                                | 548.3599 | 545.3179 | 526.6138 | 491.9164 | 458.5378 | 428.4864 | 410.9716 | 415.1084 | 432.9372 | 464.1636 | 501.6883 | 534.0546 | (73) |

## 6. Solar gains

| [Jan]       |          |          |          |           | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c |          |          | Access<br>factor<br>Table 6d |  |  | Gains<br>W    |
|-------------|----------|----------|----------|-----------|------------|--------------------------------|-----------------------------------|------------------------------------|----------|----------|------------------------------|--|--|---------------|
| East        |          |          |          |           | 4.9600     | 19.6403                        | 0.7600                            | 0.0000                             |          |          | 0.7700                       |  |  | 57.0077 (76)  |
| West        |          |          |          |           | 4.9600     | 19.6403                        | 0.7600                            | 0.0000                             |          |          | 0.7700                       |  |  | 57.0077 (80)  |
|             |          |          |          |           |            |                                |                                   |                                    |          |          |                              |  |  |               |
| Solar gains | 114.0153 | 223.0382 | 367.3122 | 535.7029  | 656.5240   | 672.0691                       | 639.8372                          | 549.6107                           | 427.1992 | 264.6536 | 142.1637                     |  |  | 93.7607 (83)  |
| Total gains | 662.3753 | 768.3561 | 893.9259 | 1027.6193 | 1115.0618  | 1100.5555                      | 1050.8088                         | 964.7191                           | 860.1365 | 728.8172 | 643.8521                     |  |  | 627.8152 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |                           |         |         |         |         |      |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|---------|---------|------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |                           |         |         |         | 21.0000 | (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |                           |         |         |         |         |      |
| tau                                                                         | 22.8395 | 22.8395 | 22.8395 | 22.8395 | 22.8395 | 22.8395 | 22.8395 | 22.8395 | 22.8395                   | 22.8395 | 22.8395 | 22.8395 |         |      |
| alpha                                                                       | 2.5226  | 2.5226  | 2.5226  | 2.5226  | 2.5226  | 2.5226  | 2.5226  | 2.5226  | 2.5226                    | 2.5226  | 2.5226  | 2.5226  |         |      |
| util living area                                                            | 0.9042  | 0.8667  | 0.7988  | 0.6903  | 0.5576  | 0.4226  | 0.3174  | 0.3565  | 0.5425                    | 0.7581  | 0.8734  | 0.9144  | (86)    |      |
| MIT                                                                         | 18.7864 | 19.1371 | 19.6725 | 20.2402 | 20.6504 | 20.8736 | 20.9551 | 20.9386 | 20.7569                   | 20.1716 | 19.3531 | 18.6859 | (87)    |      |
| Th 2                                                                        | 20.0308 | 20.0308 | 20.0308 | 20.0308 | 20.0308 | 20.0308 | 20.0308 | 20.0308 | 20.0308                   | 20.0308 | 20.0308 | 20.0308 | (88)    |      |
| util rest of house                                                          | 0.8931  | 0.8519  | 0.7773  | 0.6590  | 0.5150  | 0.3674  | 0.2520  | 0.2878  | 0.4846                    | 0.7245  | 0.8567  | 0.9043  | (89)    |      |
| MIT 2                                                                       | 17.4630 | 17.8973 | 18.5535 | 19.2307 | 19.6971 | 19.9311 | 20.0045 | 19.9929 | 19.8246                   | 19.1730 | 18.1768 | 17.3380 | (90)    |      |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         | 0.3347  | (91)    |      |
| MIT                                                                         | 17.9059 | 18.3123 | 18.9280 | 19.5685 | 20.0162 | 20.2466 | 20.3227 | 20.3094 | 20.1366                   | 19.5072 | 18.5705 | 17.7891 | (92)    |      |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000  |         |      |
| adjusted MIT                                                                | 17.9059 | 18.3123 | 18.9280 | 19.5685 | 20.0162 | 20.2466 | 20.3227 | 20.3094 | 20.1366                   | 19.5072 | 18.5705 | 17.7891 | (93)    |      |

## 8. Space heating requirement

|                                                                                | Jan       | Feb       | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec       |       |
|--------------------------------------------------------------------------------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-------|
| Utilisation                                                                    | 0.8621    | 0.8201    | 0.7494   | 0.6428   | 0.5143   | 0.3801   | 0.2721   | 0.3080   | 0.4912   | 0.7040   | 0.8258   | 0.8740    | (94)  |
| Useful gains                                                                   | 571.0179  | 630.1452  | 669.8713 | 660.5297 | 573.5214 | 418.2675 | 285.8752 | 297.1742 | 422.5250 | 513.0846 | 531.6871 | 548.6866  | (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000   | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000  | 7.1000   | 4.2000    | (96)  |
| Heat loss rate W                                                               | 1076.5084 | 1061.1888 | 983.3148 | 844.1035 | 657.9804 | 446.7596 | 294.5409 | 309.3168 | 477.6195 | 704.7467 | 907.5554 | 1075.1783 | (97)  |
| Space heating kWh                                                              | 376.0849  | 289.6613  | 233.2020 | 132.1732 | 62.8374  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 142.5966 | 270.6251 | 391.7098  | (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |          |          |          |          |          |          |          |          |          | 1898.8904 |       |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (98b) |
| Solar heating contribution - total per year (kWh/year)                         |           |           |          |          |          |          |          |          |          |          |          | 0.0000    |       |
| Space heating kWh                                                              | 376.0849  | 289.6613  | 233.2020 | 132.1732 | 62.8374  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 142.5966 | 270.6251 | 391.7098  | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |          |          |          |          |          |          |          |          |          | 1898.8904 |       |
| Space heating per m2                                                           |           |           |          |          |          |          |          |          |          |          |          | 25.5227   | (99)  |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                       |  |  |  |  |  |  |  |  |  |  |  |  |        |       |
|-----------------------------------------------------------------------|--|--|--|--|--|--|--|--|--|--|--|--|--------|-------|
| Fraction of space heat from secondary/supplementary system (Table 11) |  |  |  |  |  |  |  |  |  |  |  |  | 0.0000 | (201) |
| Fraction of space heat from main system(s)                            |  |  |  |  |  |  |  |  |  |  |  |  | 1.0000 | (202) |
| Fraction of main heating from main system 2                           |  |  |  |  |  |  |  |  |  |  |  |  | 0.0000 | (203) |
| Fraction of total heating from main system 1                          |  |  |  |  |  |  |  |  |  |  |  |  | 1.0000 | (204) |

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|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |                 |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of total heating from main system 2                                                         |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (205)    |
| Efficiency of main space heating system 1 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 100.0000 (206)  |
| Efficiency of main space heating system 2 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                              |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
|                                                                                                      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                                                            | 376.0849 | 289.6613 | 233.2020 | 132.1732 | 62.8374  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 142.5966 | 270.6251 | 391.7098 (98)   |
| Space heating efficiency (main heating system 1)                                                     | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 100.0000 | 100.0000 | 100.0000 (210)  |
| Space heating fuel (main heating system)                                                             | 376.0849 | 289.6613 | 233.2020 | 132.1732 | 62.8374  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 142.5966 | 270.6251 | 391.7098 (211)  |
| Space heating efficiency (main heating system 2)                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |
| Space heating fuel (secondary)                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Space heating fuel used, main system 2                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Water heating                                                                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| Water heating requirement                                                                            | 265.1947 | 234.0774 | 247.2128 | 213.4908 | 204.4030 | 181.3778 | 176.8083 | 185.2957 | 188.9820 | 214.1205 | 231.8729 | 261.7608 (64)   |
| Efficiency of water heater                                                                           | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 (216)  |
| Fuel for water heating, kWh/month                                                                    | 84.6172  | 74.6885  | 78.8797  | 68.1198  | 65.2201  | 57.8733  | 56.4153  | 59.1234  | 60.2996  | 68.3207  | 73.9851  | 83.5216 (219)   |
| Space cooling fuel requirement                                                                       |          |          |          |          |          |          |          |          |          |          |          |                 |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                                         | 15.0751  | 13.6162  | 15.0751  | 14.5888  | 15.0751  | 14.5888  | 15.0751  | 15.0751  | 14.5888  | 15.0751  | 14.5888  | 15.0751 (231)   |
| Lighting                                                                                             | 27.8306  | 22.3267  | 20.1027  | 14.7281  | 11.3764  | 9.2946   | 10.3780  | 13.4897  | 17.5217  | 22.9895  | 25.9666  | 28.6041 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| (233a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (233a)   |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |                 |
| (234a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |                 |
| (235a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |                 |
| (235c)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| (233b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (233b)   |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |                 |
| (234b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |                 |
| (235b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |                 |
| (235d)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 1898.8904 (211) |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 313.4050        |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          | 831.0641 (219)  |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (221)    |
| Electricity for pumps and fans:                                                                      |          |          |          |          |          |          |          |          |          |          |          |                 |
| (MEV)Centralised, Database: in-use factor = 1.3000, SFP = 0.6630)                                    |          |          |          |          |          |          |          |          |          |          |          |                 |
| mechanical ventilation fans (SFP = 0.6630)                                                           |          |          |          |          |          |          |          |          |          |          |          | 177.4970 (230a) |
| Total electricity for the above, kWh/year                                                            |          |          |          |          |          |          |          |          |          |          |          | 177.4970 (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |          |          |          |          |          |          |          |          | 224.6087 (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| PV generation                                                                                        |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (233)    |
| Wind generation                                                                                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (234)    |
| Hydro-electric generation (Appendix N)                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (235a)   |
| Electricity generated - Micro CHP (Appendix N)                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (235)    |
| Appendix Q - special features                                                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| Energy saved or generated                                                                            |          |          |          |          |          |          |          |          |          |          |          | -0.0000 (236)   |
| Energy used                                                                                          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (237)    |
| Total delivered energy for all uses                                                                  |          |          |          |          |          |          |          |          |          |          |          | 3132.0603 (238) |

## 10a. Fuel costs - using Table 12 prices

|                                             | Fuel<br>kWh/year | Fuel price<br>p/kWh | Fuel cost<br>£/year |
|---------------------------------------------|------------------|---------------------|---------------------|
| Space heating - main system 1               | 1898.8904        | 16.4900             | 313.1270 (240)      |
| Space heating - main system 2               | 0.0000           | 16.4900             | 0.0000 (241)        |
| Total CO2 associated with community systems |                  |                     | 0.0000 (473)        |
| Water heating (other fuel)                  | 831.0641         | 16.4900             | 137.0425 (247)      |
| Energy for instantaneous electric shower(s) | 0.0000           | 16.4900             | 0.0000 (247a)       |
| Pumps, fans and electric keep-hot           | 177.4970         | 16.4900             | 29.2693 (249)       |
| Energy for lighting                         | 224.6087         | 16.4900             | 37.0380 (250)       |
| Additional standing charges                 |                  |                     | 0.0000 (251)        |
| Total energy cost                           |                  |                     | 516.4767 (255)      |

## 11a. SAP rating - Individual heating systems

|                                  |                                  |              |
|----------------------------------|----------------------------------|--------------|
| Energy cost deflator (Table 12): |                                  | 0.3600 (256) |
| Energy cost factor (ECF)         | [(255) x (256)] / [(4) + 45.0] = | 1.5572 (257) |
| SAP value                        |                                  | 74.7575      |
| SAP rating (Section 12)          |                                  | 75 (258)     |
| SAP band                         |                                  | C            |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|---------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1               | 1898.8904          | 0.1552                        | 294.6291 (261)           |
| Space heating - main system 2               | 0.0000             | 0.0000                        | 0.0000 (262)             |
| Total CO2 associated with community systems |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                  | 831.0641           | 0.1413                        | 117.4242 (264)           |
| Space and water heating                     |                    |                               | 412.0533 (265)           |

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|                                              |          |        |                |
|----------------------------------------------|----------|--------|----------------|
| Pumps, fans and electric keep-hot            | 177.4970 | 0.1387 | 24.6210 (267)  |
| Energy for lighting                          | 224.6087 | 0.1443 | 32.4180 (268)  |
| Total CO <sub>2</sub> , kg/year              |          |        | 469.0923 (272) |
| CO <sub>2</sub> emissions per m <sup>2</sup> |          |        | 6.3100 (273)   |
| EI value                                     |          |        | 94.7355        |
| EI rating                                    |          |        | 95 (274)       |
| EI band                                      |          |        | A              |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                 |                             |
| Ground floor                                           | 45.3000 (1b)              | x 2.7500 (2b)                   | = 124.5750 (1b) - (3b)      |
| First floor                                            | 29.1000 (1c)              | x 3.2600 (2c)                   | = 94.8660 (1c) - (3c)       |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 74.4000                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 219.4410 (5)              |

## 2. Ventilation rate

|                                                    | m <sup>3</sup> per hour |
|----------------------------------------------------|-------------------------|
| Number of open chimneys                            | 0 * 80 = 0.0000 (6a)    |
| Number of open flues                               | 0 * 20 = 0.0000 (6b)    |
| Number of chimneys / flues attached to closed fire | 0 * 10 = 0.0000 (6c)    |
| Number of flues attached to solid fuel boiler      | 0 * 20 = 0.0000 (6d)    |
| Number of flues attached to other heater           | 0 * 35 = 0.0000 (6e)    |
| Number of blocked chimneys                         | 0 * 20 = 0.0000 (6f)    |
| Number of intermittent extract fans                | 0 * 10 = 0.0000 (7a)    |
| Number of passive vents                            | 0 * 10 = 0.0000 (7b)    |
| Number of flueless gas fires                       | 0 * 40 = 0.0000 (7c)    |

|                                                      |                                                       |                |            |
|------------------------------------------------------|-------------------------------------------------------|----------------|------------|
| Infiltration due to chimneys, flues and fans         | = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 / (5) = | 0.0000 (8) |
| Pressure test                                        |                                                       | Yes            |            |
| Pressure Test Method                                 |                                                       | Blower Door    |            |
| Measured/design AP50                                 |                                                       | 4.0000         | (17)       |
| Infiltration rate                                    |                                                       | 0.2000         | (18)       |
| Number of sides sheltered                            |                                                       | 1              | (19)       |
| Shelter factor                                       | (20) = 1 - [0.075 x (19)] =                           | 0.9250         | (20)       |
| Infiltration rate adjusted to include shelter factor | (21) = (18) x (20) =                                  | 0.1850         | (21)       |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 4.3000 | 4.1000 | 4.1000 | 3.8000 | 3.9000 | 3.4000 | 3.4000 | 3.3000 | 3.4000 | 3.8000 | 3.7000 | 4.0000 (22)  |
| Wind factor                                                                                             | 1.0750 | 1.0250 | 1.0250 | 0.9500 | 0.9750 | 0.8500 | 0.8500 | 0.8250 | 0.8500 | 0.9500 | 0.9250 | 1.0000 (22a) |
| Adj infilt rate                                                                                         | 0.1989 | 0.1896 | 0.1896 | 0.1758 | 0.1804 | 0.1573 | 0.1573 | 0.1526 | 0.1573 | 0.1758 | 0.1711 | 0.1850 (22b) |
| Mechanical extract ventilation - centralised                                                            |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

## 3. Heat losses and heat loss parameter

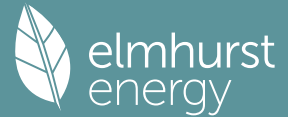
| Element                                                                  | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K   |
|--------------------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|-----------------|
| Main dwelling                                                            |                         |                            |                           |                               |              |                                |                 |
| Windows / Glazed Doors                                                   |                         |                            | 9.9200                    | 1.1450                        | 11.3588      |                                | (27)            |
| External Wall                                                            | 74.1300                 | 8.9200                     | 65.2100                   | 0.1500                        | 9.7815       | 9.0000                         | 586.8900 (29a)  |
| RIR Stud Wall                                                            | 25.3800                 |                            | 25.3800                   | 0.1500                        | 3.8070       | 9.0000                         | 228.4200 (29a)  |
| Dormer Walls                                                             | 6.6000                  | 1.0000                     | 5.6000                    | 0.1500                        | 0.8400       | 9.0000                         | 50.4000 (29a)   |
| Adj To RIR Ins At Slope                                                  | 16.0500                 |                            | 16.0500                   | 0.1400                        | 2.2470       | 9.0000                         | 144.4500 (30)   |
| Slope Roof                                                               | 37.9900                 |                            | 37.9900                   | 0.1400                        | 5.3186       | 9.0000                         | 341.9100 (30)   |
| Total net area of external elements A <sub>um</sub> (A, m <sup>2</sup> ) |                         |                            | 160.1500                  |                               |              |                                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                                      |                         |                            |                           | (26)...(30) + (32) =          | 33.3529      |                                | (33)            |
| Main dwelling                                                            |                         |                            |                           |                               |              |                                |                 |
| Party Wall 1                                                             |                         |                            | 44.2300                   | 0.0000                        | 0.0000       | 45.0000                        | 1990.3500 (32)  |
| Party Floor 1                                                            |                         |                            | 45.3000                   |                               |              | 30.0000                        | 1359.0000 (32d) |
| Internal Wall 1                                                          |                         |                            | 113.1500                  |                               |              | 9.0000                         | 1018.3500 (32c) |
| Internal Floor 1                                                         |                         |                            | 29.1000                   |                               |              | 18.0000                        | 523.8000 (32d)  |
| Internal Ceiling 1                                                       |                         |                            | 29.1000                   |                               |              | 9.0000                         | 261.9000 (32e)  |

|                                                                |                                      |                |
|----------------------------------------------------------------|--------------------------------------|----------------|
| Heat capacity Cm = Sum(A x k)                                  | (28)...(30) + (32) + (32a)...(32e) = | 6505.4700 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K |                                      | 87.4391 (35)   |

### List of Thermal Bridges

| K1 Element                                                                | Length  | Psi-value | Total  |
|---------------------------------------------------------------------------|---------|-----------|--------|
| E2 Other lintels (including other steel lintels)                          | 7.9700  | 0.0840    | 0.6695 |
| E3 Sill                                                                   | 7.0600  | 0.0340    | 0.2400 |
| E4 Jamb                                                                   | 26.6000 | 0.0430    | 1.1438 |
| E16 Corner (normal)                                                       | 17.5000 | 0.0300    | 0.5250 |
| E18 Party wall between dwellings                                          | 9.5000  | 0.0400    | 0.3800 |
| E7 Party floor between dwellings (in blocks of flats)                     | 20.1000 | 0.0660    | 1.3266 |
| E11 Eaves (insulation at rafter level)                                    | 9.6000  | 0.0130    | 0.1248 |
| E17 Corner (inverted - internal area greater than external area)          | 8.0000  | 0.0150    | 0.1200 |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | 10.7000 | 0.0000    | 0.0000 |
| E13 Gable (insulation at rafter level)                                    | 16.1000 | 0.0240    | 0.3864 |
| E6 Intermediate floor within a dwelling                                   | 22.2000 | 0.0800    | 1.7760 |
| P5 Party wall - Roof (insulation at rafter level)                         | 6.4000  | 0.2400    | 1.5360 |

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|                                                            |         |        |                       |              |
|------------------------------------------------------------|---------|--------|-----------------------|--------------|
| P2 Party wall - Intermediate floor within a dwelling       | 4.0000  | 0.0000 | 0.0000                |              |
| R4 Ridge (vaulted ceiling)                                 | 11.1000 | 0.1200 | 1.3320                |              |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |         |        |                       | 9.5601 (36)  |
| Point Thermal bridges                                      |         |        |                       | 0.0000       |
| Total fabric heat loss                                     |         |        | (33) + (36) + (36a) = | 42.9130 (37) |

|                                                                     |         |         |         |         |         |         |         |         |         |         |         |              |
|---------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) |         |         |         |         |         |         |         |         |         |         |         |              |
| (38)m                                                               | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| Heat transfer coeff                                                 | 36.2078 | 36.2078 | 36.2078 | 36.2078 | 36.2078 | 36.2078 | 36.2078 | 36.2078 | 36.2078 | 36.2078 | 36.2078 | 36.2078 (38) |
| Average = Sum(39)m / 12 =                                           | 79.1208 | 79.1208 | 79.1208 | 79.1208 | 79.1208 | 79.1208 | 79.1208 | 79.1208 | 79.1208 | 79.1208 | 79.1208 | 79.1208 (39) |
|                                                                     | 79.1208 | 79.1208 | 79.1208 | 79.1208 | 79.1208 | 79.1208 | 79.1208 | 79.1208 | 79.1208 | 79.1208 | 79.1208 | 79.1208 (39) |
| HLP                                                                 | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| HLP (average)                                                       | 1.0635  | 1.0635  | 1.0635  | 1.0635  | 1.0635  | 1.0635  | 1.0635  | 1.0635  | 1.0635  | 1.0635  | 1.0635  | 1.0635 (40)  |
| Days in mont                                                        | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31           |

## 4. Water heating energy requirements (kWh/year)

|                                                                                |          |          |          |          |          |          |          |          |          |          |          |                              |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------------------------------|
| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |          |          | 2.3480 (42)                  |
| Hot water usage for mixer showers                                              | 87.4344  | 86.1204  | 84.2057  | 80.5423  | 77.8387  | 74.8238  | 73.1101  | 75.0103  | 77.0933  | 80.3304  | 84.0726  | 87.0994 (42a)                |
| Hot water usage for baths                                                      | 27.4684  | 27.0605  | 26.4860  | 25.4268  | 24.6337  | 23.7542  | 23.2792  | 23.8496  | 24.4707  | 25.4118  | 26.4928  | 27.3756 (42b)                |
| Hot water usage for other uses                                                 | 38.6763  | 37.2699  | 35.8635  | 34.4571  | 33.0507  | 31.6443  | 31.6443  | 33.0507  | 34.4571  | 35.8635  | 37.2699  | 38.6763 (42c)                |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |          |          | 141.2394 (43)                |
| Daily hot water use                                                            | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec                          |
| Energy conte                                                                   | 153.5791 | 150.4508 | 146.5552 | 140.4261 | 135.5230 | 130.2222 | 128.0335 | 131.9106 | 136.0211 | 141.6057 | 147.8353 | 153.1513 (44)                |
| Energy content (annual)                                                        | 243.2318 | 214.2399 | 225.2499 | 192.2364 | 182.4401 | 160.1234 | 154.8454 | 163.3328 | 167.7276 | 192.1576 | 210.6185 | 239.7979 (45)                |
| Distribution loss (46)m = 0.15 x (45)m                                         |          |          |          |          |          |          |          |          |          |          |          | Total = Sum(45)m = 2346.0013 |
| Water storage loss (or HIU loss):                                              | 36.4848  | 32.1360  | 33.7875  | 28.8355  | 27.3660  | 24.0185  | 23.2268  | 24.4999  | 25.1591  | 28.8236  | 31.5928  | 35.9697 (46)                 |
| Store volume                                                                   |          |          |          |          |          |          |          |          |          |          |          | 196.0000 (47)                |
| a) If manufacturer declared loss factor is known (kWh/day):                    |          |          |          |          |          |          |          |          |          |          |          | 1.3120 (48)                  |
| Temperature factor from Table 2b                                               |          |          |          |          |          |          |          |          |          |          |          | 0.5400 (49)                  |
| Enter (49) or (54) in (55)                                                     |          |          |          |          |          |          |          |          |          |          |          | 0.7085 (55)                  |
| Total storage loss                                                             | 21.9629  | 19.8374  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629 (56)                 |
| If cylinder contains dedicated solar storage                                   | 21.9629  | 19.8374  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629 (57)                 |
| Primary loss                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (59)                  |
| Combi loss                                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (61)                  |
| Total heat required for water heating calculated for each month                | 265.1947 | 234.0774 | 247.2128 | 213.4908 | 204.4030 | 181.3778 | 176.8083 | 185.2957 | 188.9820 | 214.1205 | 231.8729 | 261.7608 (62)                |
| WWHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63a)                 |
| PV diverter                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63b)                 |
| Solar input                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63c)                 |
| FGHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63d)                 |
| Output from w/h                                                                | 265.1947 | 234.0774 | 247.2128 | 213.4908 | 204.4030 | 181.3778 | 176.8083 | 185.2957 | 188.9820 | 214.1205 | 231.8729 | 261.7608 (64)                |
| Electric shower(s)                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (64a)                 |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (64a)                 |
| Heat gains from water heating, kWh/month                                       | 80.8746  | 71.2348  | 74.8956  | 63.9186  | 60.6613  | 53.2410  | 51.4861  | 54.3082  | 55.7694  | 63.8924  | 70.0306  | 79.7328 (65)                 |

## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Metabolic gains (Table 5), Watts                                                    | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
| (66)m                                                                               | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 31.7957  | 28.2406  | 22.9668  | 17.3874  | 12.9973  | 10.9728  | 11.8565  | 15.4116  | 20.6854  | 26.2649  | 30.6550  | 32.6794 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 309.4646 | 312.6759 | 304.5836 | 287.3560 | 265.6093 | 245.1705 | 231.5161 | 228.3048 | 236.3971 | 253.6247 | 275.3714 | 295.8102 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363 (69)  |
| Pumps, fans                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (70)   |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 (71) |
| Water heating gains (Table 5)                                                       | 108.7024 | 106.0041 | 100.6661 | 88.7758  | 81.5340  | 73.9459  | 69.2017  | 72.9948  | 77.4575  | 85.8769  | 97.2648  | 107.1677 (72) |
| Total internal gains                                                                | 548.3599 | 545.3179 | 526.6138 | 491.9164 | 458.5378 | 428.4864 | 410.9716 | 415.1084 | 432.9372 | 464.1636 | 501.6883 | 534.0546 (73) |

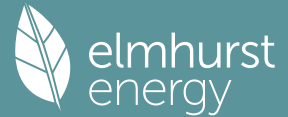
## 6. Solar gains

| [Jan]       |          |          |          |           | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W   |          |               |
|-------------|----------|----------|----------|-----------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|----------|---------------|
| East        |          |          |          |           | 4.9600     | 23.8018                        | 0.7600                            | 0.0000                             | 0.7700                       | 69.0868 (76) |          |               |
| West        |          |          |          |           | 4.9600     | 23.8018                        | 0.7600                            | 0.0000                             | 0.7700                       | 69.0868 (80) |          |               |
|             |          |          |          |           |            |                                |                                   |                                    |                              |              |          |               |
| Solar gains | 138.1736 | 236.0921 | 385.2951 | 569.0054  | 678.1730   | 733.8699                       | 691.9692                          | 610.2517                           | 477.1980                     | 300.5179     | 169.7134 | 114.2818 (83) |
| Total gains | 686.5335 | 781.4100 | 911.9088 | 1060.9218 | 1136.7108  | 1162.3563                      | 1102.9407                         | 1025.3601                          | 910.1353                     | 764.6815     | 671.4017 | 648.3364 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |              |
|-----------------------------------------------------------------------------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |              |

# Full SAP Calculation Printout



|                        | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
|------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| tau                    | 22.8395 | 22.8395 | 22.8395 | 22.8395 | 22.8395 | 22.8395 | 22.8395 | 22.8395 | 22.8395 | 22.8395 | 22.8395 | 22.8395      |
| alpha                  | 2.5226  | 2.5226  | 2.5226  | 2.5226  | 2.5226  | 2.5226  | 2.5226  | 2.5226  | 2.5226  | 2.5226  | 2.5226  | 2.5226       |
| util living area       | 0.8882  | 0.8505  | 0.7726  | 0.6458  | 0.4970  | 0.3369  | 0.2319  | 0.2557  | 0.4679  | 0.7099  | 0.8477  | 0.8992 (86)  |
| MIT                    | 19.0135 | 19.3270 | 19.8615 | 20.4081 | 20.7673 | 20.9391 | 20.9838 | 20.9790 | 20.8501 | 20.3603 | 19.5922 | 18.9315 (87) |
| Th 2                   | 20.0308 | 20.0308 | 20.0308 | 20.0308 | 20.0308 | 20.0308 | 20.0308 | 20.0308 | 20.0308 | 20.0308 | 20.0308 | 20.0308 (88) |
| util rest of house     | 0.8750  | 0.8337  | 0.7481  | 0.6104  | 0.4497  | 0.2790  | 0.1657  | 0.1853  | 0.4050  | 0.6702  | 0.8274  | 0.8870 (89)  |
| MIT 2                  | 17.7478 | 18.1338 | 18.7837 | 19.4254 | 19.8222 | 19.9897 | 20.0242 | 20.0218 | 19.9152 | 19.3919 | 18.4722 | 17.6470 (90) |
| Living area fraction   | 18.1714 | 18.5331 | 19.1444 | 19.7543 | 20.1385 | 20.3075 | 20.3453 | 20.3421 | 20.2281 | 19.7160 | 18.8470 | 18.0769 (91) |
| MIT                    | 18.1714 | 18.5331 | 19.1444 | 19.7543 | 20.1385 | 20.3075 | 20.3453 | 20.3421 | 20.2281 | 19.7160 | 18.8470 | 18.0769 (92) |
| Temperature adjustment |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT           | 18.1714 | 18.5331 | 19.1444 | 19.7543 | 20.1385 | 20.3075 | 20.3453 | 20.3421 | 20.2281 | 19.7160 | 18.8470 | 18.0769 (93) |

## 8. Space heating requirement

|                                                                                | Jan       | Feb       | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov      | Dec            |
|--------------------------------------------------------------------------------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|---------------|----------|----------------|
| Utilisation                                                                    | 0.8435    | 0.8025    | 0.7228   | 0.5996   | 0.4551   | 0.2959   | 0.1874   | 0.2083   | 0.4183   | 0.6559        | 0.7976   | 0.8559 (94)    |
| Useful gains                                                                   | 579.0575  | 627.0661  | 659.1501 | 636.1490 | 517.3538 | 343.8853 | 206.7302 | 213.5437 | 380.7366 | 501.5655      | 535.1484 | 554.9137 (95)  |
| Ext temp.                                                                      | 5.1000    | 5.7000    | 7.4000   | 9.9000   | 12.9000  | 15.8000  | 17.7000  | 17.6000  | 15.0000  | 11.5000       | 8.0000   | 5.1000 (96)    |
| Heat loss rate W                                                               | 1034.2176 | 1015.3684 | 929.2264 | 779.6795 | 572.7166 | 356.6346 | 209.2996 | 216.9592 | 413.6505 | 650.0527      | 858.2259 | 1026.7424 (97) |
| Space heating kWh                                                              | 338.6391  | 260.9392  | 200.9368 | 103.3419 | 41.1899  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 110.4745      | 232.3739 | 351.0405 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |          |          |          |          |          |          |          |               |          | 1638.9358      |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000   | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |           |           |          |          |          |          |          |          |          |               |          | 0.0000         |
| Space heating kWh                                                              | 338.6391  | 260.9392  | 200.9368 | 103.3419 | 41.1899  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 110.4745      | 232.3739 | 351.0405 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |          |          |          |          |          |          |          |               |          | 1638.9358      |
| Space heating per m2                                                           |           |           |          |          |          |          |          |          |          | (98c) / (4) = |          | 22.0287 (99)   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |                 |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)    |
| Fraction of space heat from main system(s)                                                           |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)    |
| Fraction of main heating from main system 2                                                          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (203)    |
| Fraction of total heating from main system 1                                                         |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (204)    |
| Fraction of total heating from main system 2                                                         |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (205)    |
| Efficiency of main space heating system 1 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 100.0000 (206)  |
| Efficiency of main space heating system 2 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                              |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
| Space heating requirement                                                                            | 338.6391 | 260.9392 | 200.9368 | 103.3419 | 41.1899  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 110.4745 | 232.3739 | 351.0405 (98)   |
| Space heating efficiency (main heating system 1)                                                     | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 100.0000 | 100.0000 | 100.0000 (210)  |
| Space heating fuel (main heating system)                                                             | 338.6391 | 260.9392 | 200.9368 | 103.3419 | 41.1899  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 110.4745 | 232.3739 | 351.0405 (211)  |
| Space heating efficiency (main heating system 2)                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |
| Space heating fuel (secondary)                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Space heating fuel used, main system 2                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Water heating                                                                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| Water heating requirement                                                                            | 265.1947 | 234.0774 | 247.2128 | 213.4908 | 204.4030 | 181.3778 | 176.8083 | 185.2957 | 188.9820 | 214.1205 | 231.8729 | 261.7608 (64)   |
| Efficiency of water heater                                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (216)    |
| (217)m                                                                                               | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 (217)  |
| Fuel for water heating, kWh/month                                                                    | 84.6172  | 74.6885  | 78.8797  | 68.1198  | 65.2201  | 57.8733  | 56.4153  | 59.1234  | 60.2996  | 68.3207  | 73.9851  | 83.5216 (219)   |
| Space cooling fuel requirement                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| (221)m                                                                                               | 15.0751  | 13.6162  | 15.0751  | 14.5888  | 15.0751  | 14.5888  | 15.0751  | 15.0751  | 14.5888  | 15.0751  | 14.5888  | 15.0751 (231)   |
| Pumps and Fa                                                                                         | 27.8306  | 22.3267  | 20.1027  | 14.7281  | 11.3764  | 9.2946   | 10.3780  | 13.4897  | 17.5217  | 22.9895  | 25.9666  | 28.6041 (232)   |
| Lighting                                                                                             |          |          |          |          |          |          |          |          |          |          |          |                 |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (233a)   |
| (233a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |
| (234a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |
| (235a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235e)   |
| (235c)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235f)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235g)   |
| (233b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235h)   |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235i)   |
| (234b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235j)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235k)   |
| (235b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235l)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235m)   |
| (235d)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235n)   |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 1638.9358 (211) |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 313.4050        |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          | 831.0641 (219)  |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (221)    |
| Electricity for pumps and fans:                                                                      |          |          |          |          |          |          |          |          |          |          |          |                 |
| (MEVCentralised, Database: in-use factor = 1.3000, SFP = 0.6630)                                     |          |          |          |          |          |          |          |          |          |          |          |                 |
| mechanical ventilation fans (SFP = 0.6630)                                                           |          |          |          |          |          |          |          |          |          |          |          | 177.4970 (230a) |
| Total electricity for the above, kWh/year                                                            |          |          |          |          |          |          |          |          |          |          |          | 177.4970 (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |          |          |          |          |          |          |          |          | 224.6087 (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| PV generation                                                                                        |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (233)    |
| Wind generation                                                                                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (234)    |

# Full SAP Calculation Printout



|                                                |                 |
|------------------------------------------------|-----------------|
| Hydro-electric generation (Appendix N)         | 0.0000 (235a)   |
| Electricity generated - Micro CHP (Appendix N) | 0.0000 (235)    |
| Appendix Q - special features                  |                 |
| Energy saved or generated                      | -0.0000 (236)   |
| Energy used                                    | 0.0000 (237)    |
| Total delivered energy for all uses            | 2872.1056 (238) |

## 10a. Fuel costs - using BEDF prices (585)

|                                             | Fuel<br>kWh/year | Fuel price<br>p/kWh | Fuel cost<br>£/year |
|---------------------------------------------|------------------|---------------------|---------------------|
| Space heating - main system 1               | 1638.9358        | 28.4300             | 465.9494 (240)      |
| Space heating - main system 2               | 0.0000           | 28.4300             | 0.0000 (241)        |
| Total CO2 associated with community systems |                  |                     | 0.0000 (473)        |
| Water heating (other fuel)                  | 831.0641         | 28.4300             | 236.2715 (247)      |
| Energy for instantaneous electric shower(s) | 0.0000           | 28.4300             | 0.0000 (247a)       |
| Pumps, fans and electric keep-hot           | 177.4970         | 28.4300             | 50.4624 (249)       |
| Energy for lighting                         | 224.6087         | 28.4300             | 63.8563 (250)       |
| Additional standing charges                 |                  |                     | 0.0000 (251)        |
| Total energy cost                           |                  |                     | 816.5396 (255)      |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|---------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1               | 1638.9358          | 0.1557                        | 255.2393 (261)           |
| Space heating - main system 2               | 0.0000             | 0.0000                        | 0.0000 (262)             |
| Total CO2 associated with community systems |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                  | 831.0641           | 0.1413                        | 117.4242 (264)           |
| Space and water heating                     |                    |                               | 372.6635 (265)           |
| Pumps, fans and electric keep-hot           | 177.4970           | 0.1387                        | 24.6210 (267)            |
| Energy for lighting                         | 224.6087           | 0.1443                        | 32.4180 (268)            |
| Total CO2, kg/year                          |                    |                               | 429.7025 (272)           |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 1638.9358          | 1.5766                              | 2583.8685 (275)            |
| Space heating - main system 2               | 0.0000             | 0.0000                              | 0.0000 (276)               |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 831.0641           | 1.5225                              | 1265.2724 (278)            |
| Space and water heating                     |                    |                                     | 3849.1409 (279)            |
| Pumps, fans and electric keep-hot           | 177.4970           | 1.5128                              | 268.5175 (281)             |
| Energy for lighting                         | 224.6087           | 1.5338                              | 344.5124 (282)             |
| Total Primary energy kWh/year               |                    |                                     | 4462.1708 (286)            |

## SAP 10 EPC IMPROVEMENTS

### Electric Panel Heaters HC

|                                      |      |
|--------------------------------------|------|
| Current energy efficiency rating:    | C 75 |
| Current environmental impact rating: | A 95 |

|                             |                |
|-----------------------------|----------------|
| N Solar water heating       | Not applicable |
| U Solar photovoltaic panels | Not applicable |
| V2 Wind turbine             | Not applicable |

| Recommended measures: | SAP change | Cost change | CO2 change |
|-----------------------|------------|-------------|------------|
| (none)                |            |             |            |

| Recommended measures<br>(none) | Typical annual savings | Energy efficiency | Environmental impact |
|--------------------------------|------------------------|-------------------|----------------------|
|                                | Total Savings £0       |                   | 0.00 kg/m²           |

|                                        |      |
|----------------------------------------|------|
| Potential energy efficiency rating:    | C 75 |
| Potential environmental impact rating: | A 95 |

Fuel prices for cost data on this page from database revision number 585 TEST (31 Oct 2025)  
Recommendation texts revision number 6.1 (11 Jun 2019)

### Typical heating and lighting costs of this home (per year, Thames Valley):

|                          | Current<br>£817 | Potential<br>£817 | Saving<br>£0 |
|--------------------------|-----------------|-------------------|--------------|
| Electricity              |                 |                   |              |
| Space heating            | £516            | £516              | £0           |
| Water heating            | £236            | £236              | £0           |
| Lighting                 | £64             | £64               | £0           |
| Total cost of fuels      | £817            | £817              | £0           |
| Total cost of uses       | £816            | £816              | £0           |
| Delivered energy         | 39 kWh/m²       | 39 kWh/m²         | 0 kWh/m²     |
| Carbon dioxide emissions | 0.4 tonnes      | 0.4 tonnes        | 0.0 tonnes   |
| CO2 emissions per m²     | 6 kg/m²         | 6 kg/m²           | 0 kg/m²      |
| Primary energy           | 60 kWh/m²       | 60 kWh/m²         | 0 kWh/m²     |

# Full SAP Calculation Printout



SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)              | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|-----------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                   |                             |
| Ground floor                                           | 45.3000 (1b)              | x 2.7500 (2b)                     | = 124.5750 (1b) - (3b)      |
| First floor                                            | 29.1000 (1c)              | x 3.2600 (2c)                     | = 94.8660 (1c) - (3c)       |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 74.4000                   |                                   | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 219.4410 (5)                |

## 2. Ventilation rate

|                                                    | m <sup>3</sup> per hour |
|----------------------------------------------------|-------------------------|
| Number of open chimneys                            | 0 * 80 = 0.0000 (6a)    |
| Number of open flues                               | 0 * 20 = 0.0000 (6b)    |
| Number of chimneys / flues attached to closed fire | 0 * 10 = 0.0000 (6c)    |
| Number of flues attached to solid fuel boiler      | 0 * 20 = 0.0000 (6d)    |
| Number of flues attached to other heater           | 0 * 35 = 0.0000 (6e)    |
| Number of blocked chimneys                         | 0 * 20 = 0.0000 (6f)    |
| Number of intermittent extract fans                | 0 * 10 = 0.0000 (7a)    |
| Number of passive vents                            | 0 * 10 = 0.0000 (7b)    |
| Number of flueless gas fires                       | 0 * 40 = 0.0000 (7c)    |

|                                                                                                    |                             |             |
|----------------------------------------------------------------------------------------------------|-----------------------------|-------------|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 / (5) =              | 0.0000 (8)  |
| Pressure test                                                                                      | Yes                         |             |
| Pressure Test Method                                                                               | Blower Door                 |             |
| Measured/design AP50                                                                               | 4.0000 (17)                 |             |
| Infiltration rate                                                                                  | 0.2000 (18)                 |             |
| Number of sides sheltered                                                                          | 1 (19)                      |             |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = | 0.9250 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) =        | 0.1850 (21) |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate                                                                                         | 0.2359 | 0.2313 | 0.2266 | 0.2035 | 0.1989 | 0.1758 | 0.1758 | 0.1711 | 0.1850 | 0.1989 | 0.2081 | 0.2174 (22b) |
| Mechanical extract ventilation - centralised                                                            |        |        |        |        |        |        |        |        |        |        |        |              |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                                     | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K         | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K   |
|-------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|----------------------|--------------------------------|-----------------|
| Main dwelling                                               |                         |                            |                           |                               |                      |                                |                 |
| Windows / Glazed Doors                                      |                         |                            | 9.9200                    | 1.1450                        | 11.3588              |                                | (27)            |
| External Wall                                               | 74.1300                 | 8.9200                     | 65.2100                   | 0.1500                        | 9.7815               | 9.0000                         | 586.8900 (29a)  |
| RIR Stud Wall                                               | 25.3800                 |                            | 25.3800                   | 0.1500                        | 3.8070               | 9.0000                         | 228.4200 (29a)  |
| Dormer Walls                                                | 6.6000                  | 1.0000                     | 5.6000                    | 0.1500                        | 0.8400               | 9.0000                         | 50.4000 (29a)   |
| Adj To RIR Ins At Slope                                     | 16.0500                 |                            | 16.0500                   | 0.1400                        | 2.2470               | 9.0000                         | 144.4500 (30)   |
| Slope Roof                                                  | 37.9900                 |                            | 37.9900                   | 0.1400                        | 5.3186               | 9.0000                         | 341.9100 (30)   |
| Total net area of external elements Aum(A, m <sup>2</sup> ) |                         |                            | 160.1500                  |                               |                      |                                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                         |                         |                            |                           |                               | (26)...(30) + (32) = | 33.3529                        | (33)            |
| Main dwelling                                               |                         |                            |                           |                               |                      |                                |                 |
| Party Wall 1                                                |                         |                            | 44.2300                   | 0.0000                        | 0.0000               | 45.0000                        | 1990.3500 (32)  |
| Party Floor 1                                               |                         |                            | 45.3000                   |                               |                      | 30.0000                        | 1359.0000 (32d) |
| Internal Wall 1                                             |                         |                            | 113.1500                  |                               |                      | 9.0000                         | 1018.3500 (32c) |
| Internal Floor 1                                            |                         |                            | 29.1000                   |                               |                      | 18.0000                        | 523.8000 (32d)  |
| Internal Ceiling 1                                          |                         |                            | 29.1000                   |                               |                      | 9.0000                         | 261.9000 (32e)  |

|                                                                |                                      |                |
|----------------------------------------------------------------|--------------------------------------|----------------|
| Heat capacity Cm = Sum(A x k)                                  | (28)...(30) + (32) + (32a)...(32e) = | 6505.4700 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K |                                      | 87.4391 (35)   |

### List of Thermal Bridges

|                                                                           | Length  | Psi-value | Total  |
|---------------------------------------------------------------------------|---------|-----------|--------|
| K1 Element                                                                |         |           |        |
| E2 Other lintels (including other steel lintels)                          | 7.9700  | 0.0840    | 0.6695 |
| E3 Sill                                                                   | 7.0600  | 0.0340    | 0.2400 |
| E4 Jamb                                                                   | 26.6000 | 0.0430    | 1.1438 |
| E16 Corner (normal)                                                       | 17.5000 | 0.0300    | 0.5250 |
| E18 Party wall between dwellings                                          | 9.5000  | 0.0400    | 0.3800 |
| E7 Party floor between dwellings (in blocks of flats)                     | 20.1000 | 0.0660    | 1.3266 |
| E11 Eaves (insulation at rafter level)                                    | 9.6000  | 0.0130    | 0.1248 |
| E17 Corner (inverted - internal area greater than external area)          | 8.0000  | 0.0150    | 0.1200 |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | 10.7000 | 0.0000    | 0.0000 |
| E13 Gable (insulation at rafter level)                                    | 16.1000 | 0.0240    | 0.3864 |
| E6 Intermediate floor within a dwelling                                   | 22.2000 | 0.0800    | 1.7760 |
| P5 Party wall - Roof (insulation at rafter level)                         | 6.4000  | 0.2400    | 1.5360 |
| P2 Party wall - Intermediate floor within a dwelling                      | 4.0000  | 0.0000    | 0.0000 |
| R4 Ridge (vaulted ceiling)                                                | 11.1000 | 0.1200    | 1.3320 |

|                                                            |                       |              |
|------------------------------------------------------------|-----------------------|--------------|
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |                       | 9.5601 (36)  |
| Point Thermal bridges                                      | (36a) =               | 0.0000       |
| Total fabric heat loss                                     | (33) + (36) + (36a) = | 42.9130 (37) |

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

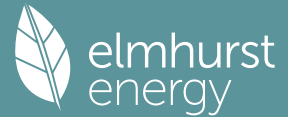
|                           | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| (38)m                     | 36.2078 | 36.2078 | 36.2078 | 36.2078 | 36.2078 | 36.2078 | 36.2078 | 36.2078 | 36.2078 | 36.2078 | 36.2078 | 36.2078 (38) |
| Heat transfer coeff       | 79.1208 | 79.1208 | 79.1208 | 79.1208 | 79.1208 | 79.1208 | 79.1208 | 79.1208 | 79.1208 | 79.1208 | 79.1208 | 79.1208 (39) |
| Average = Sum(39)m / 12 = |         |         |         |         |         |         |         |         |         |         |         | 79.1208      |

# Full SAP Calculation Printout



|                                                                                     |          |          |          |           |            |           |               |                                                                    |               |          |             |               |               |
|-------------------------------------------------------------------------------------|----------|----------|----------|-----------|------------|-----------|---------------|--------------------------------------------------------------------|---------------|----------|-------------|---------------|---------------|
|                                                                                     | Jan      | Feb      | Mar      | Apr       | May        | Jun       | Jul           | Aug                                                                | Sep           | Oct      | Nov         | Dec           |               |
| HLP                                                                                 | 1.0635   | 1.0635   | 1.0635   | 1.0635    | 1.0635     | 1.0635    | 1.0635        | 1.0635                                                             | 1.0635        | 1.0635   | 1.0635      | 1.0635        | (40)          |
| HLP (average)                                                                       |          |          |          |           |            |           |               |                                                                    |               |          |             | 1.0635        |               |
| Days in month                                                                       | 31       | 28       | 31       | 30        | 31         | 30        | 31            | 31                                                                 | 30            | 31       | 30          | 31            |               |
| -----                                                                               |          |          |          |           |            |           |               |                                                                    |               |          |             |               |               |
| 4. Water heating energy requirements (kWh/year)                                     |          |          |          |           |            |           |               |                                                                    |               |          |             |               |               |
| -----                                                                               |          |          |          |           |            |           |               |                                                                    |               |          |             |               |               |
| Assumed occupancy                                                                   |          |          |          |           |            |           |               |                                                                    |               |          |             |               | 2.3480 (42)   |
| Hot water usage for mixer showers                                                   |          |          |          |           |            |           |               |                                                                    |               |          |             |               |               |
| 87.4344                                                                             | 86.1204  | 84.2057  | 80.5423  | 77.8387   | 74.8238    | 73.1101   | 75.0103       | 77.0933                                                            | 80.3304       | 84.0726  | 87.0994     | (42a)         |               |
| Hot water usage for baths                                                           |          |          |          |           |            |           |               |                                                                    |               |          |             |               |               |
| 27.4684                                                                             | 27.0605  | 26.4860  | 25.4268  | 24.6337   | 23.7542    | 23.2792   | 23.8496       | 24.4707                                                            | 25.4118       | 26.4928  | 27.3756     | (42b)         |               |
| Hot water usage for other uses                                                      |          |          |          |           |            |           |               |                                                                    |               |          |             |               |               |
| 38.6763                                                                             | 37.2699  | 35.8635  | 34.4571  | 33.0507   | 31.6443    | 31.6443   | 33.0507       | 34.4571                                                            | 35.8635       | 37.2699  | 38.6763     | (42c)         |               |
| Average daily hot water use (litres/day)                                            |          |          |          |           |            |           |               |                                                                    |               |          |             |               | 141.2394 (43) |
| -----                                                                               |          |          |          |           |            |           |               |                                                                    |               |          |             |               |               |
|                                                                                     | Jan      | Feb      | Mar      | Apr       | May        | Jun       | Jul           | Aug                                                                | Sep           | Oct      | Nov         | Dec           |               |
| Daily hot water use                                                                 | 153.5791 | 150.4508 | 146.5552 | 140.4261  | 135.5230   | 130.2222  | 128.0335      | 131.9106                                                           | 136.0211      | 141.6057 | 147.8353    | 153.1513      | (44)          |
| Energy content                                                                      | 243.2318 | 214.2399 | 225.2499 | 192.2364  | 182.4401   | 160.1234  | 154.8454      | 163.3328                                                           | 167.7276      | 192.1576 | 210.6185    | 239.7979      | (45)          |
| Energy content (annual)                                                             |          |          |          |           |            |           |               |                                                                    |               | Total =  | Sum(45)m =  | 2346.0013     |               |
| Distribution loss (46)m = 0.15 x (45)m                                              |          |          |          |           |            |           |               |                                                                    |               |          |             |               |               |
| 36.4848                                                                             | 32.1360  | 33.7875  | 28.8355  | 27.3660   | 24.0185    | 23.2268   | 24.4999       | 25.1591                                                            | 28.8236       | 31.5928  | 35.9697     | (46)          |               |
| Water storage loss (or HIU loss):                                                   |          |          |          |           |            |           |               |                                                                    |               |          |             |               |               |
| Store volume                                                                        |          |          |          |           |            |           |               |                                                                    |               |          |             |               | 196.0000 (47) |
| a) If manufacturer declared loss factor is known (kWh/day):                         |          |          |          |           |            |           |               |                                                                    |               |          |             |               | 1.3120 (48)   |
| Temperature factor from Table 2b                                                    |          |          |          |           |            |           |               |                                                                    |               |          |             |               | 0.5400 (49)   |
| Enter (49) or (54) in (55)                                                          |          |          |          |           |            |           |               |                                                                    |               |          |             |               | 0.7085 (55)   |
| Total storage loss                                                                  |          |          |          |           |            |           |               |                                                                    |               |          |             |               |               |
| 21.9629                                                                             | 19.8374  | 21.9629  | 21.2544  | 21.9629   | 21.2544    | 21.9629   | 21.9629       | 21.9629                                                            | 21.2544       | 21.9629  | 21.2544     | 21.9629       | (56)          |
| If cylinder contains dedicated solar storage                                        |          |          |          |           |            |           |               |                                                                    |               |          |             |               |               |
| 21.9629                                                                             | 19.8374  | 21.9629  | 21.2544  | 21.9629   | 21.2544    | 21.9629   | 21.9629       | 21.9629                                                            | 21.2544       | 21.9629  | 21.2544     | 21.9629       | (57)          |
| Primary loss                                                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000     | 0.0000    | 0.0000        | 0.0000                                                             | 0.0000        | 0.0000   | 0.0000      | 0.0000        | (59)          |
| Combi loss                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000     | 0.0000    | 0.0000        | 0.0000                                                             | 0.0000        | 0.0000   | 0.0000      | 0.0000        | (61)          |
| Total heat required for water heating calculated for each month                     |          |          |          |           |            |           |               |                                                                    |               |          |             |               |               |
| 265.1947                                                                            | 234.0774 | 247.2128 | 213.4908 | 204.4030  | 181.3778   | 176.8083  | 185.2957      | 188.9820                                                           | 214.1205      | 231.8729 | 261.7608    | (62)          |               |
| WWHRS                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000     | 0.0000    | 0.0000        | 0.0000                                                             | 0.0000        | 0.0000   | 0.0000      | 0.0000        | (63a)         |
| PV diverter                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000     | 0.0000    | 0.0000        | 0.0000                                                             | 0.0000        | 0.0000   | 0.0000      | 0.0000        | (63b)         |
| Solar input                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000     | 0.0000    | 0.0000        | 0.0000                                                             | 0.0000        | 0.0000   | 0.0000      | 0.0000        | (63c)         |
| FGHRS                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000     | 0.0000    | 0.0000        | 0.0000                                                             | 0.0000        | 0.0000   | 0.0000      | 0.0000        | (63d)         |
| Output from w/h                                                                     | 265.1947 | 234.0774 | 247.2128 | 213.4908  | 204.4030   | 181.3778  | 176.8083      | 185.2957                                                           | 188.9820      | 214.1205 | 231.8729    | 261.7608      | (64)          |
|                                                                                     |          |          |          |           |            |           |               | Total per year (kWh/year) =                                        | Sum(64)m =    |          |             | 2604.5965     | (64)          |
| Electric shower(s)                                                                  |          |          |          |           |            |           |               |                                                                    |               |          |             |               |               |
| 0.0000                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000     | 0.0000    | 0.0000        | 0.0000                                                             | 0.0000        | 0.0000   | 0.0000      | 0.0000        | (64a)         |
|                                                                                     |          |          |          |           |            |           |               | Total Energy used by instantaneous electric shower(s) (kWh/year) = | Sum(64a)m =   |          |             | 0.0000        | (64a)         |
| Heat gains from water heating, kWh/month                                            |          |          |          |           |            |           |               |                                                                    |               |          |             |               |               |
| 80.8746                                                                             | 71.2348  | 74.8956  | 63.9186  | 60.6613   | 53.2410    | 51.4861   | 54.3082       | 55.7694                                                            | 63.8924       | 70.0306  | 79.7328     | (65)          |               |
| -----                                                                               |          |          |          |           |            |           |               |                                                                    |               |          |             |               |               |
| 5. Internal gains (see Table 5 and 5a)                                              |          |          |          |           |            |           |               |                                                                    |               |          |             |               |               |
| -----                                                                               |          |          |          |           |            |           |               |                                                                    |               |          |             |               |               |
| Metabolic gains (Table 5), Watts                                                    |          |          |          |           |            |           |               |                                                                    |               |          |             |               |               |
| (66)m                                                                               | 140.8826 | 140.8826 | 140.8826 | 140.8826  | 140.8826   | 140.8826  | 140.8826      | 140.8826                                                           | 140.8826      | 140.8826 | 140.8826    | 140.8826      | (66)          |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     |          |          |          |           |            |           |               |                                                                    |               |          |             |               |               |
| 31.7957                                                                             | 28.2406  | 22.9668  | 17.3874  | 12.9973   | 10.9728    | 11.8565   | 15.4116       | 20.6854                                                            | 26.2649       | 30.6550  | 32.6794     | (67)          |               |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 |          |          |          |           |            |           |               |                                                                    |               |          |             |               |               |
| 309.4646                                                                            | 312.6759 | 304.5836 | 287.3560 | 265.6093  | 245.1705   | 231.5161  | 228.3048      | 236.3971                                                           | 253.6247      | 275.3714 | 295.8102    | (68)          |               |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    |          |          |          |           |            |           |               |                                                                    |               |          |             |               |               |
| 51.4363                                                                             | 51.4363  | 51.4363  | 51.4363  | 51.4363   | 51.4363    | 51.4363   | 51.4363       | 51.4363                                                            | 51.4363       | 51.4363  | 51.4363     | (69)          |               |
| Pumps, fans                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000     | 0.0000    | 0.0000        | 0.0000                                                             | 0.0000        | 0.0000   | 0.0000      | 0.0000        | (70)          |
| Losses e.g. evaporation (negative values) (Table 5)                                 |          |          |          |           |            |           |               |                                                                    |               |          |             |               |               |
| -93.9218                                                                            | -93.9218 | -93.9218 | -93.9218 | -93.9218  | -93.9218   | -93.9218  | -93.9218      | -93.9218                                                           | -93.9218      | -93.9218 | -93.9218    | -93.9218      | (71)          |
| Water heating gains (Table 5)                                                       |          |          |          |           |            |           |               |                                                                    |               |          |             |               |               |
| 108.7024                                                                            | 106.0041 | 100.6661 | 88.7758  | 81.5340   | 73.9459    | 69.2017   | 72.9948       | 77.4575                                                            | 85.8769       | 97.2648  | 107.1677    | (72)          |               |
| Total internal gains                                                                | 548.3599 | 545.3179 | 526.6138 | 491.9164  | 458.5378   | 428.4864  | 410.9716      | 415.1084                                                           | 432.9372      | 464.1636 | 501.6883    | 534.0546      | (73)          |
| -----                                                                               |          |          |          |           |            |           |               |                                                                    |               |          |             |               |               |
| 6. Solar gains                                                                      |          |          |          |           |            |           |               |                                                                    |               |          |             |               |               |
| -----                                                                               |          |          |          |           |            |           |               |                                                                    |               |          |             |               |               |
| [Jan]                                                                               |          |          |          | Area      | Solar flux |           | g             |                                                                    | FF            |          | Access      |               | Gains         |
|                                                                                     |          |          |          | m2        | Table 6a   |           | Specific data |                                                                    | Specific data |          | factor      |               | W             |
|                                                                                     |          |          |          |           | W/m2       |           | or Table 6b   |                                                                    | or Table 6c   |          | Table 6d    |               |               |
| East                                                                                |          |          |          | 4.9600    | 19.6403    |           | 0.7600        |                                                                    | 0.0000        |          | 0.7700      |               | 57.0077 (76)  |
| West                                                                                |          |          |          | 4.9600    | 19.6403    |           | 0.7600        |                                                                    | 0.0000        |          | 0.7700      |               | 57.0077 (80)  |
| -----                                                                               |          |          |          |           |            |           |               |                                                                    |               |          |             |               |               |
| Solar gains                                                                         | 114.0153 | 223.0382 | 367.3122 | 535.7029  | 656.5240   | 672.0691  | 639.8372      | 549.6107                                                           | 427.1992      | 264.6536 | 142.1637    | 93.7607 (83)  |               |
| Total gains                                                                         | 662.3753 | 768.3561 | 893.9259 | 1027.6193 | 1115.0618  | 1100.5555 | 1050.8088     | 964.7191                                                           | 860.1365      | 728.8172 | 643.8521    | 627.8152 (84) |               |
| -----                                                                               |          |          |          |           |            |           |               |                                                                    |               |          |             |               |               |
| 7. Mean internal temperature (heating season)                                       |          |          |          |           |            |           |               |                                                                    |               |          |             |               |               |
| -----                                                                               |          |          |          |           |            |           |               |                                                                    |               |          |             |               |               |
| Temperature during heating periods in the living area from Table 9, Th1 (C)         |          |          |          |           |            |           |               |                                                                    |               |          |             |               | 21.0000 (85)  |
| Utilisation factor for gains for living area, nil,m (see Table 9a)                  |          |          |          |           |            |           |               |                                                                    |               |          |             |               |               |
| Jan                                                                                 | Feb      | Mar      | Apr      | May       | Jun        | Jul       | Aug           | Sep                                                                | Oct           | Nov      | Dec         |               |               |
| tau                                                                                 | 22.8395  | 22.8395  | 22.8395  | 22.8395   | 22.8395    | 22.8395   | 22.8395       | 22.8395                                                            | 22.8395       | 22.8395  | 22.8395     | 22.8395       |               |
| alpha                                                                               | 2.5226   | 2.5226   | 2.5226   | 2.5226    | 2.5226     | 2.5226    | 2.5226        | 2.5226                                                             | 2.5226        | 2.5226   | 2.5226      | 2.5226        |               |
| util living area                                                                    | 0.9042   | 0.8667   | 0.7988   | 0.6903    | 0.5576     | 0.4226    | 0.3174        | 0.3565                                                             | 0.5425        | 0.7581   | 0.8734      | 0.9144 (86)   |               |
| MIT                                                                                 | 18.7864  | 19.1371  | 19.6725  | 20.2402   | 20.6504    | 20.8736   | 20.9551       | 20.9386                                                            | 20.7569       | 20.1716  | 19.3531     | 18.6859 (87)  |               |
| Th 2                                                                                | 20.0308  | 20.0308  | 20.0308  | 20.0308   | 20.0308    | 20.0308   | 20.0308       | 20.0308                                                            | 20.0308       | 20.0308  | 20.0308     | 20.0308 (88)  |               |
| util rest of house                                                                  |          |          |          |           |            |           |               |                                                                    |               |          |             |               |               |
| 0.8931                                                                              | 0.8519   | 0.7773   | 0.6590   | 0.5150    | 0.3674     | 0.2520    | 0.2878        | 0.4846                                                             | 0.7245        | 0.8567   | 0.9043 (89) |               |               |
| MIT 2                                                                               | 17.4630  | 17.8973  | 18.5535  | 19.2307   | 19.6971    | 19.9311   | 20.0045       | 19.9929                                                            | 19.8246       | 19.1730  | 18.1768     | 17.3380 (90)  |               |
| Living area fraction                                                                |          |          |          |           |            |           |               |                                                                    |               |          |             |               |               |
| MIT                                                                                 | 17.9059  | 18.3123  | 18.9280  | 19.5685   | 20.0162    | 20.2466   | 20.3227       | 20.3094                                                            | 20.1366       | 19.5072  | 18.5705     | 17.7891 (92)  |               |
|                                                                                     |          |          |          |           |            |           |               |                                                                    |               |          |             |               |               |

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|                        |         |         |         |         |         |         |         |         |         |         |         |              |
|------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature adjustment |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT           | 17.9059 | 18.3123 | 18.9280 | 19.5685 | 20.0162 | 20.2466 | 20.3227 | 20.3094 | 20.1366 | 19.5072 | 18.5705 | 17.7891 (93) |

## 8. Space heating requirement

|                                                                                | Jan       | Feb       | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec       |       |
|--------------------------------------------------------------------------------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-------|
| Utilisation                                                                    | 0.8621    | 0.8201    | 0.7494   | 0.6428   | 0.5143   | 0.3801   | 0.2721   | 0.3080   | 0.4912   | 0.7040   | 0.8258   | 0.8740    | (94)  |
| Useful gains                                                                   | 571.0179  | 630.1452  | 669.8713 | 660.5297 | 573.5214 | 418.2675 | 285.8752 | 297.1742 | 422.5250 | 513.0846 | 531.6871 | 548.6866  | (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000   | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000  | 7.1000   | 4.2000    | (96)  |
| Heat loss rate W                                                               | 1076.5084 | 1061.1888 | 983.3148 | 844.1035 | 657.9804 | 446.7596 | 294.5409 | 309.3168 | 477.6195 | 704.7467 | 907.5554 | 1075.1783 | (97)  |
| Space heating kWh                                                              | 376.0849  | 289.6613  | 233.2020 | 132.1732 | 62.8374  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 142.5966 | 270.6251 | 391.7098  | (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |          |          |          |          |          |          |          |          |          | 1898.8904 |       |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (98b) |
| Solar heating contribution - total per year (kWh/year)                         |           |           |          |          |          |          |          |          |          |          |          | 0.0000    |       |
| Space heating kWh                                                              | 376.0849  | 289.6613  | 233.2020 | 132.1732 | 62.8374  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 142.5966 | 270.6251 | 391.7098  | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |          |          |          |          |          |          |          |          |          | 1898.8904 |       |
| Space heating per m2                                                           |           |           |          |          |          |          |          |          |          |          |          | 25.5227   | (99)  |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |           |                |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                |          |          |          |          |          |          |          |          |          |          |          |           | 0.0000 (201)   |
| Fraction of space heat from main system(s)                                                           |          |          |          |          |          |          |          |          |          |          |          |           | 1.0000 (202)   |
| Fraction of main heating from main system 2                                                          |          |          |          |          |          |          |          |          |          |          |          |           | 0.0000 (203)   |
| Fraction of total heating from main system 1                                                         |          |          |          |          |          |          |          |          |          |          |          |           | 1.0000 (204)   |
| Fraction of total heating from main system 2                                                         |          |          |          |          |          |          |          |          |          |          |          |           | 0.0000 (205)   |
| Efficiency of main space heating system 1 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          |           | 100.0000 (206) |
| Efficiency of main space heating system 2 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          |           | 0.0000 (207)   |
| Efficiency of secondary/supplementary heating system, %                                              |          |          |          |          |          |          |          |          |          |          |          |           | 0.0000 (208)   |
| Space heating requirement                                                                            | 376.0849 | 289.6613 | 233.2020 | 132.1732 | 62.8374  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 142.5966 | 270.6251 | 391.7098  | (98)           |
| Space heating efficiency (main heating system 1)                                                     | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 100.0000 | 100.0000 | 100.0000  | (210)          |
| Space heating fuel (main heating system)                                                             | 376.0849 | 289.6613 | 233.2020 | 132.1732 | 62.8374  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 142.5966 | 270.6251 | 391.7098  | (211)          |
| Space heating efficiency (main heating system 2)                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (212)          |
| Space heating fuel (main heating system 2)                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (213)          |
| Space heating fuel (secondary)                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (215)          |
| Space heating fuel used, main system 2                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (213)          |
| Water heating                                                                                        |          |          |          |          |          |          |          |          |          |          |          |           |                |
| Water heating requirement                                                                            | 265.1947 | 234.0774 | 247.2128 | 213.4908 | 204.4030 | 181.3778 | 176.8083 | 185.2957 | 188.9820 | 214.1205 | 231.8729 | 261.7608  | (64)           |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          |           |                |
| (217)m                                                                                               | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050  | (216)          |
| Fuel for water heating, kWh/month                                                                    | 84.6172  | 74.6885  | 78.8797  | 68.1198  | 65.2201  | 57.8733  | 56.4153  | 59.1234  | 60.2996  | 68.3207  | 73.9851  | 83.5216   | (219)          |
| Space cooling fuel requirement                                                                       |          |          |          |          |          |          |          |          |          |          |          |           |                |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (221)          |
| Pumps and Fa                                                                                         | 15.0751  | 13.6162  | 15.0751  | 14.5888  | 15.0751  | 14.5888  | 15.0751  | 15.0751  | 14.5888  | 15.0751  | 14.5888  | 15.0751   | (231)          |
| Lighting                                                                                             | 27.8306  | 22.3267  | 20.1027  | 14.7281  | 11.3764  | 9.2946   | 10.3780  | 13.4897  | 17.5217  | 22.9895  | 25.9666  | 28.6041   | (232)          |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |           |                |
| (233a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (233a)         |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |           |                |
| (234a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (234a)         |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |           |                |
| (235a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235a)         |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |           |                |
| (235c)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235c)         |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |           |                |
| (233b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (233b)         |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |           |                |
| (234b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (234b)         |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |           |                |
| (235b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235b)         |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |           |                |
| (235d)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235d)         |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |           |                |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 1898.8904 | (211)          |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (213)          |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (215)          |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 313.4050  |                |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          | 831.0641  | (219)          |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (221)          |
| Electricity for pumps and fans:                                                                      |          |          |          |          |          |          |          |          |          |          |          |           |                |
| (MEVCentralised, Database: in-use factor = 1.3000, SFP = 0.6630)                                     |          |          |          |          |          |          |          |          |          |          |          |           |                |
| mechanical ventilation fans (SFP = 0.6630)                                                           |          |          |          |          |          |          |          |          |          |          |          | 177.4970  | (230a)         |
| Total electricity for the above, kWh/year                                                            |          |          |          |          |          |          |          |          |          |          |          | 177.4970  | (231)          |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |          |          |          |          |          |          |          |          | 224.6087  | (232)          |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |          |          |          |          |          |          |          |          |           |                |
| PV generation                                                                                        |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (233)          |
| Wind generation                                                                                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (234)          |
| Hydro-electric generation (Appendix N)                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (235a)         |
| Electricity generated - Micro CHP (Appendix N)                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (235)          |
| Appendix Q - special features                                                                        |          |          |          |          |          |          |          |          |          |          |          |           |                |
| Energy saved or generated                                                                            |          |          |          |          |          |          |          |          |          |          |          | -0.0000   | (236)          |
| Energy used                                                                                          |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (237)          |
| Total delivered energy for all uses                                                                  |          |          |          |          |          |          |          |          |          |          |          | 3132.0603 | (238)          |

## 10a. Fuel costs - using Table 12 prices

Fuel Fuel price Fuel cost

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|                                             | kWh/year  | p/kWh   | £/year         |
|---------------------------------------------|-----------|---------|----------------|
| Space heating - main system 1               | 1898.8904 | 16.4900 | 313.1270 (240) |
| Space heating - main system 2               | 0.0000    | 16.4900 | 0.0000 (241)   |
| Total CO2 associated with community systems |           |         | 0.0000 (473)   |
| Water heating (other fuel)                  | 831.0641  | 16.4900 | 137.0425 (247) |
| Energy for instantaneous electric shower(s) | 0.0000    | 16.4900 | 0.0000 (247a)  |
| Pumps, fans and electric keep-hot           | 177.4970  | 16.4900 | 29.2693 (249)  |
| Energy for lighting                         | 224.6087  | 16.4900 | 37.0380 (250)  |
| Additional standing charges                 |           |         | 0.0000 (251)   |
| Total energy cost                           |           |         | 516.4767 (255) |

## 11a. SAP rating - Individual heating systems

|                                  |                                         |              |
|----------------------------------|-----------------------------------------|--------------|
| Energy cost deflator (Table 12): |                                         | 0.3600 (256) |
| Energy cost factor (ECF)         | $[(255) \times (256)] / [(4) + 45.0] =$ | 1.5572 (257) |
| SAP value                        |                                         | 74.7575      |
| SAP rating (Section 12)          |                                         | 75 (258)     |
| SAP band                         |                                         | C            |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|---------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1               | 1898.8904          | 0.1552                        | 294.6291 (261)           |
| Space heating - main system 2               | 0.0000             | 0.0000                        | 0.0000 (262)             |
| Total CO2 associated with community systems |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                  | 831.0641           | 0.1413                        | 117.4242 (264)           |
| Space and water heating                     |                    |                               | 412.0533 (265)           |
| Pumps, fans and electric keep-hot           | 177.4970           | 0.1387                        | 24.6210 (267)            |
| Energy for lighting                         | 224.6087           | 0.1443                        | 32.4180 (268)            |
| Total CO2, kg/year                          |                    |                               | 469.0923 (272)           |
| CO2 emissions per m2                        |                    |                               | 6.3100 (273)             |
| EI value                                    |                    |                               | 94.7355                  |
| EI rating                                   |                    |                               | 95 (274)                 |
| EI band                                     |                    |                               | A                        |

## SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

### 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m)              | Volume<br>(m3)         |
|--------------------------------------------------------|--------------|-----------------------------------|------------------------|
| Main dwelling                                          |              |                                   |                        |
| Ground floor                                           | 45.3000 (1b) | x 2.7500 (2b)                     | = 124.5750 (1b) - (3b) |
| First floor                                            | 29.1000 (1c) | x 3.2600 (2c)                     | = 94.8660 (1c) - (3c)  |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 74.4000      |                                   | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 219.4410 (5)           |

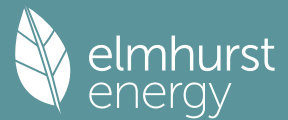
### 2. Ventilation rate

|                                                    | m3 per hour          |
|----------------------------------------------------|----------------------|
| Number of open chimneys                            | 0 * 80 = 0.0000 (6a) |
| Number of open flues                               | 0 * 20 = 0.0000 (6b) |
| Number of chimneys / flues attached to closed fire | 0 * 10 = 0.0000 (6c) |
| Number of flues attached to solid fuel boiler      | 0 * 20 = 0.0000 (6d) |
| Number of flues attached to other heater           | 0 * 35 = 0.0000 (6e) |
| Number of blocked chimneys                         | 0 * 20 = 0.0000 (6f) |
| Number of intermittent extract fans                | 0 * 10 = 0.0000 (7a) |
| Number of passive vents                            | 0 * 10 = 0.0000 (7b) |
| Number of flueless gas fires                       | 0 * 40 = 0.0000 (7c) |

|                                                      |                                                       |                |             |
|------------------------------------------------------|-------------------------------------------------------|----------------|-------------|
| Infiltration due to chimneys, flues and fans         | = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 / (5) = | 0.0000 (8)  |
| Pressure test                                        |                                                       |                | Yes         |
| Pressure Test Method                                 |                                                       |                | Blower Door |
| Measured/design AP50                                 |                                                       |                | 4.0000 (17) |
| Infiltration rate                                    |                                                       |                | 0.2000 (18) |
| Number of sides sheltered                            |                                                       |                | 1 (19)      |
| Shelter factor                                       | (20) = 1 - [0.075 x (19)] =                           |                | 0.9250 (20) |
| Infiltration rate adjusted to include shelter factor | (21) = (18) x (20) =                                  |                | 0.1850 (21) |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 4.3000 | 4.1000 | 4.1000 | 3.8000 | 3.9000 | 3.4000 | 3.4000 | 3.3000 | 3.4000 | 3.8000 | 3.7000 | 4.0000 (22)  |
| Wind factor                                                                                             | 1.0750 | 1.0250 | 1.0250 | 0.9500 | 0.9750 | 0.8500 | 0.8500 | 0.8250 | 0.8500 | 0.9500 | 0.9250 | 1.0000 (22a) |
| Adj infilt rate                                                                                         | 0.1989 | 0.1896 | 0.1896 | 0.1758 | 0.1804 | 0.1573 | 0.1573 | 0.1526 | 0.1573 | 0.1758 | 0.1711 | 0.1850 (22b) |
| Mechanical extract ventilation - centralised                                                            |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        |              |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

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## 3. Heat losses and heat loss parameter

| Element                                                                   | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2        | U-value<br>W/m2K | A x U<br>W/K | K-value<br>kJ/m2K                    | A x K<br>kJ/K |         |         |         |         |         |      |
|---------------------------------------------------------------------------|-------------|----------------|----------------------|------------------|--------------|--------------------------------------|---------------|---------|---------|---------|---------|---------|------|
| Main dwelling                                                             |             |                |                      |                  |              |                                      |               |         |         |         |         |         |      |
| Windows / Glazed Doors                                                    |             |                | 9.9200               | 1.1450           | 11.3588      |                                      |               | (27)    |         |         |         |         |      |
| External Wall                                                             | 74.1300     | 8.9200         | 65.2100              | 0.1500           | 9.7815       | 9.0000                               | 586.8900      | (29a)   |         |         |         |         |      |
| RIR Stud Wall                                                             | 25.3800     |                | 25.3800              | 0.1500           | 3.8070       | 9.0000                               | 228.4200      | (29a)   |         |         |         |         |      |
| Dormer Walls                                                              | 6.6000      | 1.0000         | 5.6000               | 0.1500           | 0.8400       | 9.0000                               | 50.4000       | (29a)   |         |         |         |         |      |
| Adj To RIR Ins At Slope                                                   | 16.0500     |                | 16.0500              | 0.1400           | 2.2470       | 9.0000                               | 144.4500      | (30)    |         |         |         |         |      |
| Slope Roof                                                                | 37.9900     |                | 37.9900              | 0.1400           | 5.3186       | 9.0000                               | 341.9100      | (30)    |         |         |         |         |      |
| Total net area of external elements Aum(A, m2)                            |             |                | 160.1500             |                  |              |                                      |               | (31)    |         |         |         |         |      |
| Fabric heat loss, W/K = Sum (A x U)                                       |             |                | (26)...(30) + (32) = |                  | 33.3529      |                                      |               | (33)    |         |         |         |         |      |
| Main dwelling                                                             |             |                |                      |                  |              |                                      |               |         |         |         |         |         |      |
| Party Wall 1                                                              |             |                | 44.2300              | 0.0000           | 0.0000       | 45.0000                              | 1990.3500     | (32)    |         |         |         |         |      |
| Party Floor 1                                                             |             |                | 45.3000              |                  |              | 30.0000                              | 1359.0000     | (32d)   |         |         |         |         |      |
| Internal Wall 1                                                           |             |                | 113.1500             |                  |              | 9.0000                               | 1018.3500     | (32c)   |         |         |         |         |      |
| Internal Floor 1                                                          |             |                | 29.1000              |                  |              | 18.0000                              | 523.8000      | (32d)   |         |         |         |         |      |
| Internal Ceiling 1                                                        |             |                | 29.1000              |                  |              | 9.0000                               | 261.9000      | (32e)   |         |         |         |         |      |
| Heat capacity Cm = Sum(A x k)                                             |             |                |                      |                  |              | (28)...(30) + (32) + (32a)...(32e) = | 6505.4700     | (34)    |         |         |         |         |      |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K                         |             |                |                      |                  |              |                                      | 87.4391       | (35)    |         |         |         |         |      |
| List of Thermal Bridges                                                   |             |                |                      |                  |              |                                      |               |         |         |         |         |         |      |
| K1 Element                                                                |             |                |                      | Length           | Psi-value    | Total                                |               |         |         |         |         |         |      |
| E2 Other lintels (including other steel lintels)                          |             |                |                      | 7.9700           | 0.0840       | 0.6695                               |               |         |         |         |         |         |      |
| E3 Sill                                                                   |             |                |                      | 7.0600           | 0.0340       | 0.2400                               |               |         |         |         |         |         |      |
| E4 Jamb                                                                   |             |                |                      | 26.6000          | 0.0430       | 1.1438                               |               |         |         |         |         |         |      |
| E16 Corner (normal)                                                       |             |                |                      | 17.5000          | 0.0300       | 0.5250                               |               |         |         |         |         |         |      |
| E18 Party wall between dwellings                                          |             |                |                      | 9.5000           | 0.0400       | 0.3800                               |               |         |         |         |         |         |      |
| E7 Party floor between dwellings (in blocks of flats)                     |             |                |                      | 20.1000          | 0.0660       | 1.3266                               |               |         |         |         |         |         |      |
| E11 Eaves (insulation at rafter level)                                    |             |                |                      | 9.6000           | 0.0130       | 0.1248                               |               |         |         |         |         |         |      |
| E17 Corner (inverted - internal area greater than external area)          |             |                |                      | 8.0000           | 0.0150       | 0.1200                               |               |         |         |         |         |         |      |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) |             |                |                      | 10.7000          | 0.0000       | 0.0000                               |               |         |         |         |         |         |      |
| E13 Gable (insulation at rafter level)                                    |             |                |                      | 16.1000          | 0.0240       | 0.3864                               |               |         |         |         |         |         |      |
| E6 Intermediate floor within a dwelling                                   |             |                |                      | 22.2000          | 0.0800       | 1.7760                               |               |         |         |         |         |         |      |
| P5 Party wall - Roof (insulation at rafter level)                         |             |                |                      | 6.4000           | 0.2400       | 1.5360                               |               |         |         |         |         |         |      |
| P2 Party wall - Intermediate floor within a dwelling                      |             |                |                      | 4.0000           | 0.0000       | 0.0000                               |               |         |         |         |         |         |      |
| R4 Ridge (vaulted ceiling)                                                |             |                |                      | 11.1000          | 0.1200       | 1.3320                               |               |         |         |         |         |         |      |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                |             |                |                      |                  |              |                                      | 9.5601        | (36)    |         |         |         |         |      |
| Point Thermal bridges                                                     |             |                |                      |                  |              | (36a) =                              | 0.0000        |         |         |         |         |         |      |
| Total fabric heat loss                                                    |             |                |                      |                  |              | (33) + (36) + (36a) =                | 42.9130       | (37)    |         |         |         |         |      |
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)       |             |                |                      |                  |              |                                      |               |         |         |         |         |         |      |
| (38)m                                                                     | Jan         | Feb            | Mar                  | Apr              | May          | Jun                                  | Jul           | Aug     | Sep     | Oct     | Nov     | Dec     |      |
| Heat transfer coeff                                                       | 36.2078     | 36.2078        | 36.2078              | 36.2078          | 36.2078      | 36.2078                              | 36.2078       | 36.2078 | 36.2078 | 36.2078 | 36.2078 | 36.2078 | (38) |
| Average = Sum(39)m / 12 =                                                 | 79.1208     | 79.1208        | 79.1208              | 79.1208          | 79.1208      | 79.1208                              | 79.1208       | 79.1208 | 79.1208 | 79.1208 | 79.1208 | 79.1208 | (39) |
| HLP                                                                       | 1.0635      | 1.0635         | 1.0635               | 1.0635           | 1.0635       | 1.0635                               | 1.0635        | 1.0635  | 1.0635  | 1.0635  | 1.0635  | 1.0635  | (40) |
| HLP (average)                                                             |             |                |                      |                  |              |                                      |               |         |         |         |         | 1.0635  |      |
| Days in mont                                                              | 31          | 28             | 31                   | 30               | 31           | 30                                   | 31            | 31      | 30      | 31      | 30      | 31      |      |

## 4. Water heating energy requirements (kWh/year)

|                                                                                |          |          |          |          |          |          |          |          |          |          |          |          |          |       |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-------|
| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |          |          |          | 2.3480   | (42)  |
| Hot water usage for mixer showers                                              |          |          |          |          |          |          |          |          |          |          |          |          |          |       |
| Hot water usage for baths                                                      | 87.4344  | 86.1204  | 84.2057  | 80.5423  | 77.8387  | 74.8238  | 73.1101  | 75.0103  | 77.0933  | 80.3304  | 84.0726  | 87.0994  | 87.0994  | (42a) |
| Hot water usage for other uses                                                 | 27.4684  | 27.0605  | 26.4860  | 25.4268  | 24.6337  | 23.7542  | 23.2792  | 23.8496  | 24.4707  | 25.4118  | 26.4928  | 27.3756  | 27.3756  | (42b) |
| Average daily hot water use (litres/day)                                       | 38.6763  | 37.2699  | 35.8635  | 34.4571  | 33.0507  | 31.6443  | 31.6443  | 33.0507  | 34.4571  | 35.8635  | 37.2699  | 38.6763  | 38.6763  | (42c) |
| Daily hot water use                                                            | 153.5791 | 150.4508 | 146.5552 | 140.4261 | 135.5230 | 130.2222 | 128.0335 | 131.9106 | 136.0211 | 141.6057 | 147.8353 | 153.1513 | 153.1513 | (44)  |
| Energy content (annual)                                                        | 243.2318 | 214.2399 | 225.2499 | 192.2364 | 182.4401 | 160.1234 | 154.8454 | 163.3328 | 167.7276 | 192.1576 | 210.6185 | 239.7979 | 239.7979 | (45)  |
| Distribution loss (46)m = 0.15 x (45)m                                         | 36.4848  | 32.1360  | 33.7875  | 28.8355  | 27.3660  | 24.0185  | 23.2268  | 24.4999  | 25.1591  | 28.8236  | 31.5928  | 35.9697  | 35.9697  | (46)  |
| Water storage loss (or HIU loss):                                              |          |          |          |          |          |          |          |          |          |          |          |          |          |       |
| Store volume                                                                   |          |          |          |          |          |          |          |          |          |          |          |          | 196.0000 | (47)  |
| a) If manufacturer declared loss factor is known (kWh/day):                    |          |          |          |          |          |          |          |          |          |          |          |          | 1.3120   | (48)  |
| Temperature factor from Table 2b                                               |          |          |          |          |          |          |          |          |          |          |          |          | 0.5400   | (49)  |
| Enter (49) or (54) in (55)                                                     |          |          |          |          |          |          |          |          |          |          |          |          | 0.7085   | (55)  |
| Total storage loss                                                             | 21.9629  | 19.8374  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  | 21.9629  | (56)  |
| If cylinder contains dedicated solar storage                                   | 21.9629  | 19.8374  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  | 21.9629  | (57)  |
| Primary loss                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (59)  |
| Combi loss                                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (61)  |
| Total heat required for water heating calculated for each month                | 265.1947 | 234.0774 | 247.2128 | 213.4908 | 204.4030 | 181.3778 | 176.8083 | 185.2957 | 188.9820 | 214.1205 | 231.8729 | 261.7608 | 261.7608 | (62)  |
| WWHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (63a) |
| PV diverter                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (63b) |
| Solar input                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (63c) |
| FGHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (63d) |
| Output from w/h                                                                | 265.1947 | 234.0774 | 247.2128 | 213.4908 | 204.4030 | 181.3778 | 176.8083 | 185.2957 | 188.9820 | 214.1205 | 231.8729 | 261.7608 | 261.7608 | (64)  |
| Electric shower(s)                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (64a) |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |          |          | 0.0000   | 0.0000   | (64a) |
| Heat gains from water heating, kWh/month                                       | 80.8746  | 71.2348  | 74.8956  | 63.9186  | 60.6613  | 53.2410  | 51.4861  | 54.3082  | 55.7694  | 63.8924  | 70.0306  | 79.7328  | 79.7328  | (65)  |

## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |          |          |      |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| Metabolic gains (Table 5), Watts                                                    |          |          |          |          |          |          |          |          |          |          |          |          |          |      |
| (66)m                                                                               | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |          |      |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | (66) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 31.7957  | 28.2406  | 22.9668  | 17.3874  | 12.9973  | 10.9728  | 11.8565  | 15.4116  | 20.6854  | 26.2649  | 30.6550  | 32.6794  | 32.6794  | (67) |

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|                               |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Cooking gains                 | 309.4646 | 312.6759 | 304.5836 | 287.3560 | 265.6093 | 245.1705 | 231.5161 | 228.3048 | 236.3971 | 253.6247 | 275.3714 | 295.8102 (68) |
| Pumps, fans                   | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363 (69)  |
| Losses e.g. evaporation       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (70)   |
| (negative values) (Table 5)   |          |          |          |          |          |          |          |          |          |          |          |               |
| Water heating gains (Table 5) | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 (71) |
| Total internal gains          | 108.7024 | 106.0041 | 100.6661 | 88.7758  | 81.5340  | 73.9459  | 69.2017  | 72.9948  | 77.4575  | 85.8769  | 97.2648  | 107.1677 (72) |
|                               | 548.3599 | 545.3179 | 526.6138 | 491.9164 | 458.5378 | 428.4864 | 410.9716 | 415.1084 | 432.9372 | 464.1636 | 501.6883 | 534.0546 (73) |

## 6. Solar gains

| [Jan]       |          |          |          |           |           | Area<br>m <sup>2</sup> | Solar flux<br>Table 6a<br>W/m <sup>2</sup> | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d |          |          | Gains<br>W   |
|-------------|----------|----------|----------|-----------|-----------|------------------------|--------------------------------------------|-----------------------------------|------------------------------------|------------------------------|----------|----------|--------------|
| East        |          |          |          |           |           | 4.9600                 | 23.8018                                    | 0.7600                            | 0.0000                             | 0.7700                       |          |          | 69.0868 (76) |
| West        |          |          |          |           |           | 4.9600                 | 23.8018                                    | 0.7600                            | 0.0000                             | 0.7700                       |          |          | 69.0868 (80) |
|             |          |          |          |           |           |                        |                                            |                                   |                                    |                              |          |          |              |
| Solar gains | 138.1736 | 236.0921 | 385.2951 | 569.0054  | 678.1730  | 733.8699               | 691.9692                                   | 610.2517                          | 477.1980                           | 300.5179                     | 169.7134 | 114.2818 | (83)         |
| Total gains | 686.5335 | 781.4100 | 911.9088 | 1060.9218 | 1136.7108 | 1162.3563              | 1102.9407                                  | 1025.3601                         | 910.1353                           | 764.6815                     | 671.4017 | 648.3364 | (84)         |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |                           |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |                           |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |                           |         |         |              |
| Jan                                                                         | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct                       | Nov     | Dec     |              |
| tau                                                                         | 22.8395 | 22.8395 | 22.8395 | 22.8395 | 22.8395 | 22.8395 | 22.8395 | 22.8395 | 22.8395                   | 22.8395 | 22.8395 | 22.8395      |
| alpha                                                                       | 2.5226  | 2.5226  | 2.5226  | 2.5226  | 2.5226  | 2.5226  | 2.5226  | 2.5226  | 2.5226                    | 2.5226  | 2.5226  | 2.5226       |
| util living area                                                            | 0.8882  | 0.8505  | 0.7726  | 0.6458  | 0.4970  | 0.3369  | 0.2319  | 0.2557  | 0.4679                    | 0.7099  | 0.8477  | 0.8992 (86)  |
| MIT                                                                         | 19.0135 | 19.3270 | 19.8615 | 20.4081 | 20.7673 | 20.9391 | 20.9838 | 20.9790 | 20.8501                   | 20.3603 | 19.5922 | 18.9315 (87) |
| Th 2                                                                        | 20.0308 | 20.0308 | 20.0308 | 20.0308 | 20.0308 | 20.0308 | 20.0308 | 20.0308 | 20.0308                   | 20.0308 | 20.0308 | 20.0308 (88) |
| util rest of house                                                          | 0.8750  | 0.8337  | 0.7481  | 0.6104  | 0.4497  | 0.2790  | 0.1657  | 0.1853  | 0.4050                    | 0.6702  | 0.8274  | 0.8870 (89)  |
| MIT 2                                                                       | 17.7478 | 18.1338 | 18.7837 | 19.4254 | 19.8222 | 19.9897 | 20.0242 | 20.0218 | 19.9152                   | 19.3919 | 18.4722 | 17.6470 (90) |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | FLA = Living area / (4) = |         |         | 0.3347 (91)  |
| MIT                                                                         | 18.1714 | 18.5331 | 19.1444 | 19.7543 | 20.1385 | 20.3075 | 20.3453 | 20.3421 | 20.2281                   | 19.7160 | 18.8470 | 18.0769 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |
| adjusted MIT                                                                | 18.1714 | 18.5331 | 19.1444 | 19.7543 | 20.1385 | 20.3075 | 20.3453 | 20.3421 | 20.2281                   | 19.7160 | 18.8470 | 18.0769 (93) |

## 8. Space heating requirement

|                                                                                | Jan       | Feb       | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov      | Dec       |       |
|--------------------------------------------------------------------------------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|---------------|----------|-----------|-------|
| Utilisation                                                                    | 0.8435    | 0.8025    | 0.7228   | 0.5996   | 0.4551   | 0.2959   | 0.1874   | 0.2083   | 0.4183   | 0.6559        | 0.7976   | 0.8559    | (94)  |
| Useful gains                                                                   | 579.0575  | 627.0661  | 659.1501 | 636.1490 | 517.3538 | 343.8853 | 206.7302 | 213.5437 | 380.7366 | 501.5655      | 535.4843 | 554.9137  | (95)  |
| Ext temp.                                                                      | 5.1000    | 5.7000    | 7.4000   | 9.9000   | 12.9000  | 15.8000  | 17.7000  | 17.6000  | 15.0000  | 11.5000       | 8.0000   | 5.1000    | (96)  |
| Heat loss rate W                                                               |           |           |          |          |          |          |          |          |          |               |          |           |       |
| Space heating kWh                                                              | 1034.2176 | 1015.3684 | 929.2264 | 779.6795 | 572.7166 | 356.6346 | 209.2996 | 216.9592 | 413.6505 | 650.0527      | 858.2259 | 1026.7424 | (97)  |
| Space heating requirement - total per year (kWh/year)                          | 338.6391  | 260.9392  | 200.9368 | 103.3419 | 41.1899  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 110.4745      | 232.3739 | 351.0405  | (98a) |
| Solar heating kWh                                                              |           |           |          |          |          |          |          |          |          |               |          | 1638.9358 |       |
| Solar heating contribution - total per year (kWh/year)                         | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000   | 0.0000    | (98b) |
| Space heating kWh                                                              |           |           |          |          |          |          |          |          |          |               |          | 0.0000    |       |
| Space heating requirement after solar contribution - total per year (kWh/year) | 338.6391  | 260.9392  | 200.9368 | 103.3419 | 41.1899  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 110.4745      | 232.3739 | 351.0405  | (98c) |
| Space heating per m2                                                           |           |           |          |          |          |          |          |          |          |               |          | 1638.9358 |       |
|                                                                                |           |           |          |          |          |          |          |          |          | (98c) / (4) = |          | 22.0287   | (99)  |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                       |          |          |          |          |          |          |          |          |          |          |          |                |
|-----------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Fraction of space heat from secondary/supplementary system (Table 11) |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)   |
| Fraction of space heat from main system(s)                            |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)   |
| Fraction of main heating from main system 2                           |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (203)   |
| Fraction of total heating from main system 1                          |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (204)   |
| Fraction of total heating from main system 2                          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (205)   |
| Efficiency of main space heating system 1 (in %)                      |          |          |          |          |          |          |          |          |          |          |          | 100.0000 (206) |
| Efficiency of main space heating system 2 (in %)                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)   |
| Efficiency of secondary/supplementary heating system, %               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)   |
| Jan                                                                   | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |                |
| Space heating requirement                                             | 338.6391 | 260.9392 | 200.9368 | 103.3419 | 41.1899  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 110.4745 | 232.3739 | 351.0405 (98)  |
| Space heating efficiency (main heating system 1)                      | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 100.0000 | 100.0000 | 100.0000 (210) |
| Space heating fuel (main heating system)                              | 338.6391 | 260.9392 | 200.9368 | 103.3419 | 41.1899  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 110.4745 | 232.3739 | 351.0405 (211) |
| Space heating efficiency (main heating system 2)                      | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)   |
| Space heating fuel (main heating system 2)                            | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)   |
| Space heating fuel (secondary)                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)   |
| Space heating fuel used, main system 2                                |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)   |
| Water heating                                                         |          |          |          |          |          |          |          |          |          |          |          |                |
| Water heating requirement                                             | 265.1947 | 234.0774 | 247.2128 | 213.4908 | 204.4030 | 181.3778 | 176.8083 | 185.2957 | 188.9820 | 214.1205 | 231.8729 | 261.7608 (64)  |
| Efficiency of water heater (217)m                                     | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 (216) |
| Fuel for water heating, kWh/month                                     | 84.6172  | 74.6885  | 78.8797  | 68.1198  | 65.2201  | 57.8733  | 56.4153  | 59.1234  | 60.2996  | 68.3207  | 73.9851  | 83.5216 (219)  |
| Space cooling fuel requirement (221)m                                 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)   |

# Full SAP Calculation Printout



|                                                                                                      |         |         |         |         |         |         |         |         |         |         |         |           |        |
|------------------------------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|-----------|--------|
| Pumps and Fa                                                                                         | 15.0751 | 13.6162 | 15.0751 | 14.5888 | 15.0751 | 14.5888 | 15.0751 | 15.0751 | 14.5888 | 15.0751 | 14.5888 | 15.0751   | (231)  |
| Lighting                                                                                             | 27.8306 | 22.3267 | 20.1027 | 14.7281 | 11.3764 | 9.2946  | 10.3780 | 13.4897 | 17.5217 | 22.9895 | 25.9666 | 28.6041   | (232)  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |         |         |         |         |         |         |         |         |         |         |         |           |        |
| (233a)m                                                                                              | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000    | (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |         |         |         |         |         |         |         |         |         |         |         |           |        |
| (234a)m                                                                                              | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000    | (234a) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |         |         |         |         |         |         |         |         |         |         |         |           |        |
| (235a)m                                                                                              | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000    | (235a) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |         |         |         |         |         |         |         |         |         |         |         |           |        |
| (235c)m                                                                                              | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000    | (235c) |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |         |         |         |         |         |         |         |         |         |         |         |           |        |
| (233b)m                                                                                              | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000    | (233b) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |         |         |         |         |         |         |         |         |         |         |         |           |        |
| (234b)m                                                                                              | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000    | (234b) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |         |         |         |         |         |         |         |         |         |         |         |           |        |
| (235b)m                                                                                              | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000    | (235b) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |         |         |         |         |         |         |         |         |         |         |         |           |        |
| (235d)m                                                                                              | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000    | (235d) |
| Annual totals kWh/year                                                                               |         |         |         |         |         |         |         |         |         |         |         |           |        |
| Space heating fuel - main system 1                                                                   |         |         |         |         |         |         |         |         |         |         |         | 1638.9358 | (211)  |
| Space heating fuel - main system 2                                                                   |         |         |         |         |         |         |         |         |         |         |         | 0.0000    | (213)  |
| Space heating fuel - secondary                                                                       |         |         |         |         |         |         |         |         |         |         |         | 0.0000    | (215)  |
| Efficiency of water heater                                                                           |         |         |         |         |         |         |         |         |         |         |         | 313.4050  |        |
| Water heating fuel used                                                                              |         |         |         |         |         |         |         |         |         |         |         | 831.0641  | (219)  |
| Space cooling fuel                                                                                   |         |         |         |         |         |         |         |         |         |         |         | 0.0000    | (221)  |
| Electricity for pumps and fans:                                                                      |         |         |         |         |         |         |         |         |         |         |         |           |        |
| (MEV)Centralised, Database: in-use factor = 1.3000, SFP = 0.6630)                                    |         |         |         |         |         |         |         |         |         |         |         |           |        |
| mechanical ventilation fans (SFP = 0.6630)                                                           |         |         |         |         |         |         |         |         |         |         |         | 177.4970  | (230a) |
| Total electricity for the above, kWh/year                                                            |         |         |         |         |         |         |         |         |         |         |         | 177.4970  | (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |         |         |         |         |         |         |         |         |         |         |         | 224.6087  | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |         |         |         |         |         |         |         |         |         |         |         |           |        |
| PV generation                                                                                        |         |         |         |         |         |         |         |         |         |         |         | 0.0000    | (233)  |
| Wind generation                                                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000    | (234)  |
| Hydro-electric generation (Appendix N)                                                               |         |         |         |         |         |         |         |         |         |         |         | 0.0000    | (235a) |
| Electricity generated - Micro CHP (Appendix N)                                                       |         |         |         |         |         |         |         |         |         |         |         | 0.0000    | (235)  |
| Appendix Q - special features                                                                        |         |         |         |         |         |         |         |         |         |         |         |           |        |
| Energy saved or generated                                                                            |         |         |         |         |         |         |         |         |         |         |         | -0.0000   | (236)  |
| Energy used                                                                                          |         |         |         |         |         |         |         |         |         |         |         | 0.0000    | (237)  |
| Total delivered energy for all uses                                                                  |         |         |         |         |         |         |         |         |         |         |         | 2872.1056 | (238)  |

## 10a. Fuel costs - using BEDF prices (585)

|                                             | Fuel<br>kWh/year | Fuel price<br>p/kWh | Fuel cost<br>£/year |        |
|---------------------------------------------|------------------|---------------------|---------------------|--------|
| Space heating - main system 1               | 1638.9358        | 28.4300             | 465.9494            | (240)  |
| Space heating - main system 2               | 0.0000           | 28.4300             | 0.0000              | (241)  |
| Total CO2 associated with community systems |                  |                     | 0.0000              | (473)  |
| Water heating (other fuel)                  | 831.0641         | 28.4300             | 236.2715            | (247)  |
| Energy for instantaneous electric shower(s) | 0.0000           | 28.4300             | 0.0000              | (247a) |
| Pumps, fans and electric keep-hot           | 177.4970         | 28.4300             | 50.4624             | (249)  |
| Energy for lighting                         | 224.6087         | 28.4300             | 63.8563             | (250)  |
| Additional standing charges                 |                  |                     | 0.0000              | (251)  |
| Total energy cost                           |                  |                     | 816.5396            | (255)  |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |       |
|---------------------------------------------|--------------------|-------------------------------|--------------------------|-------|
| Space heating - main system 1               | 1638.9358          | 0.1557                        | 255.2393                 | (261) |
| Space heating - main system 2               | 0.0000             | 0.0000                        | 0.0000                   | (262) |
| Total CO2 associated with community systems |                    |                               | 0.0000                   | (373) |
| Water heating (other fuel)                  | 831.0641           | 0.1413                        | 117.4242                 | (264) |
| Space and water heating                     |                    |                               | 372.6635                 | (265) |
| Pumps, fans and electric keep-hot           | 177.4970           | 0.1387                        | 24.6210                  | (267) |
| Energy for lighting                         | 224.6087           | 0.1443                        | 32.4180                  | (268) |
| Total CO2, kg/year                          |                    |                               | 429.7025                 | (272) |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |       |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|-------|
| Space heating - main system 1               | 1638.9358          | 1.5766                              | 2583.8685                  | (275) |
| Space heating - main system 2               | 0.0000             | 0.0000                              | 0.0000                     | (276) |
| Total CO2 associated with community systems |                    |                                     | 0.0000                     | (473) |
| Water heating (other fuel)                  | 831.0641           | 1.5225                              | 1265.2724                  | (278) |
| Space and water heating                     |                    |                                     | 3849.1409                  | (279) |
| Pumps, fans and electric keep-hot           | 177.4970           | 1.5128                              | 268.5175                   | (281) |
| Energy for lighting                         | 224.6087           | 1.5338                              | 344.5124                   | (282) |
| Total Primary energy kWh/year               |                    |                                     | 4462.1708                  | (286) |

# Predicted Energy Assessment



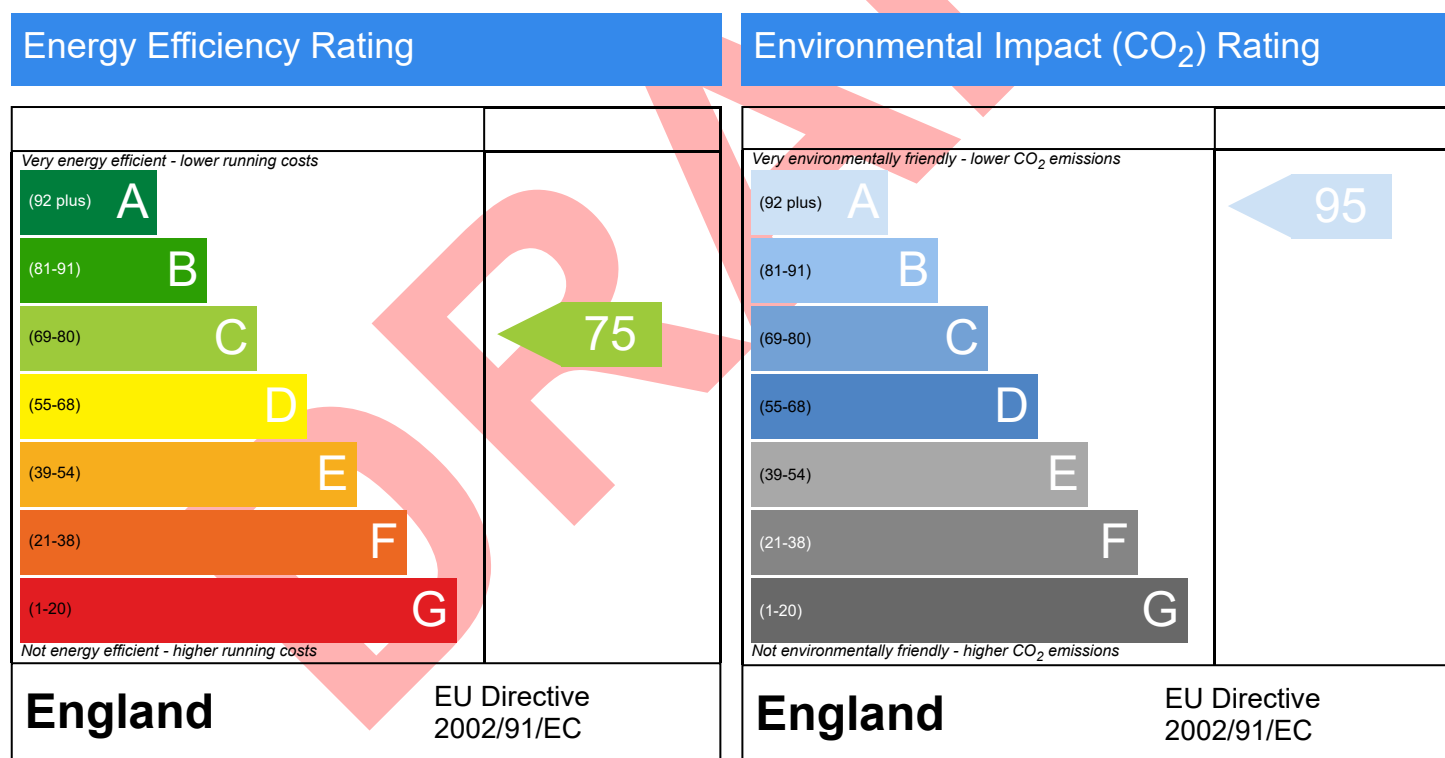
Flat 3, 85, Pell Street, Reading, RG1 2NP

Dwelling type:  
Date of assessment:  
SAP Version:  
Produced by:  
Total floor area:  
DRRN:

Flat, End-Terrace  
28/11/2025  
10.2  
Peter Yearsley  
74.4 m<sup>2</sup>

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO<sub>2</sub>) emissions.



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO<sub>2</sub>) emissions. The higher the rating the less impact it has on the environment.

# Summary for Input Data



|                      |                                           |               |                |            |
|----------------------|-------------------------------------------|---------------|----------------|------------|
| Plot Reference       | Flat 3, 85 Pell Street                    |               | Issued on Date | 28/11/2025 |
| Assessment Reference | Electric Panel Heaters HC                 | Plot Type Ref |                |            |
| Plot Address         | Flat 3, 85, Pell Street, Reading, RG1 2NP |               | SAP Version    | 10.2       |

|                                    |          |               |       |      |       |
|------------------------------------|----------|---------------|-------|------|-------|
| SAP Rating                         | 75 C     | DER           | 6.50  | TER  | 13.47 |
| Environmental                      | 95 A     | % DER < TER   |       |      | 51.74 |
| CO <sub>2</sub> Emissions (t/year) | 0.43     | DFEE          | 36.67 | TFEE | 39.42 |
| Compliance Check                   | See BREL | % DFEE < TFEE |       |      | 6.98  |
| % DPER < TPER                      | 5.06     | DPER          | 67.45 | TPER | 71.04 |

|                  |                    |             |           |
|------------------|--------------------|-------------|-----------|
| Assessor Details | Mr. Peter Yearsley | Assessor ID | R301-0001 |
| Client           |                    |             |           |

## SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

|                                |                     |        |
|--------------------------------|---------------------|--------|
| Orientation                    | North               |        |
| Property Tenture               | ND                  |        |
| Transaction Type               | 6                   |        |
| Terrain Type                   | Suburban            |        |
| 1.0 Property Type              | Flat, End-Terrace   |        |
| Position of Flat               | Mid-floor flat      |        |
| Which Floor                    | 1                   |        |
| 2.0 Number of Storeys          | 2                   |        |
| 3.0 Date Built                 | 2025                |        |
| 4.0 Sheltered Sides            | 1                   |        |
| 5.0 Sunlight/Shade             | Average or unknown  |        |
| 6.0 Thermal Mass Parameter     | Precise calculation |        |
| Thermal Mass                   | 87.44               | kJ/m²K |
|                                |                     |        |
| 7.0 Electricity Tariff         | Standard            |        |
| Smart electricity meter fitted | No                  |        |
| Smart gas meter fitted         | No                  |        |

|                  |               |                     |                      |                       |
|------------------|---------------|---------------------|----------------------|-----------------------|
| 7.0 Measurements |               | Heat Loss Perimeter | Internal Floor Area  | Average Storey Height |
|                  | Ground floor: | 20.10 m             | 45.30 m <sup>2</sup> | 2.75 m                |
|                  | 1st Storey:   | 22.20 m             | 29.10 m <sup>2</sup> | 3.26 m                |

|                 |       |                |
|-----------------|-------|----------------|
| 8.0 Living Area | 24.90 | m <sup>2</sup> |
|-----------------|-------|----------------|

| Description   | Type         | Construction                                   | U-Value (W/m <sup>2</sup> K) | Kappa (kJ/m <sup>2</sup> K) | Gross Area(m <sup>2</sup> ) | Nett Area (m <sup>2</sup> ) | Shelter Res | Shelter | Openings | Area Calculation Type |
|---------------|--------------|------------------------------------------------|------------------------------|-----------------------------|-----------------------------|-----------------------------|-------------|---------|----------|-----------------------|
| External Wall | Timber Frame | Timber framed wall (one layer of plasterboard) | 0.15                         | 9.00                        | 74.13                       | 65.21                       | 0.00        | None    | 8.92     | Enter Gross Area      |
| RIR Stud Wall | Timber Frame | Timber framed wall (one layer of plasterboard) | 0.15                         | 9.00                        | 25.38                       | 25.38                       | 0.00        | None    | 0.00     | Enter Gross Area      |
| Dormer Walls  | Timber Frame | Timber framed wall (one layer of plasterboard) | 0.15                         | 9.00                        | 6.60                        | 5.60                        | 0.00        | None    | 1.00     | Enter Gross Area      |

| Description  | Type                            | Construction | U-Value (W/m <sup>2</sup> K) | Kappa (kJ/m <sup>2</sup> K) | Area (m <sup>2</sup> ) | Shelter Res | Shelter |
|--------------|---------------------------------|--------------|------------------------------|-----------------------------|------------------------|-------------|---------|
| Party Wall 1 | Filled Cavity with Edge Sealing | Other        | 0.00                         | 45.00                       | 44.23                  |             | None    |

| Description     | Construction                 | Kappa (kJ/m <sup>2</sup> K) | Area (m <sup>2</sup> ) |
|-----------------|------------------------------|-----------------------------|------------------------|
| Internal Wall 1 | Plasterboard on timber frame | 9.00                        | 113.15                 |

| Description             | Type                | Construction                             | U-Value (W/m <sup>2</sup> K) | Kappa (kJ/m <sup>2</sup> K) | Gross Area(m <sup>2</sup> ) | Nett Area (m <sup>2</sup> ) | Shelter Code | Shelter Factor | Calculation Type | Openings |
|-------------------------|---------------------|------------------------------------------|------------------------------|-----------------------------|-----------------------------|-----------------------------|--------------|----------------|------------------|----------|
| Adj To RIR Ins At Slope | External Plane Roof | Plasterboard, insulated at ceiling level | 0.14                         | 9.00                        | 16.05                       | 16.05                       | None         | 0.00           | Enter Gross Area | 0.00     |
| Slope Roof              | External Slope Roof | Plasterboard, insulated slope            | 0.14                         | 9.00                        | 37.99                       | 37.99                       | None         | 0.00           | Enter Gross Area | 0.00     |

## 10.2 Internal Ceilings

# Summary for Input Data

|                                          |                                  |                                                                       |                      |                           |
|------------------------------------------|----------------------------------|-----------------------------------------------------------------------|----------------------|---------------------------|
| <b>Description</b><br>Internal Ceiling 1 | <b>Storey</b><br>Lowest occupied | <b>Construction</b><br>Plasterboard ceiling, carpeted chipboard floor | <b>Kappa</b><br>9.00 | <b>Area (m²)</b><br>29.10 |
|------------------------------------------|----------------------------------|-----------------------------------------------------------------------|----------------------|---------------------------|

|                          |                     |                     |                       |                  |
|--------------------------|---------------------|---------------------|-----------------------|------------------|
| <b>11.1 Party Floors</b> |                     |                     |                       |                  |
| <b>Description</b>       | <b>Storey Index</b> | <b>Construction</b> | <b>Kappa (kJ/m²K)</b> | <b>Area (m²)</b> |
| Party Floor 1            | +1                  | Other               | 30.00                 | 45.30            |

|                             |                     |                                                |                       |                  |
|-----------------------------|---------------------|------------------------------------------------|-----------------------|------------------|
| <b>11.2 Internal Floors</b> |                     |                                                |                       |                  |
| <b>Description</b>          | <b>Storey Index</b> | <b>Construction</b>                            | <b>Kappa (kJ/m²K)</b> | <b>Area (m²)</b> |
| Internal Floor 1            | +1                  | Plasterboard ceiling, carpeted chipboard floor | 18.00                 | 29.10            |

|                           |                           |             |                |                    |                     |                |                   |                     |                        |
|---------------------------|---------------------------|-------------|----------------|--------------------|---------------------|----------------|-------------------|---------------------|------------------------|
| <b>12.0 Opening Types</b> |                           |             |                |                    |                     |                |                   |                     |                        |
| <b>Description</b>        | <b>Data Source</b>        | <b>Type</b> | <b>Glazing</b> | <b>Glazing Gap</b> | <b>Filling Type</b> | <b>G-value</b> | <b>Frame Type</b> | <b>Frame Factor</b> | <b>U Value (W/m²K)</b> |
| Solid Door                | Manufacturer              | Solid Door  |                |                    |                     | 0.00           |                   |                     | 1.20                   |
| Windows / Glazed Doors    | BFRC, BSI or CERTASS data | Window      | Double glazed  |                    |                     | 0.76           |                   |                     | 1.20                   |

|                      |                        |                 |                    |                  |              |
|----------------------|------------------------|-----------------|--------------------|------------------|--------------|
| <b>13.0 Openings</b> |                        |                 |                    |                  |              |
| <b>Name</b>          | <b>Opening Type</b>    | <b>Location</b> | <b>Orientation</b> | <b>Area (m²)</b> | <b>Pitch</b> |
| Opening2             | Windows / Glazed Doors | External Wall   | East               | 4.96             |              |
| Opening3             | Windows / Glazed Doors | External Wall   | West               | 3.96             |              |
| Opening4             | Windows / Glazed Doors | Dormer Walls    | West               | 1.00             |              |

|                              |                                                |
|------------------------------|------------------------------------------------|
| <b>14.0 Conservatory</b>     | <input type="text" value="None"/>              |
| <b>15.0 Draught Proofing</b> | <input type="text" value="100"/> %             |
| <b>16.0 Draught Lobby</b>    | <input type="text" value="Yes"/>               |
| <b>17.0 Thermal Bridging</b> | <input type="text" value="Calculate Bridges"/> |

|                                                                           |                        |               |            |                 |                      |                 |
|---------------------------------------------------------------------------|------------------------|---------------|------------|-----------------|----------------------|-----------------|
| <b>17.1 List of Bridges</b>                                               |                        |               |            |                 |                      |                 |
| <b>Bridge Type</b>                                                        | <b>Source Type</b>     | <b>Length</b> | <b>Psi</b> | <b>Adjusted</b> | <b>Reference:</b>    | <b>Imported</b> |
| E2 Other lintels (including other steel lintels)                          | Independently assessed | 7.97          | 0.08       | 0.08            | R.O.I. Psi Value     | No              |
| E3 Sill                                                                   | Independently assessed | 7.06          | 0.03       | 0.03            | R.O.I. Psi Value     | No              |
| E4 Jamb                                                                   | Independently assessed | 26.60         | 0.04       | 0.04            | R.O.I. Psi Value     | No              |
| E16 Corner (normal)                                                       | Independently assessed | 17.50         | 0.03       | 0.03            | R.O.I. Psi Value     | No              |
| E18 Party wall between dwellings                                          | Independently assessed | 9.50          | 0.04       | 0.04            | R.O.I. Psi Value     | No              |
| E7 Party floor between dwellings (in blocks of flats)                     | Independently assessed | 20.10         | 0.07       | 0.07            | R.O.I. Psi Value     | No              |
| E11 Eaves (insulation at rafter level)                                    | Independently assessed | 9.60          | 0.01       | 0.01            | R.O.I. Psi Value     | No              |
| E17 Corner (inverted – internal area greater than external area)          | Independently assessed | 8.00          | 0.01       | 0.01            | R.O.I. Psi Value     | No              |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | Table K1 - Default     | 10.70         | 0.00       | 0.00            |                      | No              |
| E13 Gable (insulation at rafter level)                                    | Independently assessed | 16.10         | 0.02       | 0.02            | R.O.I. Psi Value     | No              |
| E6 Intermediate floor within a dwelling                                   | Independently assessed | 22.20         | 0.08       | 0.08            | R.O.I. Psi Value     | No              |
| P5 Party wall - Roof (insulation at rafter level)                         | Independently assessed | 6.40          | 0.24       | 0.24            | Default Value Halved | No              |
| P2 Party wall - Intermediate floor within a dwelling                      | Table K1 - Default     | 4.00          | 0.00       | 0.00            |                      | No              |
| R4 Ridge (vaulted ceiling)                                                | Table K1 - Default     | 11.10         | 0.12       | 0.12            |                      | No              |

|                |                                         |
|----------------|-----------------------------------------|
| <b>Y-value</b> | <input type="text" value="0.06"/> W/m²K |
|----------------|-----------------------------------------|

|                                       |                                                                           |
|---------------------------------------|---------------------------------------------------------------------------|
| <b>19.0 Mechanical Ventilation</b>    |                                                                           |
| <b>Mechanical Ventilation</b>         |                                                                           |
| Mechanical Ventilation System Present | <input type="text" value="Yes"/>                                          |
| Approved Installation                 | <input type="text" value="Yes"/>                                          |
| Mechanical Ventilation data Type      | <input type="text" value="Database"/>                                     |
| Type                                  | <input type="text" value="Mechanical extract ventilation - centralised"/> |
| MV Reference Number                   | <input type="text" value="500735"/>                                       |
| Configuration                         | <input type="text" value="1"/>                                            |
| Manufacturer SFP                      | <input type="text" value="0.51"/>                                         |
| Duct Type                             | <input type="text" value="Rigid"/>                                        |
| Wet Rooms                             | <input type="text" value="1"/>                                            |

|                                                  |                                |
|--------------------------------------------------|--------------------------------|
| <b>20.0 Fans, Open Fireplaces, Flues</b>         |                                |
| Number of open chimneys                          | <input type="text" value="0"/> |
| Number of open flues                             | <input type="text" value="0"/> |
| Number of chimneys/flues attached to closed fire | <input type="text" value="0"/> |
| Number of flues attached to solid fuel boiler    | <input type="text" value="0"/> |
| Number of flues attached to other heater         | <input type="text" value="0"/> |
| Number of blocked chimneys                       | <input type="text" value="0"/> |

# Summary for Input Data

|                                     |                                |
|-------------------------------------|--------------------------------|
| Number of intermittent extract fans | <input type="text" value="0"/> |
| Number of passive vents             | <input type="text" value="0"/> |
| Number of flueless gas fires        | <input type="text" value="0"/> |

**21.0 Fixed Cooling System**

**22.0 Pressure Testing**

Designed AP<sub>50</sub>  m<sup>3</sup>/(h.m<sup>2</sup>) @ 50 Pa

Test Method

**22.0 Lighting**

No Fixed Lighting

| Name       | Efficacy | Power | Capacity | Count |
|------------|----------|-------|----------|-------|
| Lighting 1 | 90.00    | 5.00  | 450.00   | 9     |

**24.0 Main Heating 1**

Percentage of Heat  %

Fuel Type

SAP Code

In Winter

In Summer

Controls SAP Code

Controls description

**25.0 Main Heating 2**

Percentage of Heat  %

Database Ref. No.

Fuel Type

In Winter

In Summer

Model Name

Manufacturer

Controls

Controls description

**26.0 Heat Networks**

**27.0 Secondary Heating**

**28.0 Water Heating**

Water Heating

SAP Code

Flue Gas Heat Recovery System

Waste Water Heat Recovery Instantaneous System 1

Waste Water Heat Recovery Instantaneous System 2

Waste Water Heat Recovery Storage System

Solar Panel

Water use <= 125 litres/person/day

Cold Water Source

Bath Count

Immersion Only Heating Hot Water

**28.1 Showers**

| Description | Shower Type                               | Flow Rate [l/min] | Rated Power [kW] | Connected | Connected To |
|-------------|-------------------------------------------|-------------------|------------------|-----------|--------------|
| Shower      | Combi boiler or unvented hot water system | 11.00             |                  | No        |              |

**28.3 Waste Water Heat Recovery System**

# Summary for Input Data



## 29.0 Hot Water Cylinder

|                 |               |
|-----------------|---------------|
| Internal Store  |               |
| Insulation Type | Measured Loss |
| Cylinder Volume | 196.00 L      |
| Loss            | 1.31 kWh/day  |

## 34.0 Small-scale Hydro

None

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

## Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

|                     | Typical Cost | Typical savings per year | Ratings after improvement<br>SAP rating | Environmental Impact |
|---------------------|--------------|--------------------------|-----------------------------------------|----------------------|
| Solar water heating |              |                          | 0                                       | 0                    |
| Photovoltaic        |              |                          | 0                                       | 0                    |
| Wind turbine        |              |                          | 0                                       | 0                    |

# Thermal Bridging

|                      |                                           |               |                  |            |
|----------------------|-------------------------------------------|---------------|------------------|------------|
| Plot Reference       | Flat 3, 85 Pell Street                    |               | Issued on Date   | 28/11/2025 |
| Assessment Reference | Electric Panel Heaters HC                 | Plot Type Ref | End-Terrace Flat |            |
| Plot Address         | Flat 3, 85, Pell Street, Reading, RG1 2NP |               | SAP Version      | 10.2       |

|                                    |          |               |       |      |       |
|------------------------------------|----------|---------------|-------|------|-------|
| SAP Rating                         | 75 C     | DER           | 6.50  | TER  | 13.47 |
| Environmental                      | 95 A     | % DER < TER   |       |      | 51.74 |
| CO <sub>2</sub> Emissions (t/year) | 0.43     | DFEE          | 36.67 | TFEE | 39.42 |
| Compliance Check                   | See BREL | % DFEE < TFEE |       |      | 6.98  |
| % DPER < TPER                      | 5.06     | DPER          | 67.45 | TPER | 71.04 |

|                  |                    |             |           |
|------------------|--------------------|-------------|-----------|
| Assessor Details | Mr. Peter Yearsley | Assessor ID | R301-0001 |
| Client           |                    |             |           |

|               | Junction details                                                          | Source Type            | Psi (W/mK) | Length (m) | Result | Reference            |
|---------------|---------------------------------------------------------------------------|------------------------|------------|------------|--------|----------------------|
| External wall | E2 Other lintels (including other steel lintels)                          | Independently assessed | 0.084      | 7.97       | 0.67   | R.O.I. Psi Value     |
| External wall | E3 Sill                                                                   | Independently assessed | 0.034      | 7.06       | 0.24   | R.O.I. Psi Value     |
| External wall | E4 Jamb                                                                   | Independently assessed | 0.043      | 26.60      | 1.14   | R.O.I. Psi Value     |
| External wall | E16 Corner (normal)                                                       | Independently assessed | 0.030      | 17.50      | 0.53   | R.O.I. Psi Value     |
| External wall | E18 Party wall between dwellings                                          | Independently assessed | 0.040      | 9.50       | 0.38   | R.O.I. Psi Value     |
| External wall | E7 Party floor between dwellings (in blocks of flats)                     | Independently assessed | 0.066      | 20.10      | 1.33   | R.O.I. Psi Value     |
| External wall | E11 Eaves (insulation at rafter level)                                    | Independently assessed | 0.013      | 9.60       | 0.12   | R.O.I. Psi Value     |
| External wall | E17 Corner (inverted – internal area greater than external area)          | Independently assessed | 0.015      | 8.00       | 0.12   | R.O.I. Psi Value     |
| Party wall    | P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | Table K1 - Default     | 0.000      | 10.70      | 0.00   |                      |
| External wall | E13 Gable (insulation at rafter level)                                    | Independently assessed | 0.024      | 16.10      | 0.39   | R.O.I. Psi Value     |
| External wall | E6 Intermediate floor within a dwelling                                   | Independently assessed | 0.080      | 22.20      | 1.78   | R.O.I. Psi Value     |
| Party wall    | P5 Party wall - Roof (insulation at rafter level)                         | Independently assessed | 0.240      | 6.40       | 1.54   | Default Value Halved |
| Party wall    | P2 Party wall - Intermediate floor within a dwelling                      | Table K1 - Default     | 0.000      | 4.00       | 0.00   |                      |
| External roof | R4 Ridge (vaulted ceiling)                                                | Table K1 - Default     | 0.120      | 11.10      | 1.33   |                      |

Total: 176.83 W/mK:  
Y-Value: 0.06 W/m²K:

# Energy Report



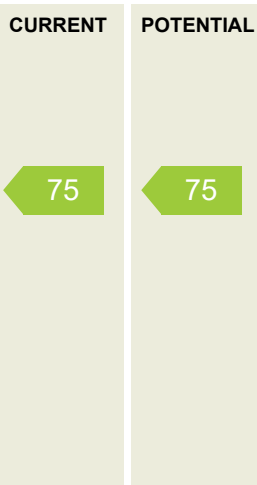
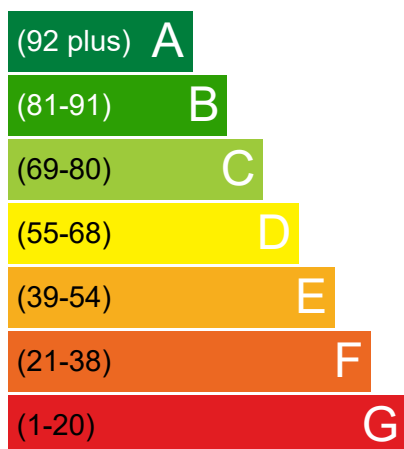
|                  |                                                  |
|------------------|--------------------------------------------------|
| Dwelling Address | Flat 3, 85, Pell Street, Reading, RG1 2NP        |
| Reference        | Flat 3, 85 Pell Street-Electric Panel Heaters HC |
| SAP Version      | 10.2                                             |
| Assessment Date  | 28/11/2025                                       |
| Submission Date  |                                                  |
| Property Type    | Flat, End-Terrace                                |
| Total Floor Area | 74                                               |

This Energy Report has been generated using the UK's National Calculation Methodology for dwellings, Standard Assessment Procedure (SAP). This methodology is used to assess the energy efficiency of dwellings which is calculated based on a dwelling's heating, hot water, ventilation and lighting usage.

This document is not an Energy Performance Certificate (EPC) as required by the Energy Performance of Buildings Regulations

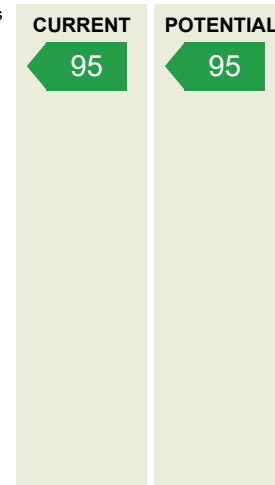
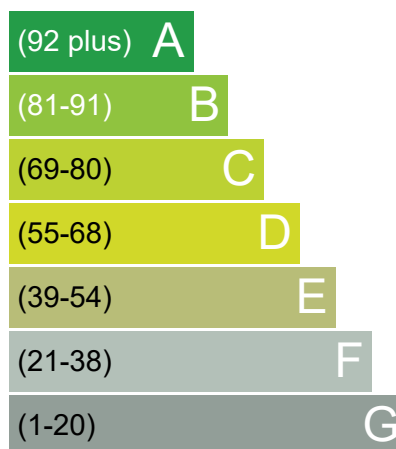
## Energy Efficiency Rating

Most energy efficient - lower running costs



## Carbon Dioxide (CO2) Emissions Rating

Very environmentally friendly - lower CO2 emissions



## Additional ratings for your home

|           | Primary Energy | Energy      | Carbon    | Cost        | HTC       |
|-----------|----------------|-------------|-----------|-------------|-----------|
| CURRENT   | 59.98<br>kWh   | 2872<br>kWh | 430<br>kg | 816.54<br>£ | 79<br>W/K |
| POTENTIAL | 59.98<br>kWh   | 2872<br>kWh | 430<br>kg | 816.54<br>£ | 79<br>W/K |

## Breakdown of property's energy performance

Each feature is assessed as one of the following:

|           |      |         |      |           |
|-----------|------|---------|------|-----------|
| Very Poor | Poor | Average | Good | Very Good |
|-----------|------|---------|------|-----------|

| Feature               | Description                                                              | Energy Performance |
|-----------------------|--------------------------------------------------------------------------|--------------------|
| Walls                 | Average thermal transmittance 0.15 W/m <sup>2</sup> K                    | Very Good          |
| Roof                  | Average thermal transmittance 0.14 W/m <sup>2</sup> K                    | Very Good          |
| Windows               | High performance glazing                                                 | Very Good          |
| Main heating          | Room heaters, electric                                                   | Very Poor          |
| Main heating controls | Programmer and appliance thermostats                                     | Good               |
| Secondary heating     | None                                                                     |                    |
| Hot water             | From main system                                                         | Very Good          |
| Lighting              | Good lighting efficiency                                                 | Good               |
| Air tightness         | Air permeability [AP50] = 4.0 m <sup>3</sup> /h.m <sup>2</sup> (assumed) | Good               |

## Recommendations

The recommended measures provided below will help to improve the energy efficiency of the dwelling. To reach the dwelling's potential energy rating all of the recommended measures shown below would need to be installed. Having these measures installed individually or in any other order may give a different result when compared with the cumulative potential rating.

| Recommended measures | Cumulative savings (per year) | Cumulative rating | Typical costs | Incremental savings (per year) | Cumulative CO2 rating |
|----------------------|-------------------------------|-------------------|---------------|--------------------------------|-----------------------|
|----------------------|-------------------------------|-------------------|---------------|--------------------------------|-----------------------|

The typical cost is based on average installation prices across the country so may not be representative of the actual costs in your area.

## Estimated energy costs of the dwelling

# Energy Report

The table below shows the estimated running costs of the space and water heating and lighting within the dwelling. It does not include the energy used from household appliances. The estimated annual costs after potential improvements indicates the total energy cost if all recommended measures named above were installed.

|                                    |                                                                                   | Estimated annual costs | Estimated annual costs after potential improvements | Potential future savings                                                            |
|------------------------------------|-----------------------------------------------------------------------------------|------------------------|-----------------------------------------------------|-------------------------------------------------------------------------------------|
| Lighting                           |  | £64                    | £64                                                 |  |
| Heating                            |  | £516                   | £516                                                |                                                                                     |
| Hot Water                          |  | £236                   | £236                                                |                                                                                     |
| New Technologies e.g. Impact of PV |                                                                                   | £0                     | £0                                                  |                                                                                     |
| TOTAL                              |                                                                                   | £817                   | £817                                                |                                                                                     |

## Estimated energy use and potential savings



Space Heating

**1639**

kWh per year



Water Heating

**831**

kWh per year

## About this document

Created by:

Company/Trading name:

Phone number:

Email address:

### Disclaimer

This Energy Report should not under any circumstances be treated as a Condition Survey and cannot be used to indicate that any element of the dwelling (e.g. heating system) is working correctly.

This Energy Report must not be used in situations where an Energy Performance Certificate (EPC) is required.

This Energy Report is generated from a set of data inputs which may not reflect the actual dimensions, services or construction of the dwelling.

The calculation used to generate this report reflects the SAP Methodology current at the time of report generation.

## Glossary terms for additional metrics

|                           |                                                                                                                                                                                                                                                                       |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Primary Energy            | The measure of the energy required for lighting, heating and hot water in a property. This includes the efficiency of the property's heating system, power station efficiency for electricity and the energy used to produce the fuel and deliver it to the property. |
| Energy Used               | The estimated amount of fuel energy for lighting, heating and hot water for the property. The estimate is based on typical usage which is likely to be different to actual consumption.                                                                               |
| Carbon (CO2)              | The current emissions based on the energy estimates.                                                                                                                                                                                                                  |
| Cost                      | The estimated cost of energy. The cost of each unit of fuel is based on an industry standard which is likely to be different to those the occupier actually pays.                                                                                                     |
| Heat Transfer Coefficient | Heat flow through the property envelope where internal and external temperatures are different.                                                                                                                                                                       |

# Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Fri 28 Nov 2025 14:02:42

| Project Information |                |                 |                   |
|---------------------|----------------|-----------------|-------------------|
| Assessed By         | Peter Yearsley | Building Type   | Flat, End-terrace |
| OCDEA Registration  | EES/017088     | Assessment Date | 2025-11-28        |

| Dwelling Details |                                         |                  |                           |
|------------------|-----------------------------------------|------------------|---------------------------|
| Assessment Type  | As designed                             | Total Floor Area | 74 m <sup>2</sup>         |
| Site Reference   | Flat 4, 85 Pell Street                  | Plot Reference   | Electric Panel Heaters HC |
| Address          | 85 Flat 4 Pell Street, Reading, RG1 2NP |                  |                           |

| Client Details |       |
|----------------|-------|
| Name           | Array |
| Company        | Array |
| Address        |       |

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

## 1a Target emission rate and dwelling emission rate

|                                       |                                                        |
|---------------------------------------|--------------------------------------------------------|
| Fuel for main heating system          | Electricity                                            |
| Target carbon dioxide emission rate   | 13.17 kgCO <sub>2</sub> /m <sup>2</sup>                |
| Dwelling carbon dioxide emission rate | 6.34 kgCO <sub>2</sub> /m <sup>2</sup> <span>OK</span> |

## 1b Target primary energy rate and dwelling primary energy

|                         |                                                         |
|-------------------------|---------------------------------------------------------|
| Target primary energy   | 69.44 kWh <sub>PE</sub> /m <sup>2</sup>                 |
| Dwelling primary energy | 65.74 kWh <sub>PE</sub> /m <sup>2</sup> <span>OK</span> |

## 1c Target fabric energy efficiency and dwelling fabric energy efficiency

|                                   |                                         |
|-----------------------------------|-----------------------------------------|
| Target fabric energy efficiency   | 38.0 kWh/m <sup>2</sup>                 |
| Dwelling fabric energy efficiency | 35.6 kWh/m <sup>2</sup> <span>OK</span> |

## 2a Fabric U-values

| Element                          | Maximum permitted average U-Value [W/m <sup>2</sup> K] | Dwelling average U-Value [W/m <sup>2</sup> K] | Element with highest individual U-Value |                  |
|----------------------------------|--------------------------------------------------------|-----------------------------------------------|-----------------------------------------|------------------|
| External walls                   | 0.26                                                   | 0.15                                          | Walls (1) (0.15)                        | <span>OK</span>  |
| Party walls                      | 0.2                                                    | 0                                             | Party Wall (1) (0)                      | <span>N/A</span> |
| Curtain walls                    | 1.6                                                    | 0                                             | N/A                                     | <span>N/A</span> |
| Floors                           | 0.18                                                   | N/A                                           | N/A                                     | <span>N/A</span> |
| Roofs                            | 0.16                                                   | 0.14                                          | Roof (1) (0.14)                         | <span>OK</span>  |
| Windows, doors, and roof windows | 1.6                                                    | 1.2                                           | Opening2 (1.2)                          | <span>OK</span>  |
| Rooflights                       | 2.2                                                    | N/A                                           | N/A                                     | <span>N/A</span> |

## 2b Envelope elements (better than typically expected values are flagged with a subsequent (!))

| Name                       | Net area [m <sup>2</sup> ] | U-Value [W/m <sup>2</sup> K] |
|----------------------------|----------------------------|------------------------------|
| Exposed wall: Walls (1)    | 53.463                     | 0.15                         |
| Exposed wall: Walls (2)    | 25.38                      | 0.15                         |
| Exposed wall: Walls (3)    | 5.6                        | 0.15                         |
| Party wall: Party Wall (1) | 44.23                      | 0 (!)                        |
| Exposed roof: Roof (1)     | 16.05                      | 0.14                         |
| Exposed roof: Roof (2)     | 37.99                      | 0.14                         |

## 2c Openings (better than typically expected values are flagged with a subsequent (!))

| Name                             | Area [m <sup>2</sup> ] | Orientation | Frame factor | U-Value [W/m <sup>2</sup> K] |
|----------------------------------|------------------------|-------------|--------------|------------------------------|
| Opening2, Windows / Glazed Doors | 1.3195                 | East        | 1.0          | 1.2                          |
| Opening2, Windows / Glazed Doors | 1.3195                 | East        | 1.0          | 1.2                          |
| Opening2, Windows / Glazed Doors | 1.3195                 | East        | 1.0          | 1.2                          |
| Opening2, Windows / Glazed Doors | 1                      | East        | 1.0          | 1.2                          |
| Opening3, Windows / Glazed Doors | 1.3195                 | West        | 1.0          | 1.2                          |
| Opening3, Windows / Glazed Doors | 1.3195                 | West        | 1.0          | 1.2                          |
| Opening3, Windows / Glazed Doors | 1.3195                 | West        | 1.0          | 1.2                          |
| Opening4, Windows / Glazed Doors | 1                      | West        | 1.0          | 1.2                          |

## 2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

|                                                                                                   |
|---------------------------------------------------------------------------------------------------|
| Building part 1: Thermal bridging calculated from linear thermal transmittances for each junction |
|---------------------------------------------------------------------------------------------------|

| Main element  | Junction detail                                                   | Source                                       | Psi value [W/mK] | Drawing / reference  |
|---------------|-------------------------------------------------------------------|----------------------------------------------|------------------|----------------------|
| External wall | E2: Other lintels (including other steel lintels)                 | Calculated by person with suitable expertise | 0.084            | R.O.I. Psi Value     |
| External wall | E3: Sill                                                          | Calculated by person with suitable expertise | 0.034 (!)        | R.O.I. Psi Value     |
| External wall | E4: Jamb                                                          | Calculated by person with suitable expertise | 0.043            | R.O.I. Psi Value     |
| External wall | E16: Corner (normal)                                              | Calculated by person with suitable expertise | 0.03 (!)         | R.O.I. Psi Value     |
| External wall | E18: Party wall between dwellings                                 | Calculated by person with suitable expertise | 0.04             | R.O.I. Psi Value     |
| External wall | E7: Party floor between dwellings (in blocks of flats)            | Calculated by person with suitable expertise | 0.066            | R.O.I. Psi Value     |
| External wall | E11: Eaves (insulation at rafter level)                           | Calculated by person with suitable expertise | 0.013 (!)        | R.O.I. Psi Value     |
| External wall | E17: Corner (inverted - internal area greater than external area) | Calculated by person with suitable expertise | 0.015 (!)        | R.O.I. Psi Value     |
| Party wall    | P3: Intermediate floor between dwellings (in blocks of flats)     | SAP table default                            | 0 (!)            |                      |
| External wall | E13: Gable (insulation at rafter level)                           | Calculated by person with suitable expertise | 0.024 (!)        | R.O.I. Psi Value     |
| External wall | E6: Intermediate floor within a dwelling                          | Calculated by person with suitable expertise | 0.08             | R.O.I. Psi Value     |
| Party wall    | P5: Roof (insulation at rafter level)                             | Calculated by person with suitable expertise | 0.24             | Default Value Halved |
| Party wall    | P2: Intermediate floor within a dwelling                          | SAP table default                            | 0 (!)            |                      |
| Roof          | R4: Ridge (vaulted ceiling)                                       | SAP table default                            | 0.12             |                      |

### 3 Air permeability (better than typically expected values are flagged with a subsequent (!))

|                                             |                                                  |    |
|---------------------------------------------|--------------------------------------------------|----|
| Maximum permitted air permeability at 50Pa  | 8 m <sup>3</sup> /hm <sup>2</sup>                |    |
| Dwelling air permeability at 50Pa           | 4 m <sup>3</sup> /hm <sup>2</sup> , Design value | OK |
| Air permeability test certificate reference |                                                  |    |

### 4 Space heating

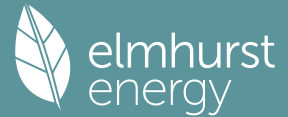
|                                                                                            |                                     |  |
|--------------------------------------------------------------------------------------------|-------------------------------------|--|
| <b>Main heating system 1: Room heaters - Electricity</b>                                   |                                     |  |
| Efficiency                                                                                 | 100.0%                              |  |
| Emitter type                                                                               |                                     |  |
| Flow temperature                                                                           |                                     |  |
| System type                                                                                | Panel, convector or radiant heaters |  |
| Manufacturer                                                                               |                                     |  |
| Model                                                                                      |                                     |  |
| Commissioning                                                                              |                                     |  |
| <b>Main heating system 2: Heat pump with radiators or underfloor heating - Electricity</b> |                                     |  |
| Efficiency                                                                                 | 0.0%                                |  |
| Emitter type                                                                               |                                     |  |
| Flow temperature                                                                           |                                     |  |
| System type                                                                                | Heat Pump                           |  |
| Manufacturer                                                                               | KERS Innovations UK Ltd             |  |
| Model                                                                                      | KERS MEV-W200SL                     |  |
| Commissioning                                                                              |                                     |  |
| <b>Secondary heating system: N/A</b>                                                       |                                     |  |
| Fuel                                                                                       | N/A                                 |  |
| Efficiency                                                                                 | N/A                                 |  |
| Commissioning                                                                              |                                     |  |

### 5 Hot water

|                                   |     |  |
|-----------------------------------|-----|--|
| <b>Cylinder/store - type: N/A</b> |     |  |
| Capacity                          | N/A |  |
| Declared heat loss                | N/A |  |
| Primary pipework insulated        | N/A |  |
| Manufacturer                      |     |  |
| Model                             |     |  |
| Commissioning                     |     |  |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                   |                        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|------------------------|
| <b>Waste water heat recovery system 1</b> - type: N/A                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                        |
| Efficiency                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                   |                        |
| Manufacturer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                   |                        |
| Model                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                        |
| <b>6 Controls</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                   |                        |
| <b>Main heating 1</b> - type: Programmer and appliance thermostats                                                                                                                                                                                                                                                                                                                                                                                                                               |                   |                        |
| Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                   |                        |
| Ecodesign class                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                   |                        |
| Manufacturer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                   |                        |
| Model                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                        |
| <b>Main heating 2</b> - type: Not applicable                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                   |                        |
| Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                   |                        |
| Ecodesign class                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                   |                        |
| Manufacturer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                   |                        |
| Model                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                        |
| <b>Water heating</b> - type: N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                   |                        |
| Manufacturer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                   |                        |
| Model                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                        |
| <b>7 Lighting</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                   |                        |
| Minimum permitted light source efficacy                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 75 lm/W           |                        |
| Lowest light source efficacy                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 90 lm/W           | OK                     |
| External lights control                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | N/A               |                        |
| <b>8 Mechanical ventilation</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                   |                        |
| <b>System type:</b> Centralised mechanical extract                                                                                                                                                                                                                                                                                                                                                                                                                                               |                   |                        |
| Maximum permitted specific fan power                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0.7 W/(l/s)       |                        |
| Specific fan power                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 0.51 W/(l/s)      | OK                     |
| Minimum permitted heat recovery efficiency                                                                                                                                                                                                                                                                                                                                                                                                                                                       | N/A               |                        |
| Heat recovery efficiency                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | N/A               | N/A                    |
| Manufacturer/Model                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | KERS MEV-W200SL   |                        |
| Commissioning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                   |                        |
| <b>9 Local generation</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                   |                        |
| N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                   |                        |
| <b>10 Heat networks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                   |                        |
| N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                   |                        |
| <b>11 Supporting documentary evidence</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                   |                        |
| N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                   |                        |
| <b>12 Declarations</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                   |                        |
| <b>a. Assessor Declaration</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                   |                        |
| This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report. |                   |                        |
| Signed:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>P Yearsley</b> | Assessor ID: R301-0001 |
| Name:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Peter Yearsley    | Date: 28/11/2025       |
| <b>b. Client Declaration</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                   |                        |
| N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                   |                        |

# Full SAP Calculation Printout



|                                    |                                           |               |       |               |                |            |  |
|------------------------------------|-------------------------------------------|---------------|-------|---------------|----------------|------------|--|
| Plot Reference                     | Flat 4, 85 Pell Street                    |               |       |               | Issued on Date | 28/11/2025 |  |
| Assessment Reference               | Electric Panel Heaters HC                 |               |       | Plot Type Ref |                |            |  |
| Plot Address                       | Flat 4, 85, Pell Street, Reading, RG1 2NP |               |       |               | SAP Version    | 10.2       |  |
|                                    |                                           |               |       |               |                |            |  |
| SAP Rating                         | 75 C                                      | DER           | 6.34  | TER           | 13.17          |            |  |
| Environmental                      | 95 A                                      | % DER < TER   |       |               |                | 51.86      |  |
| CO <sub>2</sub> Emissions (t/year) | 0.42                                      | DFEE          | 35.56 | TFEE          | 38.00          |            |  |
| Compliance Check                   | See BREL                                  | % DFEE < TFEE |       |               |                | 6.44       |  |
| % DPER < TPER                      | 5.33                                      | DPER          | 65.74 | TPER          | 69.44          |            |  |
|                                    |                                           |               |       |               |                |            |  |
| Assessor Details                   | Mr. Peter Yearsley                        |               |       |               | Assessor ID    | R301-0001  |  |
| Client                             | ,                                         |               |       |               |                |            |  |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)              | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|-----------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                   |                             |
| Ground floor                                           | 45.3000 (1b)              | x 2.7500 (2b)                     | = 124.5750 (1b) - (3b)      |
| First floor                                            | 29.1000 (1c)              | x 3.2600 (2c)                     | = 94.8660 (1c) - (3c)       |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 74.4000                   |                                   | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 219.4410 (5)                |

## 2. Ventilation rate

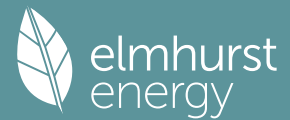
|                                                                                                    | m <sup>3</sup> per hour                 |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 0 * 10 = 0.0000 (7a)                    |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 / (5) = 0.0000 (8)               |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 4.0000 (17)                             |
| Infiltration rate                                                                                  | 0.2000 (18)                             |
| Number of sides sheltered                                                                          | 1 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.9250 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.1850 (21)        |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate                                                                                         | 0.2359 | 0.2313 | 0.2266 | 0.2035 | 0.1989 | 0.1758 | 0.1758 | 0.1711 | 0.1850 | 0.1989 | 0.2081 | 0.2174 (22b) |
| Mechanical extract ventilation - centralised                                                            |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        |              |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                                     | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K   |
|-------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|-----------------|
| Main dwelling                                               |                         |                            |                           |                               |              |                                |                 |
| Windows / Glazed Doors                                      |                         |                            | 9.9200                    | 1.1450                        | 11.3588      |                                | (27)            |
| External Wall                                               | 62.3800                 | 8.9200                     | 53.4600                   | 0.1500                        | 8.0190       | 9.0000                         | 481.1400 (29a)  |
| RIR Stud Wall                                               | 25.3800                 |                            | 25.3800                   | 0.1500                        | 3.8070       | 9.0000                         | 228.4200 (29a)  |
| Dormer Walls                                                | 6.6000                  | 1.0000                     | 5.6000                    | 0.1500                        | 0.8400       | 9.0000                         | 50.4000 (29a)   |
| Adj To RIR Ins At Slope                                     | 16.0500                 |                            | 16.0500                   | 0.1400                        | 2.2470       | 9.0000                         | 144.4500 (30)   |
| Slope Roof                                                  | 37.9900                 |                            | 37.9900                   | 0.1400                        | 5.3186       | 9.0000                         | 341.9100 (30)   |
| Total net area of external elements Aum(A, m <sup>2</sup> ) |                         |                            | 148.4000                  |                               |              |                                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                         |                         |                            |                           | (26)...(30) + (32) =          | 31.5904      |                                | (33)            |
| Main dwelling                                               |                         |                            |                           |                               |              |                                |                 |
| Party Wall 1                                                |                         |                            | 44.2300                   | 0.0000                        | 0.0000       | 45.0000                        | 1990.3500 (32)  |
| Party Floor 1                                               |                         |                            | 45.3000                   |                               |              | 30.0000                        | 1359.0000 (32d) |
| Internal Wall 1                                             |                         |                            | 113.1500                  |                               |              | 9.0000                         | 1018.3500 (32c) |
| Internal Floor 1                                            |                         |                            | 29.1000                   |                               |              | 18.0000                        | 523.8000 (32d)  |
| Internal Ceiling 1                                          |                         |                            | 29.1000                   |                               |              | 9.0000                         | 261.9000 (32e)  |

# Full SAP Calculation Printout



Heat capacity  $C_m = \text{Sum}(A \times k)$   
Thermal mass parameter (TMP =  $C_m / \text{TFA}$ ) in  $\text{kJ/m}^2\text{K}$  (28)...(30) + (32) + (32a)...(32e) = 6399.7200 (34)  
List of Thermal Bridges 86.0177 (35)

|                                                                           | Length  | Psi-value | Total  |
|---------------------------------------------------------------------------|---------|-----------|--------|
| K1 Element                                                                |         |           |        |
| E2 Other lintels (including other steel lintels)                          | 7.9700  | 0.0840    | 0.6695 |
| E3 Sill                                                                   | 7.0600  | 0.0340    | 0.2400 |
| E4 Jamb                                                                   | 26.6000 | 0.0430    | 1.1438 |
| E16 Corner (normal)                                                       | 17.5000 | 0.0300    | 0.5250 |
| E18 Party wall between dwellings                                          | 9.5000  | 0.0400    | 0.3800 |
| E7 Party floor between dwellings (in blocks of flats)                     | 17.3000 | 0.0660    | 1.1418 |
| E11 Eaves (insulation at rafter level)                                    | 9.6000  | 0.0130    | 0.1248 |
| E17 Corner (inverted - internal area greater than external area)          | 8.0000  | 0.0150    | 0.1200 |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | 13.6000 | 0.0000    | 0.0000 |
| E13 Gable (insulation at rafter level)                                    | 16.1000 | 0.0240    | 0.3864 |
| E6 Intermediate floor within a dwelling                                   | 22.2000 | 0.0800    | 1.7760 |
| P5 Party wall - Roof (insulation at rafter level)                         | 6.4000  | 0.2400    | 1.5360 |
| P2 Party wall - Intermediate floor within a dwelling                      | 4.0000  | 0.0000    | 0.0000 |
| R4 Ridge (vaulted ceiling)                                                | 11.1000 | 0.1200    | 1.3320 |

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.3753 (36)  
Point Thermal bridges (36a) = 0.0000  
Total fabric heat loss (33) + (36) + (36a) = 40.9657 (37)

Ventilation heat loss calculated monthly (38)m =  $0.33 \times (25)\text{m} \times (5)$   
(38)m Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
Heat transfer coeff 36.2078 36.2078 36.2078 36.2078 36.2078 36.2078 36.2078 36.2078 36.2078 36.2078 36.2078 36.2078 (38)  
Average =  $\text{Sum}(39)\text{m} / 12 =$  77.1735 77.1735 77.1735 77.1735 77.1735 77.1735 77.1735 77.1735 77.1735 77.1735 77.1735 77.1735 (39)

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec         |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
| HLP           | 1.0373 | 1.0373 | 1.0373 | 1.0373 | 1.0373 | 1.0373 | 1.0373 | 1.0373 | 1.0373 | 1.0373 | 1.0373 | 1.0373 (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 1.0373      |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31          |

## 4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.3480 (42)  
Hot water usage for mixer showers 87.4344 86.1204 84.2057 80.5423 77.8387 74.8238 73.1101 75.0103 77.0933 80.3304 84.0726 87.0994 (42a)  
Hot water usage for baths 27.4684 27.0605 26.4860 25.4268 24.6337 23.7542 23.2792 23.8496 24.4707 25.4118 26.4928 27.3756 (42b)  
Hot water usage for other uses 38.6763 37.2699 35.8635 34.4571 33.0507 31.6443 31.6443 33.0507 34.4571 35.8635 37.2699 38.6763 (42c)  
Average daily hot water use (litres/day) 141.2394 (43)

|                         | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov        | Dec           |
|-------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------------|---------------|
| Daily hot water use     | 153.5791 | 150.4508 | 146.5552 | 140.4261 | 135.5230 | 130.2222 | 128.0335 | 131.9106 | 136.0211 | 141.6057 | 147.8353   | 153.1513 (44) |
| Energy conte            | 243.2318 | 214.2399 | 225.2499 | 192.2364 | 182.4401 | 160.1234 | 154.8454 | 163.3328 | 167.7276 | 192.1576 | 210.6185   | 239.7979 (45) |
| Energy content (annual) |          |          |          |          |          |          |          |          |          | Total =  | Sum(45)m = | 2346.0013     |

Distribution loss (46)m =  $0.15 \times (45)\text{m}$  36.4848 32.1360 33.7875 28.8355 27.3660 24.0185 23.2268 24.4999 25.1591 28.8236 31.5928 35.9697 (46)

Water storage loss (or HIU loss):  
Store volume 196.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day):  
Temperature factor from Table 2b 1.3120 (48)  
Enter (49) or (54) in (55) 0.5400 (49)  
Total storage loss 0.7085 (55)

21.9629 19.8374 21.9629 21.2544 21.9629 21.2544 21.9629 21.9629 21.2544 21.9629 21.2544 21.9629 (56)

If cylinder contains dedicated solar storage 21.9629 19.8374 21.9629 21.2544 21.9629 21.2544 21.9629 21.9629 21.2544 21.9629 21.2544 21.9629 (57)

Primary loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (59)

Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)

Total heat required for water heating calculated for each month 265.1947 234.0774 247.2128 213.4908 204.4030 181.3778 176.8083 185.2957 188.9820 214.1205 231.8729 261.7608 (62)

WWHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63a)

PV diverter 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63b)

Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63c)

FGHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)

Output from w/h 265.1947 234.0774 247.2128 213.4908 204.4030 181.3778 176.8083 185.2957 188.9820 214.1205 231.8729 261.7608 (64)

12Total per year (kWh/year) Total per year (kWh/year) = Sum(64)m = 2604.5965 (64)

Electric shower(s) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)

Heat gains from water heating, kWh/month 80.8746 71.2348 74.8956 63.9186 60.6613 53.2410 51.4861 54.3082 55.7694 63.8924 70.0306 79.7328 (65)

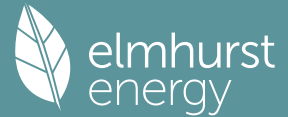
## 5. Internal gains (see Table 5 and 5a)

|                                                                                     | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Metabolic gains (Table 5), Watts                                                    |          |          |          |          |          |          |          |          |          |          |          |               |
| (66)m                                                                               | 117.4022 | 117.4022 | 117.4022 | 117.4022 | 117.4022 | 117.4022 | 117.4022 | 117.4022 | 117.4022 | 117.4022 | 117.4022 | 117.4022 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 113.4015 | 125.5517 | 113.4015 | 117.1815 | 113.4015 | 117.1815 | 113.4015 | 113.4015 | 117.1815 | 113.4015 | 117.1815 | 113.4015 (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 207.3413 | 209.4929 | 204.0710 | 192.5286 | 177.9583 | 164.2642 | 155.1158 | 152.9642 | 158.3861 | 169.9285 | 184.4988 | 198.1929 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 34.7402  | 34.7402  | 34.7402  | 34.7402  | 34.7402  | 34.7402  | 34.7402  | 34.7402  | 34.7402  | 34.7402  | 34.7402  | 34.7402 (69)  |
| Pumps, fans                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (70)   |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 (71) |
| Water heating gains (Table 5)                                                       | 108.7024 | 106.0041 | 100.6661 | 88.7758  | 81.5340  | 73.9459  | 69.2017  | 72.9948  | 77.4575  | 85.8769  | 97.2648  | 107.1677 (72) |
| Total internal gains                                                                | 487.6659 | 499.2693 | 476.3593 | 456.7066 | 431.1144 | 413.6123 | 395.9397 | 397.5812 | 411.2458 | 427.4276 | 457.1658 | 476.9828 (73) |

## 6. Solar gains

[Jan] Area Solar flux g FF Access Gains

# Full SAP Calculation Printout



|                                                                                                      |           | m2        |          | Table 6a<br>W/m2 |           | Specific data<br>or Table 6b |           | Specific data<br>or Table 6c |          | factor<br>Table 6d |          | W              |
|------------------------------------------------------------------------------------------------------|-----------|-----------|----------|------------------|-----------|------------------------------|-----------|------------------------------|----------|--------------------|----------|----------------|
| East                                                                                                 |           | 4.9600    |          | 19.6403          |           | 0.7600                       |           | 0.0000                       |          | 0.7700             |          | 57.0077 (76)   |
| West                                                                                                 |           | 4.9600    |          | 19.6403          |           | 0.7600                       |           | 0.0000                       |          | 0.7700             |          | 57.0077 (80)   |
|                                                                                                      |           |           |          |                  |           |                              |           |                              |          |                    |          |                |
| Solar gains                                                                                          | 114.0153  | 223.0382  | 367.3122 | 535.7029         | 656.5240  | 672.0691                     | 639.8372  | 549.6107                     | 427.1992 | 264.6536           | 142.1637 | 93.7607 (83)   |
| Total gains                                                                                          | 601.6812  | 722.3075  | 843.6714 | 992.4094         | 1087.6384 | 1085.6814                    | 1035.7769 | 947.1919                     | 838.4451 | 692.0812           | 599.3296 | 570.7434 (84)  |
|                                                                                                      |           |           |          |                  |           |                              |           |                              |          |                    |          |                |
| 7. Mean internal temperature (heating season)                                                        |           |           |          |                  |           |                              |           |                              |          |                    |          |                |
| Temperature during heating periods in the living area from Table 9, Th1 (C)                          |           |           |          |                  |           |                              |           |                              |          |                    |          |                |
| Utilisation factor for gains for living area, nil,m (see Table 9a)                                   |           |           |          |                  |           |                              |           |                              |          |                    |          | 21.0000 (85)   |
|                                                                                                      | Jan       | Feb       | Mar      | Apr              | May       | Jun                          | Jul       | Aug                          | Sep      | Oct                | Nov      | Dec            |
| tau                                                                                                  | 23.0351   | 23.0351   | 23.0351  | 23.0351          | 23.0351   | 23.0351                      | 23.0351   | 23.0351                      | 23.0351  | 23.0351            | 23.0351  | 23.0351        |
| alpha                                                                                                | 2.5357    | 2.5357    | 2.5357   | 2.5357           | 2.5357    | 2.5357                       | 2.5357    | 2.5357                       | 2.5357   | 2.5357             | 2.5357   | 2.5357         |
| util living area                                                                                     | 0.9171    | 0.8760    | 0.8096   | 0.6950           | 0.5583    | 0.4191                       | 0.3145    | 0.3547                       | 0.5434   | 0.7681             | 0.8844   | 0.9260 (86)    |
| MIT                                                                                                  | 18.6963   | 19.0939   | 19.6373  | 20.2371          | 20.6546   | 20.8783                      | 20.9570   | 20.9405                      | 20.7596  | 20.1527            | 19.3037  | 18.5994 (87)   |
| Th 2                                                                                                 | 20.0524   | 20.0524   | 20.0524  | 20.0524          | 20.0524   | 20.0524                      | 20.0524   | 20.0524                      | 20.0524  | 20.0524            | 20.0524  | 20.0524 (88)   |
| util rest of house                                                                                   | 0.9074    | 0.8622    | 0.7893   | 0.6645           | 0.5166    | 0.3653                       | 0.2511    | 0.2878                       | 0.4867   | 0.7358             | 0.8691   | 0.9172 (89)    |
| MIT 2                                                                                                | 17.3662   | 17.8600   | 18.5283  | 19.2452          | 19.7207   | 19.9555                      | 20.0268   | 20.0151                      | 19.8467  | 19.1689            | 18.1323  | 17.2451 (90)   |
| Living area fraction                                                                                 | 17.8113   | 18.2730   | 18.8994  | 19.5771          | 20.0333   | 20.2644                      | 20.3381   | 20.3248                      | 20.1522  | 19.4982            | 18.5243  | 17.6983 (92)   |
| MIT                                                                                                  | 17.8113   | 18.2730   | 18.8994  | 19.5771          | 20.0333   | 20.2644                      | 20.3381   | 20.3248                      | 20.1522  | 19.4982            | 18.5243  | 17.6983 (93)   |
| Temperature adjustment                                                                               |           |           |          |                  |           |                              |           |                              |          |                    |          | 0.0000         |
| adjusted MIT                                                                                         | 17.8113   | 18.2730   | 18.8994  | 19.5771          | 20.0333   | 20.2644                      | 20.3381   | 20.3248                      | 20.1522  | 19.4982            | 18.5243  | 17.6983 (93)   |
|                                                                                                      |           |           |          |                  |           |                              |           |                              |          |                    |          |                |
| 8. Space heating requirement                                                                         |           |           |          |                  |           |                              |           |                              |          |                    |          |                |
|                                                                                                      | Jan       | Feb       | Mar      | Apr              | May       | Jun                          | Jul       | Aug                          | Sep      | Oct                | Nov      | Dec            |
| Utilisation                                                                                          | 0.8776    | 0.8306    | 0.7607   | 0.6478           | 0.5157    | 0.3777                       | 0.2706    | 0.3075                       | 0.4930   | 0.7144             | 0.8384   | 0.8884 (94)    |
| Useful gains                                                                                         | 528.0212  | 599.9482  | 641.8072 | 642.9082         | 560.9361  | 410.0472                     | 280.2519  | 291.2476                     | 413.3572 | 494.3987           | 502.4658 | 507.0354 (95)  |
| Ext temp.                                                                                            | 4.3000    | 4.9000    | 6.5000   | 8.9000           | 11.7000   | 14.6000                      | 16.6000   | 16.4000                      | 14.1000  | 10.6000            | 7.1000   | 4.2000 (96)    |
| Heat loss rate W                                                                                     | 1042.7167 | 1032.0398 | 956.9074 | 823.9922         | 643.1076  | 437.1381                     | 288.4825  | 302.8939                     | 467.0725 | 686.7023           | 881.6531 | 1041.7142 (97) |
| Space heating kWh                                                                                    | 382.9335  | 290.3656  | 234.4346 | 130.3805         | 61.1356   | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 143.0739           | 273.0149 | 397.8010 (98a) |
| Space heating requirement - total per year (kWh/year)                                                |           |           |          |                  |           |                              |           |                              |          |                    |          | 1913.1394      |
| Solar heating kWh                                                                                    | 0.0000    | 0.0000    | 0.0000   | 0.0000           | 0.0000    | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 0.0000             | 0.0000   | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                                               |           |           |          |                  |           |                              |           |                              |          |                    |          | 0.0000         |
| Space heating kWh                                                                                    | 382.9335  | 290.3656  | 234.4346 | 130.3805         | 61.1356   | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 143.0739           | 273.0149 | 397.8010 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year)                       |           |           |          |                  |           |                              |           |                              |          |                    |          | 1913.1394      |
| Space heating per m2                                                                                 |           |           |          |                  |           |                              |           |                              |          | (98c) / (4) =      |          | 25.7142 (99)   |
|                                                                                                      |           |           |          |                  |           |                              |           |                              |          |                    |          |                |
| 9a. Energy requirements - Individual heating systems, including micro-CHP                            |           |           |          |                  |           |                              |           |                              |          |                    |          |                |
| Fraction of space heat from secondary/supplementary system (Table 11)                                |           |           |          |                  |           |                              |           |                              |          |                    |          |                |
| Fraction of space heat from main system(s)                                                           |           |           |          |                  |           |                              |           |                              |          |                    |          | 0.0000 (201)   |
| Fraction of main heating from main system 2                                                          |           |           |          |                  |           |                              |           |                              |          |                    |          | 1.0000 (202)   |
| Fraction of total heating from main system 1                                                         |           |           |          |                  |           |                              |           |                              |          |                    |          | 0.0000 (203)   |
| Fraction of total heating from main system 2                                                         |           |           |          |                  |           |                              |           |                              |          |                    |          | 1.0000 (204)   |
| Efficiency of main space heating system 1 (in %)                                                     |           |           |          |                  |           |                              |           |                              |          |                    |          | 0.0000 (205)   |
| Efficiency of main space heating system 2 (in %)                                                     |           |           |          |                  |           |                              |           |                              |          |                    |          | 100.0000 (206) |
| Efficiency of secondary/supplementary heating system, %                                              |           |           |          |                  |           |                              |           |                              |          |                    |          | 0.0000 (207)   |
|                                                                                                      |           |           |          |                  |           |                              |           |                              |          |                    |          | 0.0000 (208)   |
|                                                                                                      | Jan       | Feb       | Mar      | Apr              | May       | Jun                          | Jul       | Aug                          | Sep      | Oct                | Nov      | Dec            |
| Space heating requirement                                                                            | 382.9335  | 290.3656  | 234.4346 | 130.3805         | 61.1356   | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 143.0739           | 273.0149 | 397.8010 (98)  |
| Space heating efficiency (main heating system 1)                                                     | 100.0000  | 100.0000  | 100.0000 | 100.0000         | 100.0000  | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 100.0000           | 100.0000 | 100.0000 (210) |
| Space heating fuel (main heating system)                                                             | 382.9335  | 290.3656  | 234.4346 | 130.3805         | 61.1356   | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 143.0739           | 273.0149 | 397.8010 (211) |
| Space heating efficiency (main heating system 2)                                                     | 0.0000    | 0.0000    | 0.0000   | 0.0000           | 0.0000    | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 0.0000             | 0.0000   | 0.0000 (212)   |
| Space heating fuel (main heating system 2)                                                           | 0.0000    | 0.0000    | 0.0000   | 0.0000           | 0.0000    | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 0.0000             | 0.0000   | 0.0000 (213)   |
| Space heating fuel (secondary)                                                                       | 0.0000    | 0.0000    | 0.0000   | 0.0000           | 0.0000    | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 0.0000             | 0.0000   | 0.0000 (215)   |
| Space heating fuel used, main system 2                                                               | 0.0000    | 0.0000    | 0.0000   | 0.0000           | 0.0000    | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 0.0000             | 0.0000   | 0.0000 (213)   |
| Water heating                                                                                        |           |           |          |                  |           |                              |           |                              |          |                    |          |                |
| Water heating requirement                                                                            | 265.1947  | 234.0774  | 247.2128 | 213.4908         | 204.4030  | 181.3778                     | 176.8083  | 185.2957                     | 188.9820 | 214.1205           | 231.8729 | 261.7608 (64)  |
| Efficiency of water heater (217)m                                                                    | 313.4050  | 313.4050  | 313.4050 | 313.4050         | 313.4050  | 313.4050                     | 313.4050  | 313.4050                     | 313.4050 | 313.4050           | 313.4050 | 313.4050 (216) |
| Fuel for water heating, kWh/month                                                                    | 84.6172   | 74.6885   | 78.8797  | 68.1198          | 65.2201   | 57.8733                      | 56.4153   | 59.1234                      | 60.2996  | 68.3207            | 73.9851  | 83.5216 (219)  |
| Space cooling fuel requirement (221)m                                                                | 0.0000    | 0.0000    | 0.0000   | 0.0000           | 0.0000    | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 0.0000             | 0.0000   | 0.0000 (221)   |
| Pumps and Fa                                                                                         | 15.0751   | 13.6162   | 15.0751  | 14.5888          | 15.0751   | 14.5888                      | 15.0751   | 15.0751                      | 14.5888  | 15.0751            | 14.5888  | 15.0751 (231)  |
| Lighting                                                                                             | 27.8306   | 22.3267   | 20.1027  | 14.7281          | 11.3764   | 9.2946                       | 10.3780   | 13.4897                      | 17.5217  | 22.9895            | 25.9666  | 28.6041 (232)  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | 0.0000    | 0.0000    | 0.0000   | 0.0000           | 0.0000    | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 0.0000             | 0.0000   | 0.0000 (233a)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000    | 0.0000    | 0.0000   | 0.0000           | 0.0000    | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 0.0000             | 0.0000   | 0.0000 (234a)  |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000    | 0.0000    | 0.0000   | 0.0000           | 0.0000    | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 0.0000             | 0.0000   | 0.0000 (235a)  |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000    | 0.0000    | 0.0000   | 0.0000           | 0.0000    | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 0.0000             | 0.0000   | 0.0000 (235c)  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | 0.0000    | 0.0000    | 0.0000   | 0.0000           | 0.0000    | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 0.0000             | 0.0000   | 0.0000 (233b)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000    | 0.0000    | 0.0000   | 0.0000           | 0.0000    | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 0.0000             | 0.0000   | 0.0000 (234b)  |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000    | 0.0000    | 0.0000   | 0.0000           | 0.0000    | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 0.0000             | 0.0000   | 0.0000 (235b)  |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000    | 0.0000    | 0.0000   | 0.0000           | 0.0000    | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 0.0000             | 0.0000   | 0.0000 (235d)  |

# Full SAP Calculation Printout



|                                                                  |                 |
|------------------------------------------------------------------|-----------------|
| Annual totals kWh/year                                           |                 |
| Space heating fuel - main system 1                               | 1913.1394 (211) |
| Space heating fuel - main system 2                               | 0.0000 (213)    |
| Space heating fuel - secondary                                   | 0.0000 (215)    |
| Efficiency of water heater                                       | 313.4050        |
| Water heating fuel used                                          | 831.0641 (219)  |
| Space cooling fuel                                               | 0.0000 (221)    |
| Electricity for pumps and fans:                                  |                 |
| (MEVCentralised, Database: in-use factor = 1.3000, SFP = 0.6630) |                 |
| mechanical ventilation fans (SFP = 0.6630)                       | 177.4970 (230a) |
| Total electricity for the above, kWh/year                        | 177.4970 (231)  |
| Electricity for lighting (calculated in Appendix L)              | 224.6087 (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)    |                 |
| PV generation                                                    | 0.0000 (233)    |
| Wind generation                                                  | 0.0000 (234)    |
| Hydro-electric generation (Appendix N)                           | 0.0000 (235a)   |
| Electricity generated - Micro CHP (Appendix N)                   | 0.0000 (235)    |
| Appendix Q - special features                                    |                 |
| Energy saved or generated                                        | -0.0000 (236)   |
| Energy used                                                      | 0.0000 (237)    |
| Total delivered energy for all uses                              | 3146.3093 (238) |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                                 | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|-------------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1                   | 1913.1394          | 0.1552                        | 296.9843 (261)           |
| Space heating - main system 2                   | 0.0000             | 0.0000                        | 0.0000 (262)             |
| Total CO2 associated with community systems     |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                      | 831.0641           | 0.1413                        | 117.4242 (264)           |
| Space and water heating                         |                    |                               | 414.4085 (265)           |
| Pumps, fans and electric keep-hot               | 177.4970           | 0.1387                        | 24.6210 (267)            |
| Energy for lighting                             | 224.6087           | 0.1443                        | 32.4180 (268)            |
| Total CO2, kg/year                              |                    |                               | 471.4475 (272)           |
| EPC Dwelling Carbon Dioxide Emission Rate (DER) |                    |                               | 6.3400 (273)             |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 1913.1394          | 1.5747                              | 3012.6091 (275)            |
| Space heating - main system 2               | 0.0000             | 0.0000                              | 0.0000 (276)               |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 831.0641           | 1.5225                              | 1265.2724 (278)            |
| Space and water heating                     |                    |                                     | 4277.8815 (279)            |
| Pumps, fans and electric keep-hot           | 177.4970           | 1.5128                              | 268.5175 (281)             |
| Energy for lighting                         | 224.6087           | 1.5338                              | 344.5124 (282)             |
| Total Primary energy kWh/year               |                    |                                     | 4890.9114 (286)            |
| Dwelling Primary energy Rate (DPER)         |                    |                                     | 65.7400 (287)              |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF TARGET EMISSIONS

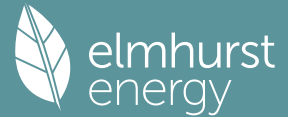
## 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m)              | Volume<br>(m3)         |
|--------------------------------------------------------|--------------|-----------------------------------|------------------------|
| Main dwelling                                          |              |                                   |                        |
| Ground floor                                           | 45.3000 (1b) | x 2.7500 (2b)                     | = 124.5750 (1b) - (3b) |
| First floor                                            | 29.1000 (1c) | x 3.2600 (2c)                     | = 94.8660 (1c) - (3c)  |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 74.4000      |                                   | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 219.4410 (5)           |

## 2. Ventilation rate

|                                                                                                    | m3 per hour                             |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 3 * 10 = 30.0000 (7a)                   |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 30.0000 / (5) = 0.1367 (8)              |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 5.0000 (17)                             |
| Infiltration rate                                                                                  | 0.3867 (18)                             |
| Number of sides sheltered                                                                          | 1 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.9250 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.3577 (21)        |

# Full SAP Calculation Printout



|                 |               |               |               |               |               |               |               |               |               |               |               |               |       |
|-----------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|-------|
| Wind speed      | Jan<br>5.1000 | Feb<br>5.0000 | Mar<br>4.9000 | Apr<br>4.4000 | May<br>4.3000 | Jun<br>3.8000 | Jul<br>3.8000 | Aug<br>3.7000 | Sep<br>4.0000 | Oct<br>4.3000 | Nov<br>4.5000 | Dec<br>4.7000 | (22)  |
| Wind factor     | 1.2750        | 1.2500        | 1.2250        | 1.1000        | 1.0750        | 0.9500        | 0.9500        | 0.9250        | 1.0000        | 1.0750        | 1.1250        | 1.1750        | (22a) |
| Adj infilt rate |               |               |               |               |               |               |               |               |               |               |               |               |       |
| Effective ac    | 0.4561        | 0.4471        | 0.4382        | 0.3935        | 0.3845        | 0.3398        | 0.3398        | 0.3309        | 0.3577        | 0.3845        | 0.4024        | 0.4203        | (22b) |
|                 | 0.6040        | 0.6000        | 0.5960        | 0.5774        | 0.5739        | 0.5577        | 0.5577        | 0.5547        | 0.5640        | 0.5739        | 0.5810        | 0.5883        | (25)  |

## 3. Heat losses and heat loss parameter

| Element                                                        | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K         | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K |
|----------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|----------------------|--------------------------------|---------------|
| Main dwelling                                                  |                         |                            |                           |                               |                      |                                |               |
| TER Opening Type                                               |                         |                            | 9.9200                    | 1.1450                        | 11.3588              |                                | (27)          |
| External Wall                                                  | 62.3800                 | 8.9200                     | 53.4600                   | 0.1800                        | 9.6228               |                                | (29a)         |
| RIR Stud Wall                                                  | 25.3800                 |                            | 25.3800                   | 0.1800                        | 4.5684               |                                | (29a)         |
| Dormer Walls                                                   | 6.6000                  | 1.0000                     | 5.6000                    | 0.1800                        | 1.0080               |                                | (29a)         |
| Adj To RIR Ins At Slope                                        | 16.0500                 |                            | 16.0500                   | 0.1100                        | 1.7655               |                                | (30)          |
| Slope Roof                                                     | 37.9900                 |                            | 37.9900                   | 0.1100                        | 4.1789               |                                | (30)          |
| Total net area of external elements Aum(A, m <sup>2</sup> )    |                         |                            | 148.4000                  |                               |                      |                                | (31)          |
| Fabric heat loss, W/K = Sum (A x U)                            |                         |                            |                           |                               | (26)...(30) + (32) = | 32.5024                        | (33)          |
| Main dwelling                                                  |                         |                            |                           |                               |                      |                                |               |
| Party Wall 1                                                   |                         |                            | 44.2300                   | 0.0000                        | 0.0000               |                                | (32)          |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K |                         |                            |                           |                               |                      |                                | 86.0177 (35)  |

## List of Thermal Bridges

| K1 Element                                                                | Length  | Psi-value | Total   |
|---------------------------------------------------------------------------|---------|-----------|---------|
| E2 Other lintels (including other steel lintels)                          | 7.9700  | 0.0500    | 0.3985  |
| E3 Sill                                                                   | 7.0600  | 0.0500    | 0.3530  |
| E4 Jamb                                                                   | 26.6000 | 0.0500    | 1.3300  |
| E16 Corner (normal)                                                       | 17.5000 | 0.0900    | 1.5750  |
| E18 Party wall between dwellings                                          | 9.5000  | 0.0600    | 0.5700  |
| E7 Party floor between dwellings (in blocks of flats)                     | 17.3000 | 0.0700    | 1.2110  |
| E11 Eaves (insulation at rafter level)                                    | 9.6000  | 0.0400    | 0.3840  |
| E17 Corner (inverted - internal area greater than external area)          | 8.0000  | -0.0900   | -0.7200 |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | 13.6000 | 0.0000    | 0.0000  |
| E13 Gable (insulation at rafter level)                                    | 16.1000 | 0.0800    | 1.2880  |
| E6 Intermediate floor within a dwelling                                   | 22.2000 | 0.0000    | 0.0000  |
| P5 Party wall - Roof (insulation at rafter level)                         | 6.4000  | 0.0800    | 0.5120  |
| P2 Party wall - Intermediate floor within a dwelling                      | 4.0000  | 0.0000    | 0.0000  |
| R4 Ridge (vaulted ceiling)                                                | 11.1000 | 0.0800    | 0.8880  |

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal Bridges

Total fabric heat loss

(33a) = 0.0000  
(33) + (36) + (36a) = 40.2919 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

|                           |                |                |                |                |                |                |                |                |                |                |                |                |      |
|---------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|------|
| (38)m                     | Jan<br>43.7392 | Feb<br>43.4468 | Mar<br>43.1601 | Apr<br>41.8136 | May<br>41.5617 | Jun<br>40.3890 | Jul<br>40.3890 | Aug<br>40.1718 | Sep<br>40.8407 | Oct<br>41.5617 | Nov<br>42.0714 | Dec<br>42.6041 | (38) |
| Heat transfer coeff       | 84.0311        | 83.7386        | 83.4520        | 82.1055        | 81.8536        | 80.6809        | 80.6809        | 80.4637        | 81.1326        | 81.8536        | 82.3632        | 82.8960        | (39) |
| Average = Sum(39)m / 12 = |                |                |                |                |                |                |                |                |                |                |                | 82.1043        |      |

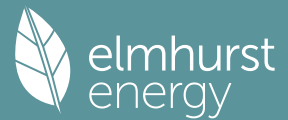
|               |               |               |               |               |               |               |               |               |               |               |               |               |      |
|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|------|
| HLP           | Jan<br>1.1295 | Feb<br>1.1255 | Mar<br>1.1217 | Apr<br>1.1036 | May<br>1.1002 | Jun<br>1.0844 | Jul<br>1.0844 | Aug<br>1.0815 | Sep<br>1.0905 | Oct<br>1.1002 | Nov<br>1.1070 | Dec<br>1.1142 | (40) |
| HLP (average) |               |               |               |               |               |               |               |               |               |               |               | 1.1036        |      |
| Days in mont  | 31            | 28            | 31            | 30            | 31            | 30            | 31            | 31            | 30            | 31            | 30            | 31            |      |

## 4. Water heating energy requirements (kWh/year)

|                                                                                |                 |                 |                 |                 |                 |                 |                 |                 |                 |                                        |                 |                 |             |
|--------------------------------------------------------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|----------------------------------------|-----------------|-----------------|-------------|
| Assumed occupancy                                                              |                 |                 |                 |                 |                 |                 |                 |                 |                 |                                        |                 |                 | 2.3480 (42) |
| Hot water usage for mixer showers                                              | 63.5886         | 62.6330         | 61.2405         | 58.5762         | 56.6100         | 54.4173         | 53.1710         | 54.5529         | 56.0678         | 58.4221                                | 61.1437         | 63.3450         | (42a)       |
| Hot water usage for baths                                                      | 27.4684         | 27.0605         | 26.4860         | 25.4268         | 24.6337         | 23.7542         | 23.2792         | 23.8496         | 24.4707         | 25.4118                                | 26.4928         | 27.3756         | (42b)       |
| Hot water usage for other uses                                                 | 38.6763         | 37.2699         | 35.8635         | 34.4571         | 33.0507         | 31.6443         | 31.6443         | 33.0507         | 34.4571         | 35.8635                                | 37.2699         | 38.6763         | (42c)       |
| Average daily hot water use (litres/day)                                       |                 |                 |                 |                 |                 |                 |                 |                 |                 |                                        |                 | 119.2545        | (43)        |
| Daily hot water use                                                            | Jan<br>129.7334 | Feb<br>126.9634 | Mar<br>123.5900 | Apr<br>118.4601 | May<br>114.2943 | Jun<br>109.8157 | Jul<br>108.0944 | Aug<br>111.4532 | Sep<br>114.9956 | Oct<br>119.6974                        | Nov<br>124.9064 | Dec<br>129.3969 | (44)        |
| Energy conte                                                                   | 205.4660        | 180.7942        | 189.9533        | 162.1659        | 153.8621        | 135.0313        | 130.7308        | 138.0024        | 141.8011        | 162.4282                               | 177.9521        | 202.6043        | (45)        |
| Energy content (annual)                                                        |                 |                 |                 |                 |                 |                 |                 |                 |                 | Total = Sum(45)m =                     |                 | 1980.7916       |             |
| Distribution loss (46)m = 0.15 x (45)m                                         | 30.8199         | 27.1191         | 28.4930         | 24.3249         | 23.0793         | 20.2547         | 19.6096         | 20.7004         | 21.2702         | 24.3642                                | 26.6928         | 30.3906         | (46)        |
| Water storage loss (or HIU loss):                                              |                 |                 |                 |                 |                 |                 |                 |                 |                 |                                        |                 |                 |             |
| Store volume                                                                   |                 |                 |                 |                 |                 |                 |                 |                 |                 |                                        |                 | 150.0000        | (47)        |
| a) If manufacturer declared loss factor is known (kWh/day):                    |                 |                 |                 |                 |                 |                 |                 |                 |                 |                                        |                 | 1.3938          | (48)        |
| Temperature factor from Table 2b                                               |                 |                 |                 |                 |                 |                 |                 |                 |                 |                                        |                 | 0.5400          | (49)        |
| Enter (49) or (54) in (55)                                                     |                 |                 |                 |                 |                 |                 |                 |                 |                 |                                        |                 | 0.7527          | (55)        |
| Total storage loss                                                             | 23.3325         | 21.0745         | 23.3325         | 22.5798         | 23.3325         | 22.5798         | 23.3325         | 23.3325         | 22.5798         | 23.3325                                | 22.5798         | 23.3325         | (56)        |
| If cylinder contains dedicated solar storage                                   | 23.3325         | 21.0745         | 23.3325         | 22.5798         | 23.3325         | 22.5798         | 23.3325         | 23.3325         | 22.5798         | 23.3325                                | 22.5798         | 23.3325         | (57)        |
| Primary loss                                                                   | 23.2624         | 21.0112         | 23.2624         | 22.5120         | 23.2624         | 22.5120         | 23.2624         | 23.2624         | 22.5120         | 23.2624                                | 22.5120         | 23.2624         | (59)        |
| Combi loss                                                                     | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000                                 | 0.0000          | 0.0000          | (61)        |
| Total heat required for water heating calculated for each month                | 252.0609        | 222.8799        | 236.5482        | 207.2577        | 200.4570        | 180.1231        | 177.3257        | 184.5973        | 186.8930        | 209.0231                               | 223.0439        | 249.1992        | (62)        |
| WWHRS                                                                          | -29.0701        | -25.7098        | -26.9218        | -22.2923        | -20.7757        | -17.7779        | -16.6639        | -17.7204        | -18.3937        | -21.6841                               | -24.5655        | -28.5317        | (63a)       |
| PV diverter                                                                    | -0.0000         | -0.0000         | -0.0000         | -0.0000         | -0.0000         | -0.0000         | -0.0000         | -0.0000         | -0.0000         | -0.0000                                | -0.0000         | -0.0000         | (63b)       |
| Solar input                                                                    | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000                                 | 0.0000          | 0.0000          | (63c)       |
| FGHRS                                                                          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000                                 | 0.0000          | 0.0000          | (63d)       |
| Output from w/h                                                                | 222.9908        | 197.1701        | 209.6263        | 184.9654        | 179.6813        | 162.3452        | 160.6617        | 166.8768        | 168.4993        | 187.3390                               | 198.4784        | 220.6674        | (64)        |
| Total per year (kWh/year)                                                      |                 |                 |                 |                 |                 |                 |                 |                 |                 | Total per year (kWh/year) = Sum(64)m = |                 | 2259.3020       | (64)        |
| Electric shower(s)                                                             | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000                                 | 0.0000          | 0.0000          | (64a)       |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |                 |                 |                 |                 |                 |                 |                 |                 |                 |                                        |                 | 0.0000          | (64a)       |
| Heat gains from water heating, kWh/month                                       | 105.5934        | 93.7827         | 100.4354        | 89.9936         | 88.4351         | 80.9714         | 80.7439         | 83.1617         | 83.2223         | 91.2833                                | 95.2425         | 104.6418        | (65)        |

## 5. Internal gains (see Table 5 and 5a)

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|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Metabolic gains (Table 5), Watts                                                    |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                     | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
| (66)m                                                                               | 117.4022 | 117.4022 | 117.4022 | 117.4022 | 117.4022 | 117.4022 | 117.4022 | 117.4022 | 117.4022 | 117.4022 | 117.4022 | 117.4022 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                     | 113.4015 | 125.5517 | 113.4015 | 117.1815 | 113.4015 | 117.1815 | 113.4015 | 113.4015 | 117.1815 | 113.4015 | 117.1815 | 113.4015 (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                     | 207.3413 | 209.4929 | 204.0710 | 192.5286 | 177.9583 | 164.2642 | 155.1158 | 152.9642 | 158.3861 | 169.9285 | 184.4988 | 198.1929 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                     | 34.7402  | 34.7402  | 34.7402  | 34.7402  | 34.7402  | 34.7402  | 34.7402  | 34.7402  | 34.7402  | 34.7402  | 34.7402  | 34.7402 (69)  |
| Pumps, fans                                                                         | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 0.0000   | 0.0000   | 0.0000   | 3.0000   | 3.0000   | 3.0000 (70)   |
| Losses e.g. evaporation (negative values) (Table 5)                                 |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                     | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 (71) |
| Water heating gains (Table 5)                                                       |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                     | 141.9266 | 139.5575 | 134.9938 | 124.9912 | 118.8643 | 112.4602 | 108.5268 | 111.7765 | 115.5866 | 122.6926 | 132.2813 | 140.6476 (72) |
| Total internal gains                                                                |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                     | 523.8900 | 535.8227 | 513.6870 | 495.9219 | 471.4448 | 452.1267 | 435.2647 | 436.3629 | 449.3749 | 467.2433 | 495.1824 | 513.4627 (73) |

## 6. Solar gains

| [Jan]       |          |          |          |          |            |                                |          |                                   |                                    |          |                              |               |              |  |
|-------------|----------|----------|----------|----------|------------|--------------------------------|----------|-----------------------------------|------------------------------------|----------|------------------------------|---------------|--------------|--|
|             |          |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 |          | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c |          | Access<br>factor<br>Table 6d |               | Gains<br>W   |  |
| East        |          |          |          |          | 4.9600     | 19.6403                        |          | 0.6300                            | 0.7000                             |          | 0.7700                       |               | 29.7715 (76) |  |
| West        |          |          |          |          | 4.9600     | 19.6403                        |          | 0.6300                            | 0.7000                             |          | 0.7700                       |               | 29.7715 (80) |  |
|             |          |          |          |          |            |                                |          |                                   |                                    |          |                              |               |              |  |
| Solar gains | 59.5430  | 116.4788 | 191.8239 | 279.7638 | 342.8610   | 350.9793                       | 334.1466 | 287.0270                          | 223.0992                           | 138.2119 | 74.2431                      | 48.9653 (83)  |              |  |
| Total gains | 583.4330 | 652.3015 | 705.5109 | 775.6857 | 814.3058   | 803.1059                       | 769.4113 | 723.3898                          | 672.4741                           | 605.4552 | 569.4255                     | 562.4279 (84) |              |  |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |                           |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |                           |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |                           |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct                       | Nov     | Dec          |
| tau                                                                         | 21.1553 | 21.2291 | 21.3021 | 21.6514 | 21.7180 | 22.0337 | 22.0337 | 22.0932 | 21.9110 | 21.7180                   | 21.5837 | 21.4449      |
| alpha                                                                       | 2.4104  | 2.4153  | 2.4201  | 2.4434  | 2.4479  | 2.4689  | 2.4689  | 2.4729  | 2.4607  | 2.4479                    | 2.4389  | 2.4297       |
| util living area                                                            | 0.9258  | 0.9024  | 0.8658  | 0.7912  | 0.6857  | 0.5445  | 0.4219  | 0.4589  | 0.6434  | 0.8186                    | 0.8994  | 0.9311 (86)  |
| MIT                                                                         | 18.3967 | 18.7058 | 19.1874 | 19.8432 | 20.3812 | 20.7575 | 20.9067 | 20.8827 | 20.6108 | 19.9152                   | 19.0752 | 18.3637 (87) |
| Th 2                                                                        | 19.9769 | 19.9800 | 19.9832 | 19.9979 | 20.0007 | 20.0136 | 20.0136 | 20.0160 | 20.0086 | 20.0007                   | 19.9951 | 19.9893 (88) |
| util rest of house                                                          | 0.9166  | 0.8905  | 0.8489  | 0.7642  | 0.6433  | 0.4811  | 0.3392  | 0.3758  | 0.5839  | 0.7893                    | 0.8851  | 0.9225 (89)  |
| MIT 2                                                                       | 16.9482 | 17.3369 | 17.9402 | 18.7534 | 19.3918 | 19.8152 | 19.9569 | 19.9407 | 19.6679 | 18.8593                   | 17.8166 | 16.9138 (90) |
| Living area fraction                                                        |         |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         | 0.3347 (91)  |
| MIT                                                                         | 17.4330 | 17.7951 | 18.3576 | 19.1181 | 19.7229 | 20.1306 | 20.2748 | 20.2559 | 19.9835 | 19.2127                   | 18.2379 | 17.3991 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |                           |         | 0.0000       |
| adjusted MIT                                                                | 17.4330 | 17.7951 | 18.3576 | 19.1181 | 19.7229 | 20.1306 | 20.2748 | 20.2559 | 19.9835 | 19.2127                   | 18.2379 | 17.3991 (93) |

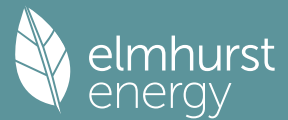
## 8. Space heating requirement

|                                                                                |           |           |          |          |          |          |          |          |          |               |          |                |
|--------------------------------------------------------------------------------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|---------------|----------|----------------|
|                                                                                | Jan       | Feb       | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov      | Dec            |
| Utilisation                                                                    | 0.8856    | 0.8573    | 0.8154   | 0.7369   | 0.6304   | 0.4891   | 0.3620   | 0.3970   | 0.5822   | 0.7618        | 0.8529   | 0.8926 (94)    |
| Useful gains                                                                   | 516.6685  | 559.2124  | 575.2624 | 571.5688 | 513.3509 | 392.7857 | 278.5229 | 287.2010 | 391.5415 | 461.2159      | 485.6805 | 502.0019 (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000   | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000   | 4.2000 (96)    |
| Heat loss rate W                                                               | 1103.5763 | 1079.8157 | 989.5380 | 838.9640 | 656.7063 | 446.2102 | 296.4826 | 310.2629 | 477.3399 | 704.9799      | 917.3506 | 1094.1489 (97) |
| Space heating kWh                                                              | 436.6594  | 349.8454  | 308.2211 | 192.5245 | 106.6564 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 181.3604      | 310.8025 | 440.5574 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |          |          |          |          |          |          |          |               |          | 2326.6271      |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000   | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |           |           |          |          |          |          |          |          |          |               |          | 0.0000         |
| Space heating kWh                                                              | 436.6594  | 349.8454  | 308.2211 | 192.5245 | 106.6564 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 181.3604      | 310.8025 | 440.5574 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |          |          |          |          |          |          |          |               |          | 2326.6271      |
| Space heating per m <sup>2</sup>                                               |           |           |          |          |          |          |          |          |          | (98c) / (4) = |          | 31.2719 (99)   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                       |          |          |          |          |          |          |          |          |          |          |          |                |
|-----------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Fraction of space heat from secondary/supplementary system (Table 11) |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)   |
| Fraction of space heat from main system(s)                            |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)   |
| Efficiency of main space heating system 1 (in %)                      |          |          |          |          |          |          |          |          |          |          |          | 92.3000 (206)  |
| Efficiency of main space heating system 2 (in %)                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)   |
| Efficiency of secondary/supplementary heating system, %               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)   |
|                                                                       | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec            |
| Space heating requirement                                             | 436.6594 | 349.8454 | 308.2211 | 192.5245 | 106.6564 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 181.3604 | 310.8025 | 440.5574 (98)  |
| Space heating efficiency (main heating system 1)                      | 92.3000  | 92.3000  | 92.3000  | 92.3000  | 92.3000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 92.3000  | 92.3000  | 92.3000 (210)  |
| Space heating fuel (main heating system)                              | 473.0871 | 379.0308 | 333.9340 | 208.5856 | 115.5541 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 196.4902 | 336.7307 | 477.3103 (211) |
| Space heating efficiency (main heating system 2)                      | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)   |
| Space heating fuel (main heating system 2)                            | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)   |
| Space heating fuel (secondary)                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)   |
| Water heating                                                         |          |          |          |          |          |          |          |          |          |          |          |                |
| Water heating requirement                                             | 222.9908 | 197.1701 | 209.6263 | 184.9654 | 179.6813 | 162.3452 | 160.6617 | 166.8768 | 168.4993 | 187.3390 | 198.4784 | 220.6674 (64)  |
| Efficiency of water heater                                            | 85.5388  | 85.3311  | 84.9229  | 84.1497  | 82.9308  | 79.8000  | 79.8000  | 79.8000  | 79.8000  | 83.9871  | 85.0612  | 79.8000 (216)  |
| Fuel for water heating, kWh/month                                     |          |          |          |          |          |          |          |          |          |          |          | 85.5790 (217)  |

# Full SAP Calculation Printout



|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |            |        |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------------|--------|
|                                                                                                      | 260.6896 | 231.0647 | 246.8431 | 219.8051 | 216.6642 | 203.4401 | 201.3305 | 209.1188 | 211.1520 | 223.0569 | 233.3359 | 257.8524   | (219)  |
| Space cooling fuel requirement                                                                       |          |          |          |          |          |          |          |          |          |          |          |            |        |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | (221)  |
| Pumps and Fa                                                                                         | 7.3041   | 6.5973   | 7.3041   | 7.0685   | 7.3041   | 7.0685   | 7.3041   | 7.3041   | 7.0685   | 7.3041   | 7.0685   | 7.3041     | (231)  |
| Lighting                                                                                             | 23.5626  | 18.9028  | 17.0199  | 12.4695  | 9.6318   | 7.8693   | 8.7864   | 11.4209  | 14.8347  | 19.4639  | 21.9844  | 24.2175    | (232)  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |            |        |
| (233a)m                                                                                              | -25.2647 | -36.7386 | -54.4445 | -63.1701 | -69.8028 | -65.7652 | -64.9678 | -60.5140 | -52.9184 | -42.8956 | -28.1747 | -21.7145   | (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |            |        |
| (234a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | (234a) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |            |        |
| (235a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | (235a) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |            |        |
| (235c)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | (235c) |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |            |        |
| (233b)m                                                                                              | -11.0474 | -23.5513 | -47.3940 | -72.0402 | -96.0929 | -96.8566 | -95.7086 | -80.6422 | -58.5969 | -33.9516 | -14.8373 | -8.7121    | (233b) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |            |        |
| (234b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | (234b) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |            |        |
| (235b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | (235b) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |            |        |
| (235d)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | (235d) |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |            |        |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 2520.7228  | (211)  |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000     | (213)  |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000     | (215)  |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 79.8000    |        |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          | 2714.3535  | (219)  |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000     | (221)  |
| Electricity for pumps and fans:                                                                      |          |          |          |          |          |          |          |          |          |          |          |            |        |
| Total electricity for the above, kWh/year                                                            |          |          |          |          |          |          |          |          |          |          |          | 86.0000    | (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |          |          |          |          |          |          |          |          | 190.1636   | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |          |          |          |          |          |          |          |          |            |        |
| PV generation                                                                                        |          |          |          |          |          |          |          |          |          |          |          | -1225.8021 | (233)  |
| Wind generation                                                                                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000     | (234)  |
| Hydro-electric generation (Appendix N)                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000     | (235a) |
| Electricity generated - Micro CHP (Appendix N)                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000     | (235)  |
| Appendix Q - special features                                                                        |          |          |          |          |          |          |          |          |          |          |          |            |        |
| Energy saved or generated                                                                            |          |          |          |          |          |          |          |          |          |          |          | -0.0000    | (236)  |
| Energy used                                                                                          |          |          |          |          |          |          |          |          |          |          |          | 0.0000     | (237)  |
| Total delivered energy for all uses                                                                  |          |          |          |          |          |          |          |          |          |          |          | 4285.4378  | (238)  |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                               | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|-----------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1                 | 2520.7228          | 0.2100                        | 529.3518 (261)           |
| Total CO2 associated with community systems   |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                    | 2714.3535          | 0.2100                        | 570.0142 (264)           |
| Space and water heating                       |                    |                               | 1099.3660 (265)          |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293 (267)            |
| Energy for lighting                           | 190.1636           | 0.1443                        | 27.4465 (268)            |
| Energy saving/generation technologies         |                    |                               |                          |
| PV Unit electricity used in dwelling          | -586.3710          | 0.1339                        | -78.5381                 |
| PV Unit electricity exported                  | -639.4311          | 0.1255                        | -80.2786                 |
| Total                                         |                    |                               | -158.8168 (269)          |
| Total CO2, kg/year                            |                    |                               | 979.9250 (272)           |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 13.1700 (273)            |

## 13a. Primary energy - Individual heating systems including micro-CHP

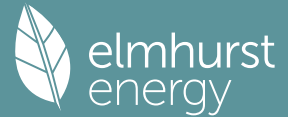
|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 2520.7228          | 1.1300                              | 2848.4167 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2714.3535          | 1.1300                              | 3067.2195 (278)            |
| Space and water heating                     |                    |                                     | 5915.6362 (279)            |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008 (281)             |
| Energy for lighting                         | 190.1636           | 1.5338                              | 291.6793 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -586.3710          | 1.4950                              | -876.6133                  |
| PV Unit electricity exported                | -639.4311          | 0.4608                              | -294.6672                  |
| Total                                       |                    |                                     | -1171.2805 (283)           |
| Total Primary energy kWh/year               |                    |                                     | 5166.1358 (286)            |
| Target Primary Energy Rate (TPER)           |                    |                                     | 69.4400 (287)              |

## SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF FABRIC ENERGY EFFICIENCY

### 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m)              | Volume<br>(m3)         |
|--------------------------------------------------------|--------------|-----------------------------------|------------------------|
| Main dwelling                                          |              |                                   |                        |
| Ground floor                                           | 45.3000 (1b) | x 2.7500 (2b)                     | = 124.5750 (1b) - (3b) |
| First floor                                            | 29.1000 (1c) | x 3.2600 (2c)                     | = 94.8660 (1c) - (3c)  |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 74.4000      |                                   | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 219.4410 (5)           |

# Full SAP Calculation Printout



## 2. Ventilation rate

|                                                                                                         |                                                       |        |        |        |        |        |        |        |        |        |                             |                       |
|---------------------------------------------------------------------------------------------------------|-------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-----------------------------|-----------------------|
|                                                                                                         |                                                       |        |        |        |        |        |        |        |        |        |                             | m3 per hour           |
| Number of open chimneys                                                                                 |                                                       |        |        |        |        |        |        |        |        |        |                             | 0 * 80 = 0.0000 (6a)  |
| Number of open flues                                                                                    |                                                       |        |        |        |        |        |        |        |        |        |                             | 0 * 20 = 0.0000 (6b)  |
| Number of chimneys / flues attached to closed fire                                                      |                                                       |        |        |        |        |        |        |        |        |        |                             | 0 * 10 = 0.0000 (6c)  |
| Number of flues attached to solid fuel boiler                                                           |                                                       |        |        |        |        |        |        |        |        |        |                             | 0 * 20 = 0.0000 (6d)  |
| Number of flues attached to other heater                                                                |                                                       |        |        |        |        |        |        |        |        |        |                             | 0 * 35 = 0.0000 (6e)  |
| Number of blocked chimneys                                                                              |                                                       |        |        |        |        |        |        |        |        |        |                             | 0 * 20 = 0.0000 (6f)  |
| Number of intermittent extract fans                                                                     |                                                       |        |        |        |        |        |        |        |        |        |                             | 3 * 10 = 30.0000 (7a) |
| Number of passive vents                                                                                 |                                                       |        |        |        |        |        |        |        |        |        |                             | 0 * 10 = 0.0000 (7b)  |
| Number of flueless gas fires                                                                            |                                                       |        |        |        |        |        |        |        |        |        |                             | 0 * 40 = 0.0000 (7c)  |
|                                                                                                         |                                                       |        |        |        |        |        |        |        |        |        |                             | Air changes per hour  |
| Infiltration due to chimneys, flues and fans                                                            | = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = |        |        |        |        |        |        |        |        |        | 30.0000 / (5) =             | 0.1367 (8)            |
| Pressure test                                                                                           |                                                       |        |        |        |        |        |        |        |        |        | Yes                         |                       |
| Pressure Test Method                                                                                    |                                                       |        |        |        |        |        |        |        |        |        | Blower Door                 |                       |
| Measured/design AP50                                                                                    |                                                       |        |        |        |        |        |        |        |        |        | 4.0000                      | (17)                  |
| Infiltration rate                                                                                       |                                                       |        |        |        |        |        |        |        |        |        | 0.3367                      | (18)                  |
| Number of sides sheltered                                                                               |                                                       |        |        |        |        |        |        |        |        |        | 1                           | (19)                  |
| Shelter factor                                                                                          |                                                       |        |        |        |        |        |        |        |        |        | (20) = 1 - [0.075 x (19)] = | 0.9250 (20)           |
| Infiltration rate adjusted to include shelter factor                                                    |                                                       |        |        |        |        |        |        |        |        |        | (21) = (18) x (20) =        | 0.3115 (21)           |
| Wind speed                                                                                              | Jan                                                   | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov                         | Dec                   |
| Wind factor                                                                                             | 5.1000                                                | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000                      | 4.7000 (22)           |
| Adj infilt rate                                                                                         | 1.2750                                                | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250                      | 1.1750 (22a)          |
|                                                                                                         | 0.3971                                                | 0.3893 | 0.3815 | 0.3426 | 0.3348 | 0.2959 | 0.2959 | 0.2881 | 0.3115 | 0.3348 | 0.3504                      | 0.3660 (22b)          |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |                                                       |        |        |        |        |        |        |        |        |        |                             | 0.0000 (23b)          |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =            |                                                       |        |        |        |        |        |        |        |        |        |                             | 0.0000 (23c)          |
| Effective ac                                                                                            | 0.5788                                                | 0.5758 | 0.5728 | 0.5587 | 0.5561 | 0.5438 | 0.5438 | 0.5415 | 0.5485 | 0.5561 | 0.5614                      | 0.5670 (25)           |

## 3. Heat losses and heat loss parameter

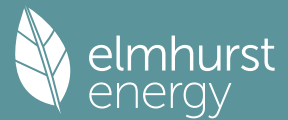
|                                                                           |             |                |               |                      |              |                                      |               |       |
|---------------------------------------------------------------------------|-------------|----------------|---------------|----------------------|--------------|--------------------------------------|---------------|-------|
| Element                                                                   | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K     | A x U<br>W/K | K-value<br>kJ/m2K                    | A x K<br>kJ/K |       |
| Main dwelling                                                             |             |                |               |                      |              |                                      |               |       |
| Windows / Glazed Doors                                                    |             |                | 9.9200        | 1.1450               | 11.3588      |                                      |               | (27)  |
| External Wall                                                             | 62.3800     | 8.9200         | 53.4600       | 0.1500               | 8.0190       | 9.0000                               | 481.1400      | (29a) |
| RIR Stud Wall                                                             | 25.3800     |                | 25.3800       | 0.1500               | 3.8070       | 9.0000                               | 228.4200      | (29a) |
| Dormer Walls                                                              | 6.6000      | 1.0000         | 5.6000        | 0.1500               | 0.8400       | 9.0000                               | 50.4000       | (29a) |
| Adj To RIR Ins At Slope                                                   | 16.0500     |                | 16.0500       | 0.1400               | 2.2470       | 9.0000                               | 144.4500      | (30)  |
| Slope Roof                                                                | 37.9900     |                | 37.9900       | 0.1400               | 5.3186       | 9.0000                               | 341.9100      | (30)  |
| Total net area of external elements Aum(A, m2)                            |             |                | 148.4000      |                      |              |                                      |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)                                       |             |                |               | (26)...(30) + (32) = | 31.5904      |                                      |               | (33)  |
| Main dwelling                                                             |             |                |               |                      |              |                                      |               |       |
| Party Wall 1                                                              |             |                | 44.2300       | 0.0000               | 0.0000       | 45.0000                              | 1990.3500     | (32)  |
| Party Floor 1                                                             |             |                | 45.3000       |                      |              | 30.0000                              | 1359.0000     | (32d) |
| Internal Wall 1                                                           |             |                | 113.1500      |                      |              | 9.0000                               | 1018.3500     | (32c) |
| Internal Floor 1                                                          |             |                | 29.1000       |                      |              | 18.0000                              | 523.8000      | (32d) |
| Internal Ceiling 1                                                        |             |                | 29.1000       |                      |              | 9.0000                               | 261.9000      | (32e) |
| Heat capacity Cm = Sum(A x k)                                             |             |                |               |                      |              |                                      |               |       |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K                         |             |                |               |                      |              | (28)...(30) + (32) + (32a)...(32e) = | 6399.7200     | (34)  |
| List of Thermal Bridges                                                   |             |                |               |                      |              |                                      | 86.0177       | (35)  |
| K1 Element                                                                |             |                |               | Length               | Psi-value    | Total                                |               |       |
| E2 Other lintels (including other steel lintels)                          |             |                |               | 7.9700               | 0.0840       | 0.6695                               |               |       |
| E3 Sill                                                                   |             |                |               | 7.0600               | 0.0340       | 0.2400                               |               |       |
| E4 Jamb                                                                   |             |                |               | 26.6000              | 0.0430       | 1.1438                               |               |       |
| E16 Corner (normal)                                                       |             |                |               | 17.5000              | 0.0300       | 0.5250                               |               |       |
| E18 Party wall between dwellings                                          |             |                |               | 9.5000               | 0.0400       | 0.3800                               |               |       |
| E7 Party floor between dwellings (in blocks of flats)                     |             |                |               | 17.3000              | 0.0660       | 1.1418                               |               |       |
| E11 Eaves (insulation at rafter level)                                    |             |                |               | 9.6000               | 0.0130       | 0.1248                               |               |       |
| E17 Corner (inverted - internal area greater than external area)          |             |                |               | 8.0000               | 0.0150       | 0.1200                               |               |       |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) |             |                |               | 13.6000              | 0.0000       | 0.0000                               |               |       |
| E13 Gable (insulation at rafter level)                                    |             |                |               | 16.1000              | 0.0240       | 0.3864                               |               |       |
| E6 Intermediate floor within a dwelling                                   |             |                |               | 22.2000              | 0.0800       | 1.7760                               |               |       |
| P5 Party wall - Roof (insulation at rafter level)                         |             |                |               | 6.4000               | 0.2400       | 1.5360                               |               |       |
| P2 Party wall - Intermediate floor within a dwelling                      |             |                |               | 4.0000               | 0.0000       | 0.0000                               |               |       |
| R4 Ridge (vaulted ceiling)                                                |             |                |               | 11.1000              | 0.1200       | 1.3320                               |               |       |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                |             |                |               |                      |              |                                      | 9.3753        | (36)  |
| Point Thermal bridges                                                     |             |                |               |                      |              | (36a) =                              | 0.0000        |       |
| Total fabric heat loss                                                    |             |                |               |                      |              | (33) + (36) + (36a) =                | 40.9657       | (37)  |

|                                                                     |         |         |         |         |         |         |         |         |         |         |         |              |
|---------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| (38)m                                                               | 41.9176 | 41.6958 | 41.4785 | 40.4577 | 40.2667 | 39.3777 | 39.3777 | 39.2130 | 39.7201 | 40.2667 | 40.6531 | 41.0570 (38) |
| Heat transfer coeff                                                 | 82.8833 | 82.6615 | 82.4442 | 81.4234 | 81.2324 | 80.3434 | 80.3434 | 80.1787 | 80.6858 | 81.2324 | 81.6188 | 82.0227 (39) |
| Average = Sum(39)m / 12 =                                           |         |         |         |         |         |         |         |         |         |         |         | 81.4225      |
| HLP                                                                 | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| HLP (average)                                                       | 1.1140  | 1.1110  | 1.1081  | 1.0944  | 1.0918  | 1.0799  | 1.0799  | 1.0777  | 1.0845  | 1.0918  | 1.0970  | 1.1025 (40)  |
| Days in mont                                                        | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31           |

## 4. Water heating energy requirements (kWh/year)

|                                          |          |         |         |         |         |         |         |         |         |         |         |               |
|------------------------------------------|----------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------------|
| Assumed occupancy                        |          |         |         |         |         |         |         |         |         |         |         | 2.3480 (42)   |
| Hot water usage for mixer showers        | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (42a)  |
| Hot water usage for baths                | 27.4684  | 27.0605 | 26.4860 | 25.4268 | 24.6337 | 23.7542 | 23.2792 | 23.8496 | 24.4707 | 25.4118 | 26.4928 | 27.3756 (42b) |
| Hot water usage for other uses           | 38.6763  | 37.2699 | 35.8635 | 34.4571 | 33.0507 | 31.6443 | 31.6443 | 33.0507 | 34.4571 | 35.8635 | 37.2699 | 38.6763 (42c) |
| Average daily hot water use (litres/day) |          |         |         |         |         |         |         |         |         |         |         | 60.6278 (43)  |
| Daily hot water use                      | Jan      | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec           |
| Energy conte                             | 66.1447  | 64.3304 | 62.3495 | 59.8839 | 57.6843 | 55.3985 | 54.9234 | 56.9003 | 58.9278 | 61.2753 | 63.7627 | 66.0519 (44)  |
|                                          | 104.7571 | 91.6056 | 95.8289 | 81.9780 | 77.6542 | 68.1189 | 66.4251 | 70.4544 | 72.6639 | 83.1500 | 90.8417 | 103.4213 (45) |

# Full SAP Calculation Printout



|                                                                                                       |                    |  |  |  |  |  |  |  |  |  |                |
|-------------------------------------------------------------------------------------------------------|--------------------|--|--|--|--|--|--|--|--|--|----------------|
| Energy content (annual)                                                                               | Total = Sum(45)m = |  |  |  |  |  |  |  |  |  | 1006.8990      |
| Distribution loss (46)m = 0.15 x (45)m                                                                |                    |  |  |  |  |  |  |  |  |  |                |
| 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (46)                     |                    |  |  |  |  |  |  |  |  |  |                |
| Water storage loss (or HIU loss):                                                                     |                    |  |  |  |  |  |  |  |  |  |                |
| Total storage loss                                                                                    |                    |  |  |  |  |  |  |  |  |  |                |
| 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)                     |                    |  |  |  |  |  |  |  |  |  |                |
| If cylinder contains dedicated solar storage                                                          |                    |  |  |  |  |  |  |  |  |  |                |
| 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)                     |                    |  |  |  |  |  |  |  |  |  |                |
| Primary loss                                                                                          |                    |  |  |  |  |  |  |  |  |  |                |
| 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (59)                     |                    |  |  |  |  |  |  |  |  |  |                |
| Combi loss                                                                                            |                    |  |  |  |  |  |  |  |  |  |                |
| 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)                     |                    |  |  |  |  |  |  |  |  |  |                |
| Total heat required for water heating calculated for each month                                       |                    |  |  |  |  |  |  |  |  |  |                |
| 89.0435 77.8648 81.4545 69.6813 66.0061 57.9010 56.4613 59.8863 61.7643 70.6775 77.2154 87.9081 (62)  |                    |  |  |  |  |  |  |  |  |  |                |
| WWHRS                                                                                                 |                    |  |  |  |  |  |  |  |  |  |                |
| 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63a)                    |                    |  |  |  |  |  |  |  |  |  |                |
| PV diverter                                                                                           |                    |  |  |  |  |  |  |  |  |  |                |
| 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63b)                    |                    |  |  |  |  |  |  |  |  |  |                |
| Solar input                                                                                           |                    |  |  |  |  |  |  |  |  |  |                |
| 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63c)                    |                    |  |  |  |  |  |  |  |  |  |                |
| FGHRS                                                                                                 |                    |  |  |  |  |  |  |  |  |  |                |
| 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)                    |                    |  |  |  |  |  |  |  |  |  |                |
| Output from w/h                                                                                       |                    |  |  |  |  |  |  |  |  |  |                |
| 89.0435 77.8648 81.4545 69.6813 66.0061 57.9010 56.4613 59.8863 61.7643 70.6775 77.2154 87.9081 (64)  |                    |  |  |  |  |  |  |  |  |  |                |
| 12Total per year (kWh/year)                                                                           |                    |  |  |  |  |  |  |  |  |  |                |
| Electric shower(s)                                                                                    |                    |  |  |  |  |  |  |  |  |  |                |
| 50.9239 45.3736 49.5463 47.2814 48.1686 45.9482 47.4798 48.1686 47.2814 49.5463 48.6146 50.9239 (64a) |                    |  |  |  |  |  |  |  |  |  |                |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =                        |                    |  |  |  |  |  |  |  |  |  | 579.2565 (64a) |
| Heat gains from water heating, kWh/month                                                              |                    |  |  |  |  |  |  |  |  |  |                |
| 34.9919 30.8096 32.7502 29.2407 28.5437 25.9623 25.9853 27.0137 27.2614 30.0559 31.4575 34.7080 (65)  |                    |  |  |  |  |  |  |  |  |  |                |

## 5. Internal gains (see Table 5 and 5a)

| Metabolic gains (Table 5), Watts                                                    |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
|                                                                                     | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
| (66)m                                                                               | 117.4022 | 117.4022 | 117.4022 | 117.4022 | 117.4022 | 117.4022 | 117.4022 | 117.4022 | 117.4022 | 117.4022 | 117.4022 | 117.4022 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 113.4015 | 125.5517 | 113.4015 | 117.1815 | 113.4015 | 117.1815 | 113.4015 | 113.4015 | 117.1815 | 113.4015 | 117.1815 | 113.4015 (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 207.3413 | 209.4929 | 204.0710 | 192.5286 | 177.9583 | 164.2642 | 155.1158 | 152.9642 | 158.3861 | 169.9285 | 184.4988 | 198.1929 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 34.7402  | 34.7402  | 34.7402  | 34.7402  | 34.7402  | 34.7402  | 34.7402  | 34.7402  | 34.7402  | 34.7402  | 34.7402  | 34.7402 (69)  |
| Pumps, fans                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (70)   |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 (71) |
| Water heating gains (Table 5)                                                       | 47.0321  | 45.8476  | 44.0191  | 40.6121  | 38.3651  | 36.0588  | 34.9265  | 36.3088  | 37.8631  | 40.3978  | 43.6910  | 46.6505 (72)  |
| Total internal gains                                                                | 425.9955 | 439.1128 | 419.7123 | 408.5428 | 387.9456 | 375.7252 | 361.6644 | 360.8951 | 371.6514 | 381.9485 | 403.5920 | 416.4656 (73) |

## 6. Solar gains

| [Jan]       |          |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c |          |          | Access<br>factor<br>Table 6d |               |  | Gains<br>W   |
|-------------|----------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|----------|----------|------------------------------|---------------|--|--------------|
| East        |          |          |          |          | 4.9600     | 19.6403                        | 0.7600                            | 0.0000                             |          |          | 0.7700                       |               |  | 57.0077 (76) |
| West        |          |          |          |          | 4.9600     | 19.6403                        | 0.7600                            | 0.0000                             |          |          | 0.7700                       |               |  | 57.0077 (80) |
|             |          |          |          |          |            |                                |                                   |                                    |          |          |                              |               |  |              |
| Solar gains | 114.0153 | 223.0382 | 367.3122 | 535.7029 | 656.5240   | 672.0691                       | 639.8372                          | 549.6107                           | 427.1992 | 264.6536 | 142.1637                     | 93.7607 (83)  |  |              |
| Total gains | 540.0109 | 662.1510 | 787.0244 | 944.2457 | 1044.4695  | 1047.7943                      | 1001.5016                         | 910.5058                           | 798.8506 | 646.6021 | 545.7558                     | 510.2262 (84) |  |              |

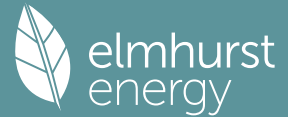
## 7. Mean internal temperature (heating season)

|                                                                             |                           |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |                           |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |                           |         |         |         |         |         |         |         |         |         |         |              |
|                                                                             | Jan                       | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 21.4482                   | 21.5058 | 21.5625 | 21.8328 | 21.8841 | 22.1263 | 22.1263 | 22.1717 | 22.0324 | 21.8841 | 21.7805 | 21.6733      |
| alpha                                                                       | 2.4299                    | 2.4337  | 2.4375  | 2.4555  | 2.4589  | 2.4751  | 2.4751  | 2.4781  | 2.4688  | 2.4589  | 2.4520  | 2.4449       |
| util living area                                                            | 0.9355                    | 0.8989  | 0.8382  | 0.7255  | 0.5894  | 0.4439  | 0.3352  | 0.3782  | 0.5756  | 0.7985  | 0.9062  | 0.9426 (86)  |
| MIT                                                                         | 18.3333                   | 18.7656 | 19.3709 | 20.0825 | 20.5720 | 20.8490 | 20.9451 | 20.9248 | 20.7027 | 19.9949 | 19.0458 | 18.2664 (87) |
| Th 2                                                                        | 19.9894                   | 19.9918 | 19.9942 | 20.0054 | 20.0075 | 20.0173 | 20.0173 | 20.0191 | 20.0135 | 20.0075 | 20.0033 | 19.9988 (88) |
| util rest of house                                                          | 0.9273                    | 0.8867  | 0.8191  | 0.6951  | 0.5459  | 0.3864  | 0.2660  | 0.3057  | 0.5163  | 0.7676  | 0.8928  | 0.9353 (89)  |
| MIT 2                                                                       | 17.5634                   | 17.9860 | 18.5716 | 19.2475 | 19.6871 | 19.9240 | 19.9921 | 19.9827 | 19.8151 | 19.1878 | 18.2751 | 17.5041 (90) |
| Living area fraction                                                        | fLA = Living area / (4) = |         |         |         |         |         |         |         |         |         |         |              |
| MIT                                                                         | 17.8211                   | 18.2469 | 18.8391 | 19.5270 | 19.9833 | 20.2336 | 20.3111 | 20.2980 | 20.1122 | 19.4579 | 18.5331 | 17.7592 (92) |
| Temperature adjustment                                                      | 0.0000                    |         |         |         |         |         |         |         |         |         |         |              |
| adjusted MIT                                                                | 17.8211                   | 18.2469 | 18.8391 | 19.5270 | 19.9833 | 20.2336 | 20.3111 | 20.2980 | 20.1122 | 19.4579 | 18.5331 | 17.7592 (93) |

## 8. Space heating requirement

|                                                                                | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov           | Dec       |       |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|---------------|-----------|-------|
| Utilisation                                                                    | 0.9043    | 0.8604    | 0.7934    | 0.6790   | 0.5447   | 0.3995   | 0.2871   | 0.3269   | 0.5226   | 0.7478   | 0.8678        | 0.9136    | (94)  |
| Useful gains                                                                   | 488.3186  | 569.7164  | 624.4290  | 641.1173 | 568.9714 | 418.5808 | 287.5653 | 297.6710 | 417.5154 | 483.5395 | 473.6201      | 466.1208  | (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000  | 7.1000        | 4.2000    | (96)  |
| Heat loss rate W                                                               | 1120.6725 | 1103.2760 | 1017.2872 | 865.2857 | 672.8720 | 452.6203 | 298.1593 | 312.5361 | 485.0978 | 719.5484 | 933.1524      | 1112.1641 | (97)  |
| Space heating kWh                                                              | 470.4713  | 358.5520  | 292.2865  | 161.4012 | 77.3020  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 175.5906 | 330.8632      | 480.6562  | (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |          |          |          |          |          |          |          |               | 2347.1231 |       |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | (98b) |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |          |          |          |          |          |          |          |               | 0.0000    |       |
| Space heating kWh                                                              | 470.4713  | 358.5520  | 292.2865  | 161.4012 | 77.3020  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 175.5906 | 330.8632      | 480.6562  | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |          |               | 2347.1231 |       |
| Space heating per m2                                                           |           |           |           |          |          |          |          |          |          |          | (98c) / (4) = | 31.5474   | (99)  |

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## 8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

|                                  | Jan    | Feb    | Mar    | Apr    | May     | Jun       | Jul       | Aug       | Sep     | Oct     | Nov    | Dec            |
|----------------------------------|--------|--------|--------|--------|---------|-----------|-----------|-----------|---------|---------|--------|----------------|
| Ext. temp.                       | 4.3000 | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000   | 16.6000   | 16.4000   | 14.1000 | 10.6000 | 7.1000 | 4.2000         |
| Heat loss rate W                 |        |        |        |        |         |           |           |           |         |         |        |                |
| Utilisation                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 755.2277  | 594.5410  | 609.3584  | 0.0000  | 0.0000  | 0.0000 | 0.0000 (100)   |
| Useful loss                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.8476    | 0.8906    | 0.8651    | 0.0000  | 0.0000  | 0.0000 | 0.0000 (101)   |
| Total gains                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 640.1082  | 529.4725  | 527.1410  | 0.0000  | 0.0000  | 0.0000 | 0.0000 (102)   |
| Space cooling kWh                | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 1175.0839 | 1123.4227 | 1019.3488 | 0.0000  | 0.0000  | 0.0000 | 0.0000 (103)   |
| Cooled fraction                  | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 385.1826  | 441.8989  | 366.2026  | 0.0000  | 0.0000  | 0.0000 | 0.0000 (104)   |
| Intermittency factor (Table 10b) | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500  | 0.2500    | 0.2500    | 0.2500    | 0.2500  | 0.2500  | 0.2500 | 0.2500 (105)   |
| Space cooling kWh                | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 96.2956   | 110.4747  | 91.5507   | 0.0000  | 0.0000  | 0.0000 | 0.0000 (107)   |
| Space cooling requirement        |        |        |        |        |         |           |           |           |         |         |        | 298.3210 (107) |
| Energy for space heating         |        |        |        |        |         |           |           |           |         |         |        | 31.5474 (99)   |
| Energy for space cooling         |        |        |        |        |         |           |           |           |         |         |        | 4.0097 (108)   |
| Total                            |        |        |        |        |         |           |           |           |         |         |        | 35.5570 (109)  |
| Fabric Energy Efficiency (DFEE)  |        |        |        |        |         |           |           |           |         |         |        | 35.6 (109)     |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)              | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|-----------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                   |                             |
| Ground floor                                           | 45.3000 (1b)              | x 2.7500 (2b)                     | = 124.5750 (1b) - (3b)      |
| First floor                                            | 29.1000 (1c)              | x 3.2600 (2c)                     | = 94.8660 (1c) - (3c)       |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 74.4000                   |                                   | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 219.4410 (5)                |

## 2. Ventilation rate

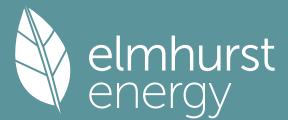
|                                                                                                    | m <sup>3</sup> per hour                 |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 3 * 10 = 30.0000 (7a)                   |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 30.0000 / (5) = 0.1367 (8)              |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 5.0000 (17)                             |
| Infiltration rate                                                                                  | 0.3867 (18)                             |
| Number of sides sheltered                                                                          | 1 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.9250 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.3577 (21)        |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate                                                                                         | 0.4561 | 0.4471 | 0.4382 | 0.3935 | 0.3845 | 0.3398 | 0.3398 | 0.3309 | 0.3577 | 0.3845 | 0.4024 | 0.4203 (22b) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.0000 (23b) |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =            |        |        |        |        |        |        |        |        |        |        |        | 0.0000 (23c) |
| Effective ac                                                                                            | 0.6040 | 0.6000 | 0.5960 | 0.5774 | 0.5739 | 0.5577 | 0.5577 | 0.5547 | 0.5640 | 0.5739 | 0.5810 | 0.5883 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                                        | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K |
|----------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|---------------|
| Main dwelling                                                  |                         |                            |                           |                               |              |                                |               |
| TER Opening Type                                               |                         |                            | 9.9200                    | 1.1450                        | 11.3588      |                                | (27)          |
| External Wall                                                  | 62.3800                 | 8.9200                     | 53.4600                   | 0.1800                        | 9.6228       |                                | (29a)         |
| RIR Stud Wall                                                  | 25.3800                 |                            | 25.3800                   | 0.1800                        | 4.5684       |                                | (29a)         |
| Dormer Walls                                                   | 6.6000                  | 1.0000                     | 5.6000                    | 0.1800                        | 1.0080       |                                | (29a)         |
| Adj To RIR Ins At Slope                                        | 16.0500                 |                            | 16.0500                   | 0.1100                        | 1.7655       |                                | (30)          |
| Slope Roof                                                     | 37.9900                 |                            | 37.9900                   | 0.1100                        | 4.1789       |                                | (30)          |
| Total net area of external elements Aum(A, m <sup>2</sup> )    |                         |                            | 148.4000                  |                               |              |                                | (31)          |
| Fabric heat loss, W/K = Sum (A x U)                            |                         |                            | (26)...(30) + (32) =      |                               | 32.5024      |                                | (33)          |
| Main dwelling                                                  |                         |                            |                           |                               |              |                                |               |
| Party Wall 1                                                   |                         |                            | 44.2300                   | 0.0000                        | 0.0000       |                                | (32)          |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K |                         |                            |                           |                               |              |                                | 86.0177 (35)  |
| List of Thermal Bridges                                        |                         |                            |                           |                               |              |                                |               |
| K1 Element                                                     |                         |                            |                           | Length                        | Psi-value    |                                | Total         |
| E2 Other lintels (including other steel lintels)               |                         |                            |                           | 7.9700                        | 0.0500       |                                | 0.3985        |
| E3 Sill                                                        |                         |                            |                           | 7.0600                        | 0.0500       |                                | 0.3530        |

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|                                                                                     |          |          |          |          |          |            |          |             |          |             |          |          |                              |         |         |                                    |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|------------|----------|-------------|----------|-------------|----------|----------|------------------------------|---------|---------|------------------------------------|
| E4 Jamb                                                                             |          |          |          |          |          |            |          |             |          |             |          |          | 26.6000                      | 0.0500  | 1.3300  |                                    |
| E16 Corner (normal)                                                                 |          |          |          |          |          |            |          |             |          |             |          |          | 17.5000                      | 0.0900  | 1.5750  |                                    |
| E18 Party wall between dwellings                                                    |          |          |          |          |          |            |          |             |          |             |          |          | 9.5000                       | 0.0600  | 0.5700  |                                    |
| E7 Party floor between dwellings (in blocks of flats)                               |          |          |          |          |          |            |          |             |          |             |          |          | 17.3000                      | 0.0700  | 1.2110  |                                    |
| E11 Eaves (insulation at rafter level)                                              |          |          |          |          |          |            |          |             |          |             |          |          | 9.6000                       | 0.0400  | 0.3840  |                                    |
| E17 Corner (inverted - internal area greater than external area)                    |          |          |          |          |          |            |          |             |          |             |          |          | 8.0000                       | -0.0900 | -0.7200 |                                    |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats)           |          |          |          |          |          |            |          |             |          |             |          |          | 13.6000                      | 0.0000  | 0.0000  |                                    |
| E13 Gable (insulation at rafter level)                                              |          |          |          |          |          |            |          |             |          |             |          |          | 16.1000                      | 0.0800  | 1.2880  |                                    |
| E6 Intermediate floor within a dwelling                                             |          |          |          |          |          |            |          |             |          |             |          |          | 22.2000                      | 0.0000  | 0.0000  |                                    |
| P5 Party wall - Roof (insulation at rafter level)                                   |          |          |          |          |          |            |          |             |          |             |          |          | 6.4000                       | 0.0800  | 0.5120  |                                    |
| P2 Party wall - Intermediate floor within a dwelling                                |          |          |          |          |          |            |          |             |          |             |          |          | 4.0000                       | 0.0000  | 0.0000  |                                    |
| R4 Ridge (vaulted ceiling)                                                          |          |          |          |          |          |            |          |             |          |             |          |          | 11.1000                      | 0.0800  | 0.8880  |                                    |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                          |          |          |          |          |          |            |          |             |          |             |          |          |                              |         |         | 7.7895 (36)                        |
| Point Thermal bridges                                                               |          |          |          |          |          |            |          |             |          |             |          |          |                              |         |         | 0.0000                             |
| Total fabric heat loss                                                              |          |          |          |          |          |            |          |             |          |             |          |          |                              |         |         | (33) + (36) + (36a) = 40.2919 (37) |
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)                 |          |          |          |          |          |            |          |             |          |             |          |          |                              |         |         |                                    |
| (38)m                                                                               | Jan      | Feb      | Mar      | Apr      | May      | Jun        | Jul      | Aug         | Sep      | Oct         | Nov      | Dec      |                              |         |         |                                    |
| Heat transfer coeff                                                                 | 43.7392  | 43.4468  | 43.1601  | 41.8136  | 41.5617  | 40.3890    | 40.3890  | 40.1718     | 40.8407  | 41.5617     | 42.0714  | 42.6041  | (38)                         |         |         |                                    |
| Average = Sum(39)m / 12 =                                                           | 84.0311  | 83.7386  | 83.4520  | 82.1055  | 81.8536  | 80.6809    | 80.6809  | 80.4637     | 81.1326  | 81.8536     | 82.3632  | 82.8960  | (39)                         |         |         |                                    |
|                                                                                     |          |          |          |          |          |            |          |             |          |             |          |          | 82.1043                      |         |         |                                    |
| HLP                                                                                 | Jan      | Feb      | Mar      | Apr      | May      | Jun        | Jul      | Aug         | Sep      | Oct         | Nov      | Dec      |                              |         |         |                                    |
| HLP (average)                                                                       | 1.1295   | 1.1255   | 1.1217   | 1.1036   | 1.1002   | 1.0844     | 1.0844   | 1.0815      | 1.0905   | 1.1002      | 1.1070   | 1.1142   | (40)                         |         |         |                                    |
| Days in mont                                                                        | 31       | 28       | 31       | 30       | 31       | 30         | 31       | 31          | 30       | 31          | 30       | 31       |                              |         |         |                                    |
|                                                                                     |          |          |          |          |          |            |          |             |          |             |          |          | 1.1036                       |         |         |                                    |
|                                                                                     |          |          |          |          |          |            |          |             |          |             |          |          | 31                           |         |         |                                    |
| -----                                                                               |          |          |          |          |          |            |          |             |          |             |          |          |                              |         |         |                                    |
| 4. Water heating energy requirements (kWh/year)                                     |          |          |          |          |          |            |          |             |          |             |          |          |                              |         |         |                                    |
| -----                                                                               |          |          |          |          |          |            |          |             |          |             |          |          |                              |         |         |                                    |
| Assumed occupancy                                                                   |          |          |          |          |          |            |          |             |          |             |          |          |                              |         |         | 2.3480 (42)                        |
| Hot water usage for mixer showers                                                   |          |          |          |          |          |            |          |             |          |             |          |          |                              |         |         |                                    |
|                                                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | 0.0000   | 0.0000      | 0.0000   | 0.0000      | 0.0000   | 0.0000   | (42a)                        |         |         |                                    |
| Hot water usage for baths                                                           |          |          |          |          |          |            |          |             |          |             |          |          |                              |         |         |                                    |
|                                                                                     | 27.4684  | 27.0605  | 26.4860  | 25.4268  | 24.6337  | 23.7542    | 23.2792  | 23.8496     | 24.4707  | 25.4118     | 26.4928  | 27.3756  | (42b)                        |         |         |                                    |
| Hot water usage for other uses                                                      |          |          |          |          |          |            |          |             |          |             |          |          |                              |         |         |                                    |
|                                                                                     | 38.6763  | 37.2699  | 35.8635  | 34.4571  | 33.0507  | 31.6443    | 31.6443  | 33.0507     | 34.4571  | 35.8635     | 37.2699  | 38.6763  | (42c)                        |         |         |                                    |
| Average daily hot water use (litres/day)                                            |          |          |          |          |          |            |          |             |          |             |          |          | 60.6278                      | (43)    |         |                                    |
|                                                                                     |          |          |          |          |          |            |          |             |          |             |          |          |                              |         |         |                                    |
| Daily hot water use                                                                 | Jan      | Feb      | Mar      | Apr      | May      | Jun        | Jul      | Aug         | Sep      | Oct         | Nov      | Dec      |                              |         |         |                                    |
|                                                                                     | 66.1447  | 64.3304  | 62.3495  | 59.8839  | 57.6843  | 55.3985    | 54.9234  | 56.9003     | 58.9278  | 61.2753     | 63.7627  | 66.0519  | (44)                         |         |         |                                    |
| Energy conte                                                                        | 104.7571 | 91.6056  | 95.8289  | 81.9780  | 77.6542  | 68.1189    | 66.4251  | 70.4544     | 72.6639  | 83.1500     | 90.8417  | 103.4213 | (45)                         |         |         |                                    |
| Energy content (annual)                                                             |          |          |          |          |          |            |          |             |          |             |          |          |                              |         |         |                                    |
| Distribution loss (46)m = 0.15 x (45)m                                              |          |          |          |          |          |            |          |             |          |             |          |          | Total = Sum(45)m = 1006.8990 |         |         |                                    |
|                                                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | 0.0000   | 0.0000      | 0.0000   | 0.0000      | 0.0000   | 0.0000   | (46)                         |         |         |                                    |
| Water storage loss (or HIU loss):                                                   |          |          |          |          |          |            |          |             |          |             |          |          |                              |         |         |                                    |
| Total storage loss                                                                  |          |          |          |          |          |            |          |             |          |             |          |          |                              |         |         |                                    |
|                                                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | 0.0000   | 0.0000      | 0.0000   | 0.0000      | 0.0000   | 0.0000   | (56)                         |         |         |                                    |
| If cylinder contains dedicated solar storage                                        |          |          |          |          |          |            |          |             |          |             |          |          |                              |         |         |                                    |
|                                                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | 0.0000   | 0.0000      | 0.0000   | 0.0000      | 0.0000   | 0.0000   | (57)                         |         |         |                                    |
| Primary loss                                                                        |          |          |          |          |          |            |          |             |          |             |          |          |                              |         |         |                                    |
|                                                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | 0.0000   | 0.0000      | 0.0000   | 0.0000      | 0.0000   | 0.0000   | (59)                         |         |         |                                    |
| Combi loss                                                                          |          |          |          |          |          |            |          |             |          |             |          |          |                              |         |         |                                    |
|                                                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | 0.0000   | 0.0000      | 0.0000   | 0.0000      | 0.0000   | 0.0000   | (61)                         |         |         |                                    |
| Total heat required for water heating calculated for each month                     |          |          |          |          |          |            |          |             |          |             |          |          |                              |         |         |                                    |
|                                                                                     | 89.0435  | 77.8648  | 81.4545  | 69.6813  | 66.0061  | 57.9010    | 56.4613  | 59.8863     | 61.7643  | 70.6775     | 77.2154  | 87.9081  | (62)                         |         |         |                                    |
| WWHRS                                                                               |          |          |          |          |          |            |          |             |          |             |          |          |                              |         |         |                                    |
|                                                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | 0.0000   | 0.0000      | 0.0000   | 0.0000      | 0.0000   | 0.0000   | (63a)                        |         |         |                                    |
| PV diverter                                                                         |          |          |          |          |          |            |          |             |          |             |          |          |                              |         |         |                                    |
|                                                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | 0.0000   | 0.0000      | 0.0000   | 0.0000      | 0.0000   | 0.0000   | (63b)                        |         |         |                                    |
| Solar input                                                                         |          |          |          |          |          |            |          |             |          |             |          |          |                              |         |         |                                    |
|                                                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | 0.0000   | 0.0000      | 0.0000   | 0.0000      | 0.0000   | 0.0000   | (63c)                        |         |         |                                    |
| FGHRS                                                                               |          |          |          |          |          |            |          |             |          |             |          |          |                              |         |         |                                    |
|                                                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | 0.0000   | 0.0000      | 0.0000   | 0.0000      | 0.0000   | 0.0000   | (63d)                        |         |         |                                    |
| Output from w/h                                                                     |          |          |          |          |          |            |          |             |          |             |          |          |                              |         |         |                                    |
|                                                                                     | 89.0435  | 77.8648  | 81.4545  | 69.6813  | 66.0061  | 57.9010    | 56.4613  | 59.8863     | 61.7643  | 70.6775     | 77.2154  | 87.9081  | (64)                         |         |         |                                    |
| 12Total per year (kWh/year)                                                         |          |          |          |          |          |            |          |             |          |             |          |          | 855.8641                     | (64)    |         |                                    |
| Electric shower(s)                                                                  |          |          |          |          |          |            |          |             |          |             |          |          | 856                          | (64)    |         |                                    |
|                                                                                     | 50.9239  | 45.3736  | 49.5463  | 47.2814  | 48.1686  | 45.9482    | 47.4798  | 48.1686     | 47.2814  | 49.5463     | 48.6146  | 50.9239  | (64a)                        |         |         |                                    |
|                                                                                     |          |          |          |          |          |            |          |             |          |             |          |          | 579.2565                     | (64a)   |         |                                    |
| Heat gains from water heating, kWh/month                                            |          |          |          |          |          |            |          |             |          |             |          |          |                              |         |         |                                    |
|                                                                                     | 34.9919  | 30.8096  | 32.7502  | 29.2407  | 28.5437  | 25.9623    | 25.9853  | 27.0137     | 27.2614  | 30.0559     | 31.4575  | 34.7080  | (65)                         |         |         |                                    |
| -----                                                                               |          |          |          |          |          |            |          |             |          |             |          |          |                              |         |         |                                    |
| 5. Internal gains (see Table 5 and 5a)                                              |          |          |          |          |          |            |          |             |          |             |          |          |                              |         |         |                                    |
| -----                                                                               |          |          |          |          |          |            |          |             |          |             |          |          |                              |         |         |                                    |
| Metabolic gains (Table 5), Watts                                                    |          |          |          |          |          |            |          |             |          |             |          |          |                              |         |         |                                    |
| (66)m                                                                               | Jan      | Feb      | Mar      | Apr      | May      | Jun        | Jul      | Aug         | Sep      | Oct         | Nov      | Dec      |                              |         |         |                                    |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 117.4022 | 117.4022 | 117.4022 | 117.4022 | 117.4022 | 117.4022   | 117.4022 | 117.4022    | 117.4022 | 117.4022    | 117.4022 | 117.4022 | (66)                         |         |         |                                    |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 113.4015 | 125.5517 | 113.4015 | 117.1815 | 113.4015 | 117.1815   | 113.4015 | 113.4015    | 117.1815 | 113.4015    | 117.1815 | 113.4015 | (67)                         |         |         |                                    |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 207.3413 | 209.4929 | 204.0710 | 192.5286 | 177.9583 | 164.2642   | 155.1158 | 152.9642    | 158.3861 | 169.9285    | 184.4988 | 198.1929 | (68)                         |         |         |                                    |
| Pumps, fans                                                                         | 34.7402  | 34.7402  | 34.7402  | 34.7402  | 34.7402  | 34.7402    | 34.7402  | 34.7402     | 34.7402  | 34.7402     | 34.7402  | 34.7402  | (69)                         |         |         |                                    |
| Losses e.g. evaporation (negative values) (Table 5)                                 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | 0.0000   | 0.0000      | 0.0000   | 0.0000      | 0.0000   | 0.0000   | (70)                         |         |         |                                    |
| Water heating gains (Table 5)                                                       | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218   | -93.9218 | -93.9218    | -93.9218 | -93.9218    | -93.9218 | -93.9218 | (71)                         |         |         |                                    |
| Total internal gains                                                                | 47.0321  | 45.8476  | 44.0191  | 40.6121  | 38.3651  | 36.0588    | 34.9265  | 36.3088     | 37.8631  | 40.3978     | 43.6910  | 46.6505  | (72)                         |         |         |                                    |
|                                                                                     | 425.9955 | 439.1128 | 419.7123 | 408.5428 | 387.9456 | 375.7252   | 361.6644 | 360.8951    | 371.6514 | 381.9485    | 403.5920 | 416.4656 | (73)                         |         |         |                                    |
| -----                                                                               |          |          |          |          |          |            |          |             |          |             |          |          |                              |         |         |                                    |
| 6. Solar gains                                                                      |          |          |          |          |          |            |          |             |          |             |          |          |                              |         |         |                                    |
| -----                                                                               |          |          |          |          |          |            |          |             |          |             |          |          |                              |         |         |                                    |
| [Jan]                                                                               |          |          |          |          |          |            |          |             |          |             |          |          |                              |         |         |                                    |
|                                                                                     |          |          |          | Area     |          | Solar flux |          | g           |          | FF          |          | Access   |                              | Gains   |         |                                    |
|                                                                                     |          |          |          | m2       |          | Table 6a   |          | or Table 6b |          | or Table 6c |          | factor   |                              | W       |         |                                    |
|                                                                                     |          |          |          |          |          |            |          |             |          |             |          | Table 6d |                              |         |         |                                    |
| East                                                                                |          |          |          | 4.9600   |          | 19.6403    |          | 0.6300      |          | 0.7000      |          | 0.7700   |                              | 29.7715 | (76)    |                                    |
| West                                                                                |          |          |          | 4.9600   |          | 19.6403    |          | 0.6300      |          | 0.7000      |          | 0.7700   |                              | 29.7715 | (80)    |                                    |
| Solar gains                                                                         | 59.5430  | 116.4788 | 191.8239 | 279.7638 | 342.8610 | 350.9793   | 334.1466 | 287.0270    | 223.0992 | 138.2119    | 74.2431  | 48.9653  | (83)                         |         |         |                                    |
| Total gains                                                                         | 485.5386 | 555.5916 | 611.5362 | 688.3066 | 730.8066 | 726.7044   | 695.8110 | 647.9221    | 594.7505 | 520.1603    | 477.8352 | 465.4308 | (84)                         |         |         |                                    |

# Full SAP Calculation Printout



|                                                                             |                           |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| 7. Mean internal temperature (heating season)                               |                           |         |         |         |         |         |         |         |         |         |              |
| Temperature during heating periods in the living area from Table 9, Th1 (C) |                           |         |         |         |         |         |         |         |         |         |              |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |                           |         |         |         |         |         |         |         |         |         |              |
|                                                                             | Jan                       | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov          |
| tau                                                                         | 21.1553                   | 21.2291 | 21.3021 | 21.6514 | 21.7180 | 22.0337 | 22.0337 | 22.0932 | 21.9110 | 21.7180 | 21.5837      |
| alpha                                                                       | 2.4104                    | 2.4153  | 2.4201  | 2.4434  | 2.4479  | 2.4689  | 2.4689  | 2.4729  | 2.4607  | 2.4479  | 2.4389       |
| util living area                                                            | 0.9480                    | 0.9274  | 0.8950  | 0.8253  | 0.7243  | 0.5831  | 0.4577  | 0.4997  | 0.6892  | 0.8574  | 0.9272       |
| MIT                                                                         | 18.1557                   | 18.4840 | 18.9952 | 19.7042 | 20.2926 | 20.7159 | 20.8878 | 20.8575 | 20.5411 | 19.7639 | 18.8651      |
| Th 2                                                                        | 19.9769                   | 19.9800 | 19.9832 | 19.9979 | 20.0007 | 20.0136 | 20.0136 | 20.0160 | 20.0086 | 20.0007 | 19.9951      |
| util rest of house                                                          | 0.9411                    | 0.9179  | 0.8808  | 0.8010  | 0.6837  | 0.5187  | 0.3705  | 0.4126  | 0.6311  | 0.8323  | 0.9162       |
| MIT 2                                                                       | 17.3818                   | 17.7062 | 18.2089 | 18.9018 | 19.4522 | 19.8300 | 19.9596 | 19.9435 | 19.6902 | 18.9742 | 18.0960      |
| Living area fraction                                                        | fLA = Living area / (4) = |         |         |         |         |         |         |         |         |         |              |
| MIT                                                                         | 17.6408                   | 17.9665 | 18.4720 | 19.1703 | 19.7335 | 20.1265 | 20.2703 | 20.2494 | 19.9749 | 19.2385 | 18.3534      |
| Temperature adjustment                                                      | 0.0000                    |         |         |         |         |         |         |         |         |         |              |
| adjusted MIT                                                                | 17.6408                   | 17.9665 | 18.4720 | 19.1703 | 19.7335 | 20.1265 | 20.2703 | 20.2494 | 19.9749 | 19.2385 | 18.3534      |
|                                                                             |                           |         |         |         |         |         |         |         |         |         | 17.6107 (93) |

|                                                                                |               |           |          |          |          |          |          |          |          |          |              |
|--------------------------------------------------------------------------------|---------------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------|
| 8. Space heating requirement                                                   |               |           |          |          |          |          |          |          |          |          |              |
|                                                                                | Jan           | Feb       | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov          |
| Utilisation                                                                    | 0.9200        | 0.8937    | 0.8546   | 0.7776   | 0.6716   | 0.5266   | 0.3943   | 0.4345   | 0.6290   | 0.8091   | 0.8927       |
| Useful gains                                                                   | 446.6716      | 496.5426  | 522.6348 | 535.1963 | 490.8204 | 382.6867 | 274.3580 | 281.4987 | 374.0687 | 420.8478 | 426.5837     |
| Ext temp.                                                                      | 4.3000        | 4.9000    | 6.5000   | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000  | 7.1000       |
| Heat loss rate W                                                               | 1121.0452     | 1094.1744 | 999.0904 | 843.2495 | 657.5716 | 445.8842 | 296.1201 | 309.7354 | 476.6498 | 707.0892 | 926.8669     |
| Space heating kWh                                                              | 501.7340      | 401.6086  | 354.4830 | 221.7983 | 124.0629 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 212.9636 | 360.2039     |
| Space heating requirement - total per year (kWh/year)                          |               |           |          |          |          |          |          |          |          |          |              |
| Solar heating kWh                                                              | 0.0000        | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000       |
| Solar heating contribution - total per year (kWh/year)                         |               |           |          |          |          |          |          |          |          |          |              |
| Space heating kWh                                                              | 501.7340      | 401.6086  | 354.4830 | 221.7983 | 124.0629 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 212.9636 | 360.2039     |
| Space heating requirement after solar contribution - total per year (kWh/year) |               |           |          |          |          |          |          |          |          |          |              |
| Space heating per m2                                                           | (98c) / (4) = |           |          |          |          |          |          |          |          |          |              |
|                                                                                |               |           |          |          |          |          |          |          |          |          | 36.0650 (99) |

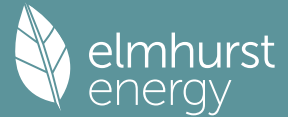
|                                                     |                          |        |        |        |         |          |          |          |         |         |            |
|-----------------------------------------------------|--------------------------|--------|--------|--------|---------|----------|----------|----------|---------|---------|------------|
| 8c. Space cooling requirement                       |                          |        |        |        |         |          |          |          |         |         |            |
| Calculated for June, July and August. See Table 10b |                          |        |        |        |         |          |          |          |         |         |            |
|                                                     | Jan                      | Feb    | Mar    | Apr    | May     | Jun      | Jul      | Aug      | Sep     | Oct     | Nov        |
| Ext. temp.                                          | 4.3000                   | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000  | 16.6000  | 16.4000  | 14.1000 | 10.6000 | 7.1000     |
| Heat loss rate W                                    | 0.0000                   | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 758.4003 | 597.0386 | 611.5243 | 0.0000  | 0.0000  | 0.0000     |
| Utilisation                                         | 0.0000                   | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.7304   | 0.7940   | 0.7641   | 0.0000  | 0.0000  | 0.0000     |
| Useful loss                                         | 0.0000                   | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 553.9173 | 474.0709 | 467.2949 | 0.0000  | 0.0000  | 0.0000     |
| Total gains                                         | 0.0000                   | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 799.7841 | 766.1219 | 712.4327 | 0.0000  | 0.0000  | 0.0000     |
| Space cooling kWh                                   | 0.0000                   | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 177.0241 | 217.2859 | 182.3825 | 0.0000  | 0.0000  | 0.0000     |
| Cooled fraction                                     | fc = cooled area / (4) = |        |        |        |         |          |          |          |         |         |            |
| Intermittency factor (Table 10b)                    | 0.2500                   | 0.2500 | 0.2500 | 0.2500 | 0.2500  | 0.2500   | 0.2500   | 0.2500   | 0.2500  | 0.2500  | 0.2500     |
| Space cooling kWh                                   | 0.0000                   | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 44.2560  | 54.3215  | 45.5956  | 0.0000  | 0.0000  | 0.0000     |
| Space cooling requirement                           |                          |        |        |        |         |          |          |          |         |         |            |
| Energy for space heating                            |                          |        |        |        |         |          |          |          |         |         |            |
| Energy for space cooling                            |                          |        |        |        |         |          |          |          |         |         |            |
| Total                                               |                          |        |        |        |         |          |          |          |         |         |            |
| Fabric Energy Efficiency (TFEE)                     |                          |        |        |        |         |          |          |          |         |         |            |
|                                                     |                          |        |        |        |         |          |          |          |         |         | 38.0 (109) |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF ENERGY RATING

|                                                        |                                   |                   |             |   |                      |  |  |  |  |              |     |
|--------------------------------------------------------|-----------------------------------|-------------------|-------------|---|----------------------|--|--|--|--|--------------|-----|
| 1. Overall dwelling characteristics                    |                                   |                   |             |   |                      |  |  |  |  |              |     |
| Main dwelling                                          | Area (m2)                         | Storey height (m) | Volume (m3) |   |                      |  |  |  |  |              |     |
| Ground floor                                           | 45.3000 (1b)                      | x                 | 2.7500 (2b) | = | 124.5750 (1b) - (3b) |  |  |  |  |              |     |
| First floor                                            | 29.1000 (1c)                      | x                 | 3.2600 (2c) | = | 94.8660 (1c) - (3c)  |  |  |  |  |              |     |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 74.4000                           |                   |             |   |                      |  |  |  |  |              | (4) |
| Dwelling volume                                        | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = |                   |             |   |                      |  |  |  |  | 219.4410 (5) |     |

|                                                    |          |  |  |  |  |  |  |  |  |  |             |
|----------------------------------------------------|----------|--|--|--|--|--|--|--|--|--|-------------|
| 2. Ventilation rate                                |          |  |  |  |  |  |  |  |  |  |             |
| m3 per hour                                        |          |  |  |  |  |  |  |  |  |  |             |
| Number of open chimneys                            | 0 * 80 = |  |  |  |  |  |  |  |  |  |             |
| Number of open flues                               | 0 * 20 = |  |  |  |  |  |  |  |  |  |             |
| Number of chimneys / flues attached to closed fire | 0 * 10 = |  |  |  |  |  |  |  |  |  |             |
| Number of flues attached to solid fuel boiler      | 0 * 20 = |  |  |  |  |  |  |  |  |  |             |
| Number of flues attached to other heater           | 0 * 35 = |  |  |  |  |  |  |  |  |  |             |
| Number of blocked chimneys                         | 0 * 20 = |  |  |  |  |  |  |  |  |  |             |
| Number of intermittent extract fans                | 0 * 10 = |  |  |  |  |  |  |  |  |  |             |
| Number of passive vents                            | 0 * 10 = |  |  |  |  |  |  |  |  |  |             |
|                                                    |          |  |  |  |  |  |  |  |  |  | 0.0000 (7b) |

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Number of flueless gas fires 0 \* 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = Air changes per hour  
Pressure test 0.0000 / (5) = 0.0000 (8)  
Pressure Test Method Yes  
Measured/design AP50 Blower Door  
Infiltration rate 4.0000 (17)  
Number of sides sheltered 0.2000 (18)  
1 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.9250 (20)  
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1850 (21)

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate                                                                                         | 0.2359 | 0.2313 | 0.2266 | 0.2035 | 0.1989 | 0.1758 | 0.1758 | 0.1711 | 0.1850 | 0.1989 | 0.2081 | 0.2174 (22b) |
| Mechanical extract ventilation - centralised                                                            |        |        |        |        |        |        |        |        |        |        |        |              |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                        | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K     | A x U<br>W/K | K-value<br>kJ/m2K | A x K<br>kJ/K   |
|------------------------------------------------|-------------|----------------|---------------|----------------------|--------------|-------------------|-----------------|
| Main dwelling                                  |             |                |               |                      |              |                   |                 |
| Windows / Glazed Doors                         |             |                | 9.9200        | 1.1450               | 11.3588      |                   | (27)            |
| External Wall                                  | 62.3800     | 8.9200         | 53.4600       | 0.1500               | 8.0190       | 9.0000            | 481.1400 (29a)  |
| RIR Stud Wall                                  | 25.3800     |                | 25.3800       | 0.1500               | 3.8070       | 9.0000            | 228.4200 (29a)  |
| Dormer Walls                                   | 6.6000      | 1.0000         | 5.6000        | 0.1500               | 0.8400       | 9.0000            | 50.4000 (29a)   |
| Adj To RIR Ins At Slope                        | 16.0500     |                | 16.0500       | 0.1400               | 2.2470       | 9.0000            | 144.4500 (30)   |
| Slope Roof                                     | 37.9900     |                | 37.9900       | 0.1400               | 5.3186       | 9.0000            | 341.9100 (30)   |
| Total net area of external elements Aum(A, m2) |             |                | 148.4000      |                      |              |                   | (31)            |
| Fabric heat loss, W/K = Sum (A x U)            |             |                |               | (26)...(30) + (32) = | 31.5904      |                   | (33)            |
| Main dwelling                                  |             |                |               |                      |              |                   |                 |
| Party Wall 1                                   |             |                | 44.2300       | 0.0000               | 0.0000       | 45.0000           | 1990.3500 (32)  |
| Party Floor 1                                  |             |                | 45.3000       |                      |              | 30.0000           | 1359.0000 (32d) |
| Internal Wall 1                                |             |                | 113.1500      |                      |              | 9.0000            | 1018.3500 (32c) |
| Internal Floor 1                               |             |                | 29.1000       |                      |              | 18.0000           | 523.8000 (32d)  |
| Internal Ceiling 1                             |             |                | 29.1000       |                      |              | 9.0000            | 261.9000 (32e)  |

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 6399.7200 (34)  
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 86.0177 (35)

List of Thermal Bridges

|                                                                           | Length  | Psi-value | Total                              |
|---------------------------------------------------------------------------|---------|-----------|------------------------------------|
| K1 Element                                                                | 7.9700  | 0.0840    | 0.6695                             |
| E2 Other lintels (including other steel lintels)                          | 7.0600  | 0.0340    | 0.2400                             |
| E3 Sill                                                                   | 26.6000 | 0.0430    | 1.1438                             |
| E4 Jamb                                                                   | 17.5000 | 0.0300    | 0.5250                             |
| E16 Corner (normal)                                                       | 9.5000  | 0.0400    | 0.3800                             |
| E18 Party wall between dwellings                                          | 17.3000 | 0.0660    | 1.1418                             |
| E7 Party floor between dwellings (in blocks of flats)                     | 9.6000  | 0.0130    | 0.1248                             |
| E11 Eaves (insulation at rafter level)                                    | 8.0000  | 0.0150    | 0.1200                             |
| E17 Corner (inverted - internal area greater than external area)          | 13.6000 | 0.0000    | 0.0000                             |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | 16.1000 | 0.0240    | 0.3864                             |
| E13 Gable (insulation at rafter level)                                    | 22.2000 | 0.0800    | 1.7760                             |
| E6 Intermediate floor within a dwelling                                   | 6.4000  | 0.2400    | 1.5360                             |
| P5 Party wall - Roof (insulation at rafter level)                         | 4.0000  | 0.0000    | 0.0000                             |
| P2 Party wall - Intermediate floor within a dwelling                      | 11.1000 | 0.1200    | 1.3320                             |
| R4 Ridge (vaulted ceiling)                                                |         |           | 9.3753 (36)                        |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                |         |           | 0.0000                             |
| Point Thermal Bridges                                                     |         |           | (36a) =                            |
| Total fabric heat loss                                                    |         |           | (33) + (36) + (36a) = 40.9657 (37) |

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

|                           | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| (38)m                     | 36.2078 | 36.2078 | 36.2078 | 36.2078 | 36.2078 | 36.2078 | 36.2078 | 36.2078 | 36.2078 | 36.2078 | 36.2078 | 36.2078 (38) |
| Heat transfer coeff       | 77.1735 | 77.1735 | 77.1735 | 77.1735 | 77.1735 | 77.1735 | 77.1735 | 77.1735 | 77.1735 | 77.1735 | 77.1735 | 77.1735 (39) |
| Average = Sum(39)m / 12 = |         |         |         |         |         |         |         |         |         |         |         | 77.1735      |

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec         |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
| HLP           | 1.0373 | 1.0373 | 1.0373 | 1.0373 | 1.0373 | 1.0373 | 1.0373 | 1.0373 | 1.0373 | 1.0373 | 1.0373 | 1.0373 (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 1.0373      |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31          |

## 4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.3480 (42)

Hot water usage for mixer showers

|  | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec           |
|--|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------------|
|  | 87.4344 | 86.1204 | 84.2057 | 80.5423 | 77.8387 | 74.8238 | 73.1101 | 75.0103 | 77.0933 | 80.3304 | 84.0726 | 87.0994 (42a) |

Hot water usage for baths

|  | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec           |
|--|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------------|
|  | 27.4684 | 27.0605 | 26.4860 | 25.4268 | 24.6337 | 23.7542 | 23.2792 | 23.8496 | 24.4707 | 25.4118 | 26.4928 | 27.3756 (42b) |

Hot water usage for other uses

|  | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec           |
|--|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------------|
|  | 38.6763 | 37.2699 | 35.8635 | 34.4571 | 33.0507 | 31.6443 | 31.6443 | 33.0507 | 34.4571 | 35.8635 | 37.2699 | 38.6763 (42c) |

Average daily hot water use (litres/day)

|  | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
|--|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
|  | 153.5791 | 150.4508 | 146.5552 | 140.4261 | 135.5230 | 130.2222 | 128.0335 | 131.9106 | 136.0211 | 141.6057 | 147.8353 | 153.1513 (44) |

Energy conte

|  | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
|--|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
|  | 243.2318 | 214.2399 | 225.2499 | 192.2364 | 182.4401 | 160.1234 | 154.8454 | 163.3328 | 167.7276 | 192.1576 | 210.6185 | 239.7979 (45) |

Energy content (annual)

|  | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
|--|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
|  | 36.4848 | 32.1360 | 33.7875 | 28.8355 | 27.3660 | 24.0185 | 23.2268 | 24.4999 | 25.1591 | 28.8236 | 31.5928 | 35.9697 (46) |

Distribution loss (46)m = 0.15 x (45)m

Water storage loss (or HIU loss):

Store volume 196.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.3120 (48)

Temperature factor from Table 2b 0.5400 (49)

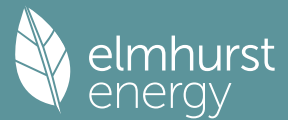
Enter (49) or (54) in (55) 0.7085 (55)

Total storage loss

|  | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
|--|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
|  | 21.9629 | 19.8374 | 21.9629 | 21.2544 | 21.9629 | 21.2544 | 21.9629 | 21.9629 | 21.2544 | 21.9629 | 21.2544 | 21.9629 (56) |

If cylinder contains dedicated solar storage

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|                                                                 |          |          |          |          |          |          |          |                                                                                |          |          |          |                |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|--------------------------------------------------------------------------------|----------|----------|----------|----------------|
|                                                                 | 21.9629  | 19.8374  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  | 21.9629                                                                        | 21.2544  | 21.9629  | 21.2544  | 21.9629 (57)   |
| Primary loss                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000 (59)    |
| Combi loss                                                      | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000 (61)    |
| Total heat required for water heating calculated for each month |          |          |          |          |          |          |          |                                                                                |          |          |          |                |
|                                                                 | 265.1947 | 234.0774 | 247.2128 | 213.4908 | 204.4030 | 181.3778 | 176.8083 | 185.2957                                                                       | 188.9820 | 214.1205 | 231.8729 | 261.7608 (62)  |
| WWHRS                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63a)   |
| PV diverter                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63b)   |
| Solar input                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63c)   |
| FGHRS                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63d)   |
| Output from w/h                                                 | 265.1947 | 234.0774 | 247.2128 | 213.4908 | 204.4030 | 181.3778 | 176.8083 | 185.2957                                                                       | 188.9820 | 214.1205 | 231.8729 | 261.7608 (64)  |
|                                                                 |          |          |          |          |          |          |          | Total per year (kWh/year) = Sum(64)m =                                         |          |          |          | 2604.5965 (64) |
| Electric shower(s)                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000 (64a)   |
|                                                                 |          |          |          |          |          |          |          | Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          | 0.0000 (64a)   |
| Heat gains from water heating, kWh/month                        | 80.8746  | 71.2348  | 74.8956  | 63.9186  | 60.6613  | 53.2410  | 51.4861  | 54.3082                                                                        | 55.7694  | 63.8924  | 70.0306  | 79.7328 (65)   |

## 5. Internal gains (see Table 5 and 5a)

| Metabolic gains (Table 5), Watts                                                    | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |      |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| (66)m                                                                               | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 31.7957  | 28.2406  | 22.9668  | 17.3874  | 12.9973  | 10.9728  | 11.8565  | 15.4116  | 20.6854  | 26.2649  | 30.6550  | 32.6794  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 309.4646 | 312.6759 | 304.5836 | 287.3560 | 265.6093 | 245.1705 | 231.5161 | 228.3048 | 236.3971 | 253.6247 | 275.3714 | 295.8102 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | (69) |
| Pumps, fans                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | (71) |
| Water heating gains (Table 5)                                                       | 108.7024 | 106.0041 | 100.6661 | 88.7758  | 81.5340  | 73.9459  | 69.2017  | 72.9948  | 77.4575  | 85.8769  | 97.2648  | 107.1677 | (72) |
| Total internal gains                                                                | 548.3599 | 545.3179 | 526.6138 | 491.9164 | 458.5378 | 428.4864 | 410.9716 | 415.1084 | 432.9372 | 464.1636 | 501.6883 | 534.0546 | (73) |

## 6. Solar gains

| [Jan]       |          |          |          |           | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c |          |          | Access<br>factor<br>Table 6d |  |  | Gains<br>W    |
|-------------|----------|----------|----------|-----------|------------|--------------------------------|-----------------------------------|------------------------------------|----------|----------|------------------------------|--|--|---------------|
| East        |          |          |          |           | 4.9600     | 19.6403                        | 0.7600                            | 0.0000                             |          |          | 0.7700                       |  |  | 57.0077 (76)  |
| West        |          |          |          |           | 4.9600     | 19.6403                        | 0.7600                            | 0.0000                             |          |          | 0.7700                       |  |  | 57.0077 (80)  |
|             |          |          |          |           |            |                                |                                   |                                    |          |          |                              |  |  |               |
| Solar gains | 114.0153 | 223.0382 | 367.3122 | 535.7029  | 656.5240   | 672.0691                       | 639.8372                          | 549.6107                           | 427.1992 | 264.6536 | 142.1637                     |  |  | 93.7607 (83)  |
| Total gains | 662.3753 | 768.3561 | 893.9259 | 1027.6193 | 1115.0618  | 1100.5555                      | 1050.8088                         | 964.7191                           | 860.1365 | 728.8172 | 643.8521                     |  |  | 627.8152 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |                           |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |                           |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |                           |         |         |         |              |
| tau                                                                         | 23.0351 | 23.0351 | 23.0351 | 23.0351 | 23.0351 | 23.0351 | 23.0351 | 23.0351 | 23.0351                   | 23.0351 | 23.0351 | 23.0351 |              |
| alpha                                                                       | 2.5357  | 2.5357  | 2.5357  | 2.5357  | 2.5357  | 2.5357  | 2.5357  | 2.5357  | 2.5357                    | 2.5357  | 2.5357  | 2.5357  |              |
| util living area                                                            | 0.9007  | 0.8620  | 0.7923  | 0.6821  | 0.5486  | 0.4143  | 0.3104  | 0.3490  | 0.5335                    | 0.7508  | 0.8689  | 0.9112  | (86)         |
| MIT                                                                         | 18.8362 | 19.1864 | 19.7160 | 20.2720 | 20.6862 | 20.8814 | 20.9583 | 20.9427 | 20.7698                   | 20.2017 | 19.3955 | 18.7354 | (87)         |
| Th 2                                                                        | 20.0524 | 20.0524 | 20.0524 | 20.0524 | 20.0524 | 20.0524 | 20.0524 | 20.0524 | 20.0524                   | 20.0524 | 20.0524 | 20.0524 | (88)         |
| util rest of house                                                          | 0.8895  | 0.8471  | 0.7709  | 0.6512  | 0.5071  | 0.3610  | 0.2477  | 0.2829  | 0.4771                    | 0.7175  | 0.8521  | 0.9010  | (89)         |
| MIT 2                                                                       | 17.5395 | 17.9728 | 18.6215 | 19.2842 | 19.7349 | 19.9582 | 20.0276 | 20.0166 | 19.8560                   | 19.2239 | 18.2436 | 17.4141 | (90)         |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         | 0.3347  | (91)         |
| MIT                                                                         | 17.9735 | 18.3790 | 18.9878 | 19.6148 | 20.0474 | 20.2672 | 20.3391 | 20.3265 | 20.1618                   | 19.5511 | 18.6291 | 17.8563 | (92)         |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000  |              |
| adjusted MIT                                                                | 17.9735 | 18.3790 | 18.9878 | 19.6148 | 20.0474 | 20.2672 | 20.3391 | 20.3265 | 20.1618                   | 19.5511 | 18.6291 | 17.8563 | (93)         |

## 8. Space heating requirement

|                                                                                | Jan       | Feb       | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec       |       |
|--------------------------------------------------------------------------------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-------|
| Utilisation                                                                    | 0.8584    | 0.8156    | 0.7436   | 0.6357   | 0.5068   | 0.3734   | 0.2670   | 0.3025   | 0.4840   | 0.6977   | 0.8214   | 0.8706    | (94)  |
| Useful gains                                                                   | 568.5877  | 626.6506  | 664.7046 | 653.2992 | 565.1648 | 410.9573 | 280.5760 | 291.8104 | 416.2816 | 508.4967 | 528.8551 | 546.5524  | (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000   | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000  | 7.1000   | 4.2000    | (96)  |
| Heat loss rate W                                                               | 1055.2283 | 1040.2175 | 963.7279 | 826.8955 | 644.1957 | 437.3558 | 288.5573 | 303.0251 | 467.8131 | 690.7898 | 889.7426 | 1053.9027 | (97)  |
| Space heating kWh                                                              | 362.0606  | 277.9170  | 222.4733 | 124.9893 | 58.7990  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 135.6260 | 259.8390 | 377.4686  | (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |          |          |          |          |          |          |          |          |          | 1819.1729 |       |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (98b) |
| Solar heating contribution - total per year (kWh/year)                         |           |           |          |          |          |          |          |          |          |          |          | 0.0000    |       |
| Space heating kWh                                                              | 362.0606  | 277.9170  | 222.4733 | 124.9893 | 58.7990  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 135.6260 | 259.8390 | 377.4686  | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |          |          |          |          |          |          |          |          |          | 1819.1729 |       |
| Space heating per m2                                                           |           |           |          |          |          |          |          |          |          |          |          | 24.4512   | (99)  |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                       |  |  |  |  |  |  |  |  |  |  |  |  |              |
|-----------------------------------------------------------------------|--|--|--|--|--|--|--|--|--|--|--|--|--------------|
| Fraction of space heat from secondary/supplementary system (Table 11) |  |  |  |  |  |  |  |  |  |  |  |  | 0.0000 (201) |
| Fraction of space heat from main system(s)                            |  |  |  |  |  |  |  |  |  |  |  |  | 1.0000 (202) |
| Fraction of main heating from main system 2                           |  |  |  |  |  |  |  |  |  |  |  |  | 0.0000 (203) |
| Fraction of total heating from main system 1                          |  |  |  |  |  |  |  |  |  |  |  |  | 1.0000 (204) |

# Full SAP Calculation Printout



|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |           |        |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|--------|
| Fraction of total heating from main system 2                                                         |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (205)  |
| Efficiency of main space heating system 1 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 100.0000  | (206)  |
| Efficiency of main space heating system 2 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (207)  |
| Efficiency of secondary/supplementary heating system, %                                              |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (208)  |
|                                                                                                      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec       |        |
| Space heating requirement                                                                            | 362.0606 | 277.9170 | 222.4733 | 124.9893 | 58.7990  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 135.6260 | 259.8390 | 377.4686  | (98)   |
| Space heating efficiency (main heating system 1)                                                     | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 100.0000 | 100.0000 | 100.0000  | (210)  |
| Space heating fuel (main heating system)                                                             | 362.0606 | 277.9170 | 222.4733 | 124.9893 | 58.7990  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 135.6260 | 259.8390 | 377.4686  | (211)  |
| Space heating efficiency (main heating system 2)                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (212)  |
| Space heating fuel (main heating system 2)                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (213)  |
| Space heating fuel (secondary)                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (215)  |
| Space heating fuel used, main system 2                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (213)  |
| Water heating                                                                                        |          |          |          |          |          |          |          |          |          |          |          |           |        |
| Water heating requirement                                                                            | 265.1947 | 234.0774 | 247.2128 | 213.4908 | 204.4030 | 181.3778 | 176.8083 | 185.2957 | 188.9820 | 214.1205 | 231.8729 | 261.7608  | (64)   |
| Efficiency of water heater                                                                           | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050  | (216)  |
| Fuel for water heating, kWh/month                                                                    | 84.6172  | 74.6885  | 78.8797  | 68.1198  | 65.2201  | 57.8733  | 56.4153  | 59.1234  | 60.2996  | 68.3207  | 73.9851  | 83.5216   | (219)  |
| Space cooling fuel requirement                                                                       |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (221)  |
| Pumps and Fa                                                                                         | 15.0751  | 13.6162  | 15.0751  | 14.5888  | 15.0751  | 14.5888  | 15.0751  | 15.0751  | 14.5888  | 15.0751  | 14.5888  | 15.0751   | (231)  |
| Lighting                                                                                             | 27.8306  | 22.3267  | 20.1027  | 14.7281  | 11.3764  | 9.2946   | 10.3780  | 13.4897  | 17.5217  | 22.9895  | 25.9666  | 28.6041   | (232)  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (233a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (234a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (234a) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (235a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235a) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (235c)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235c) |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (233b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (233b) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (234b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (234b) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (235b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235b) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (235d)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235d) |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |           |        |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 1819.1729 | (211)  |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (213)  |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (215)  |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 313.4050  |        |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          | 831.0641  | (219)  |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (221)  |
| Electricity for pumps and fans:                                                                      |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (MEV)Centralised, Database: in-use factor = 1.3000, SFP = 0.6630)                                    |          |          |          |          |          |          |          |          |          |          |          |           |        |
| mechanical ventilation fans (SFP = 0.6630)                                                           |          |          |          |          |          |          |          |          |          |          |          | 177.4970  | (230a) |
| Total electricity for the above, kWh/year                                                            |          |          |          |          |          |          |          |          |          |          |          | 177.4970  | (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |          |          |          |          |          |          |          |          | 224.6087  | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |          |          |          |          |          |          |          |          |           |        |
| PV generation                                                                                        |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (233)  |
| Wind generation                                                                                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (234)  |
| Hydro-electric generation (Appendix N)                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (235a) |
| Electricity generated - Micro CHP (Appendix N)                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (235)  |
| Appendix Q - special features                                                                        |          |          |          |          |          |          |          |          |          |          |          |           |        |
| Energy saved or generated                                                                            |          |          |          |          |          |          |          |          |          |          |          | -0.0000   | (236)  |
| Energy used                                                                                          |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (237)  |
| Total delivered energy for all uses                                                                  |          |          |          |          |          |          |          |          |          |          |          | 3052.3428 | (238)  |

## 10a. Fuel costs - using Table 12 prices

|                                             | Fuel kWh/year | Fuel price p/kWh | Fuel cost £/year |        |
|---------------------------------------------|---------------|------------------|------------------|--------|
| Space heating - main system 1               | 1819.1729     | 16.4900          | 299.9816         | (240)  |
| Space heating - main system 2               | 0.0000        | 16.4900          | 0.0000           | (241)  |
| Total CO2 associated with community systems |               |                  | 0.0000           | (473)  |
| Water heating (other fuel)                  | 831.0641      | 16.4900          | 137.0425         | (247)  |
| Energy for instantaneous electric shower(s) | 0.0000        | 16.4900          | 0.0000           | (247a) |
| Pumps, fans and electric keep-hot           | 177.4970      | 16.4900          | 29.2693          | (249)  |
| Energy for lighting                         | 224.6087      | 16.4900          | 37.0380          | (250)  |
| Additional standing charges                 |               |                  | 0.0000           | (251)  |
| Total energy cost                           |               |                  | 503.3313         | (255)  |

## 11a. SAP rating - Individual heating systems

|                                  |                                  |         |       |
|----------------------------------|----------------------------------|---------|-------|
| Energy cost deflator (Table 12): |                                  | 0.3600  | (256) |
| Energy cost factor (ECF)         |                                  | 1.5176  | (257) |
| SAP value                        | [(255) x (256)] / [(4) + 45.0] = | 75.4000 |       |
| SAP rating (Section 12)          |                                  | 75      | (258) |
| SAP band                         |                                  | C       |       |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                             | Energy kWh/year | Emission factor kg CO2/kWh | Emissions kg CO2/year |       |
|---------------------------------------------|-----------------|----------------------------|-----------------------|-------|
| Space heating - main system 1               | 1819.1729       | 0.1552                     | 282.3642              | (261) |
| Space heating - main system 2               | 0.0000          | 0.0000                     | 0.0000                | (262) |
| Total CO2 associated with community systems |                 |                            | 0.0000                | (373) |
| Water heating (other fuel)                  | 831.0641        | 0.1413                     | 117.4242              | (264) |
| Space and water heating                     |                 |                            | 399.7883              | (265) |

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|                                              |          |        |                |
|----------------------------------------------|----------|--------|----------------|
| Pumps, fans and electric keep-hot            | 177.4970 | 0.1387 | 24.6210 (267)  |
| Energy for lighting                          | 224.6087 | 0.1443 | 32.4180 (268)  |
| Total CO <sub>2</sub> , kg/year              |          |        | 456.8273 (272) |
| CO <sub>2</sub> emissions per m <sup>2</sup> |          |        | 6.1400 (273)   |
| EI value                                     |          |        | 94.8731        |
| EI rating                                    |          |        | 95 (274)       |
| EI band                                      |          |        | A              |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)              | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|-----------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                   |                             |
| Ground floor                                           | 45.3000 (1b)              | x 2.7500 (2b)                     | = 124.5750 (1b) - (3b)      |
| First floor                                            | 29.1000 (1c)              | x 3.2600 (2c)                     | = 94.8660 (1c) - (3c)       |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 74.4000                   |                                   | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 219.4410 (5)                |

## 2. Ventilation rate

|                                                                                                    | m <sup>3</sup> per hour                 |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 0 * 10 = 0.0000 (7a)                    |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 / (5) = 0.0000 (8)               |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 4.0000 (17)                             |
| Infiltration rate                                                                                  | 0.2000 (18)                             |
| Number of sides sheltered                                                                          | 1 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.9250 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.1850 (21)        |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 4.3000 | 4.1000 | 4.1000 | 3.8000 | 3.9000 | 3.4000 | 3.4000 | 3.3000 | 3.4000 | 3.8000 | 3.7000 | 4.0000 (22)  |
| Wind factor                                                                                             | 1.0750 | 1.0250 | 1.0250 | 0.9500 | 0.9750 | 0.8500 | 0.8500 | 0.8250 | 0.8500 | 0.9500 | 0.9250 | 1.0000 (22a) |
| Adj infilt rate                                                                                         | 0.1989 | 0.1896 | 0.1896 | 0.1758 | 0.1804 | 0.1573 | 0.1573 | 0.1526 | 0.1573 | 0.1758 | 0.1711 | 0.1850 (22b) |
| Mechanical extract ventilation - centralised                                                            |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                                     | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K   |
|-------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|-----------------|
| Main dwelling                                               |                         |                            |                           |                               |              |                                |                 |
| Windows / Glazed Doors                                      |                         |                            | 9.9200                    | 1.1450                        | 11.3588      |                                | (27)            |
| External Wall                                               | 62.3800                 | 8.9200                     | 53.4600                   | 0.1500                        | 8.0190       | 9.0000                         | 481.1400 (29a)  |
| RIR Stud Wall                                               | 25.3800                 |                            | 25.3800                   | 0.1500                        | 3.8070       | 9.0000                         | 228.4200 (29a)  |
| Dormer Walls                                                | 6.6000                  | 1.0000                     | 5.6000                    | 0.1500                        | 0.8400       | 9.0000                         | 50.4000 (29a)   |
| Adj To RIR Ins At Slope                                     | 16.0500                 |                            | 16.0500                   | 0.1400                        | 2.2470       | 9.0000                         | 144.4500 (30)   |
| Slope Roof                                                  | 37.9900                 |                            | 37.9900                   | 0.1400                        | 5.3186       | 9.0000                         | 341.9100 (30)   |
| Total net area of external elements Aum(A, m <sup>2</sup> ) |                         |                            | 148.4000                  |                               |              |                                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                         |                         |                            | (26)...(30) + (32) =      |                               | 31.5904      |                                | (33)            |
| Main dwelling                                               |                         |                            |                           |                               |              |                                |                 |
| Party Wall 1                                                |                         |                            | 44.2300                   | 0.0000                        | 0.0000       | 45.0000                        | 1990.3500 (32)  |
| Party Floor 1                                               |                         |                            | 45.3000                   |                               |              | 30.0000                        | 1359.0000 (32d) |
| Internal Wall 1                                             |                         |                            | 113.1500                  |                               |              | 9.0000                         | 1018.3500 (32c) |
| Internal Floor 1                                            |                         |                            | 29.1000                   |                               |              | 18.0000                        | 523.8000 (32d)  |
| Internal Ceiling 1                                          |                         |                            | 29.1000                   |                               |              | 9.0000                         | 261.9000 (32e)  |

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 6399.7200 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m<sup>2</sup>K 86.0177 (35)

### List of Thermal Bridges

| K1 Element                                                                | Length  | Psi-value | Total  |
|---------------------------------------------------------------------------|---------|-----------|--------|
| E2 Other lintels (including other steel lintels)                          | 7.9700  | 0.0840    | 0.6695 |
| E3 Sill                                                                   | 7.0600  | 0.0340    | 0.2400 |
| E4 Jamb                                                                   | 26.6000 | 0.0430    | 1.1438 |
| E16 Corner (normal)                                                       | 17.5000 | 0.0300    | 0.5250 |
| E18 Party wall between dwellings                                          | 9.5000  | 0.0400    | 0.3800 |
| E7 Party floor between dwellings (in blocks of flats)                     | 17.3000 | 0.0660    | 1.1418 |
| E11 Eaves (insulation at rafter level)                                    | 9.6000  | 0.0130    | 0.1248 |
| E17 Corner (inverted - internal area greater than external area)          | 8.0000  | 0.0150    | 0.1200 |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | 13.6000 | 0.0000    | 0.0000 |
| E13 Gable (insulation at rafter level)                                    | 16.1000 | 0.0240    | 0.3864 |
| E6 Intermediate floor within a dwelling                                   | 22.2000 | 0.0800    | 1.7760 |
| P5 Party wall - Roof (insulation at rafter level)                         | 6.4000  | 0.2400    | 1.5360 |

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|                                                            |         |        |                       |              |
|------------------------------------------------------------|---------|--------|-----------------------|--------------|
| P2 Party wall - Intermediate floor within a dwelling       | 4.0000  | 0.0000 | 0.0000                |              |
| R4 Ridge (vaulted ceiling)                                 | 11.1000 | 0.1200 | 1.3320                |              |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |         |        |                       | 9.3753 (36)  |
| Point Thermal bridges                                      |         |        |                       | 0.0000       |
| Total fabric heat loss                                     |         |        | (33) + (36) + (36a) = | 40.9657 (37) |

|                                                                     |         |         |         |         |         |         |         |         |         |         |         |              |
|---------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) |         |         |         |         |         |         |         |         |         |         |         |              |
| (38)m                                                               | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| Heat transfer coeff                                                 | 36.2078 | 36.2078 | 36.2078 | 36.2078 | 36.2078 | 36.2078 | 36.2078 | 36.2078 | 36.2078 | 36.2078 | 36.2078 | 36.2078 (38) |
| Average = Sum(39)m / 12 =                                           | 77.1735 | 77.1735 | 77.1735 | 77.1735 | 77.1735 | 77.1735 | 77.1735 | 77.1735 | 77.1735 | 77.1735 | 77.1735 | 77.1735 (39) |
| HLP                                                                 | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| HLP (average)                                                       | 1.0373  | 1.0373  | 1.0373  | 1.0373  | 1.0373  | 1.0373  | 1.0373  | 1.0373  | 1.0373  | 1.0373  | 1.0373  | 1.0373 (40)  |
| Days in mont                                                        | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31           |

## 4. Water heating energy requirements (kWh/year)

|                                                                                |          |          |          |          |          |          |          |          |          |          |          |                              |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------------------------------|
| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |          |          | 2.3480 (42)                  |
| Hot water usage for mixer showers                                              | 87.4344  | 86.1204  | 84.2057  | 80.5423  | 77.8387  | 74.8238  | 73.1101  | 75.0103  | 77.0933  | 80.3304  | 84.0726  | 87.0994 (42a)                |
| Hot water usage for baths                                                      | 27.4684  | 27.0605  | 26.4860  | 25.4268  | 24.6337  | 23.7542  | 23.2792  | 23.8496  | 24.4707  | 25.4118  | 26.4928  | 27.3756 (42b)                |
| Hot water usage for other uses                                                 | 38.6763  | 37.2699  | 35.8635  | 34.4571  | 33.0507  | 31.6443  | 31.6443  | 33.0507  | 34.4571  | 35.8635  | 37.2699  | 38.6763 (42c)                |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |          |          | 141.2394 (43)                |
| Daily hot water use                                                            | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec                          |
| Energy conte                                                                   | 153.5791 | 150.4508 | 146.5552 | 140.4261 | 135.5230 | 130.2222 | 128.0335 | 131.9106 | 136.0211 | 141.6057 | 147.8353 | 153.1513 (44)                |
| Energy content (annual)                                                        | 243.2318 | 214.2399 | 225.2499 | 192.2364 | 182.4401 | 160.1234 | 154.8454 | 163.3328 | 167.7276 | 192.1576 | 210.6185 | 239.7979 (45)                |
| Distribution loss (46)m = 0.15 x (45)m                                         |          |          |          |          |          |          |          |          |          |          |          | Total = Sum(45)m = 2346.0013 |
| Water storage loss (or HIU loss):                                              | 36.4848  | 32.1360  | 33.7875  | 28.8355  | 27.3660  | 24.0185  | 23.2268  | 24.4999  | 25.1591  | 28.8236  | 31.5928  | 35.9697 (46)                 |
| Store volume                                                                   |          |          |          |          |          |          |          |          |          |          |          | 196.0000 (47)                |
| a) If manufacturer declared loss factor is known (kWh/day):                    |          |          |          |          |          |          |          |          |          |          |          | 1.3120 (48)                  |
| Temperature factor from Table 2b                                               |          |          |          |          |          |          |          |          |          |          |          | 0.5400 (49)                  |
| Enter (49) or (54) in (55)                                                     |          |          |          |          |          |          |          |          |          |          |          | 0.7085 (55)                  |
| Total storage loss                                                             | 21.9629  | 19.8374  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629 (56)                 |
| If cylinder contains dedicated solar storage                                   | 21.9629  | 19.8374  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629 (57)                 |
| Primary loss                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (59)                  |
| Combi loss                                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (61)                  |
| Total heat required for water heating calculated for each month                | 265.1947 | 234.0774 | 247.2128 | 213.4908 | 204.4030 | 181.3778 | 176.8083 | 185.2957 | 188.9820 | 214.1205 | 231.8729 | 261.7608 (62)                |
| WWHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63a)                 |
| PV diverter                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63b)                 |
| Solar input                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63c)                 |
| FGHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63d)                 |
| Output from w/h                                                                | 265.1947 | 234.0774 | 247.2128 | 213.4908 | 204.4030 | 181.3778 | 176.8083 | 185.2957 | 188.9820 | 214.1205 | 231.8729 | 261.7608 (64)                |
| Electric shower(s)                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (64a)                 |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (64a)                 |
| Heat gains from water heating, kWh/month                                       | 80.8746  | 71.2348  | 74.8956  | 63.9186  | 60.6613  | 53.2410  | 51.4861  | 54.3082  | 55.7694  | 63.8924  | 70.0306  | 79.7328 (65)                 |

## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Metabolic gains (Table 5), Watts                                                    | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
| (66)m                                                                               | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 31.7957  | 28.2406  | 22.9668  | 17.3874  | 12.9973  | 10.9728  | 11.8565  | 15.4116  | 20.6854  | 26.2649  | 30.6550  | 32.6794 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 309.4646 | 312.6759 | 304.5836 | 287.3560 | 265.6093 | 245.1705 | 231.5161 | 228.3048 | 236.3971 | 253.6247 | 275.3714 | 295.8102 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363 (69)  |
| Pumps, fans                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (70)   |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 (71) |
| Water heating gains (Table 5)                                                       | 108.7024 | 106.0041 | 100.6661 | 88.7758  | 81.5340  | 73.9459  | 69.2017  | 72.9948  | 77.4575  | 85.8769  | 97.2648  | 107.1677 (72) |
| Total internal gains                                                                | 548.3599 | 545.3179 | 526.6138 | 491.9164 | 458.5378 | 428.4864 | 410.9716 | 415.1084 | 432.9372 | 464.1636 | 501.6883 | 534.0546 (73) |

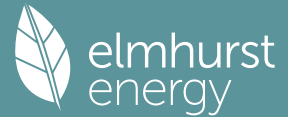
## 6. Solar gains

| [Jan]       |          |          |          |           | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W   |          |               |
|-------------|----------|----------|----------|-----------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|----------|---------------|
| East        |          |          |          |           | 4.9600     | 23.8018                        | 0.7600                            | 0.0000                             | 0.7700                       | 69.0868 (76) |          |               |
| West        |          |          |          |           | 4.9600     | 23.8018                        | 0.7600                            | 0.0000                             | 0.7700                       | 69.0868 (80) |          |               |
| Solar gains | 138.1736 | 236.0921 | 385.2951 | 569.0054  | 678.1730   | 733.8699                       | 691.9692                          | 610.2517                           | 477.1980                     | 300.5179     | 169.7134 | 114.2818 (83) |
| Total gains | 686.5335 | 781.4100 | 911.9088 | 1060.9218 | 1136.7108  | 1162.3563                      | 1102.9407                         | 1025.3601                          | 910.1353                     | 764.6815     | 671.4017 | 648.3364 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |              |
|-----------------------------------------------------------------------------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |              |

# Full SAP Calculation Printout



|                        | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
|------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| tau                    | 23.0351 | 23.0351 | 23.0351 | 23.0351 | 23.0351 | 23.0351 | 23.0351 | 23.0351 | 23.0351 | 23.0351 | 23.0351 | 23.0351      |
| alpha                  | 2.5357  | 2.5357  | 2.5357  | 2.5357  | 2.5357  | 2.5357  | 2.5357  | 2.5357  | 2.5357  | 2.5357  | 2.5357  | 2.5357       |
| util living area       | 0.8841  | 0.8453  | 0.7656  | 0.6371  | 0.4881  | 0.3296  | 0.2266  | 0.2498  | 0.4592  | 0.7019  | 0.8425  | 0.8955 (86)  |
| MIT                    | 19.0617 | 19.3739 | 19.9015 | 20.4350 | 20.7804 | 20.9433 | 20.9850 | 20.9806 | 20.8589 | 20.3860 | 19.6320 | 18.9792 (87) |
| Th 2                   | 20.0524 | 20.0524 | 20.0524 | 20.0524 | 20.0524 | 20.0524 | 20.0524 | 20.0524 | 20.0524 | 20.0524 | 20.0524 | 20.0524 (88) |
| util rest of house     | 0.8708  | 0.8284  | 0.7412  | 0.6023  | 0.4422  | 0.2740  | 0.1632  | 0.1825  | 0.3984  | 0.6627  | 0.8221  | 0.8832 (89)  |
| MIT 2                  | 17.8220 | 18.2062 | 18.8471 | 19.4730 | 19.8546 | 20.0137 | 20.0461 | 20.0438 | 19.9427 | 19.4375 | 18.5355 | 17.7207 (90) |
| Living area fraction   | 18.2369 | 18.5970 | 19.2000 | 19.7949 | 20.1645 | 20.3248 | 20.3603 | 20.3573 | 20.2494 | 19.7549 | 18.9025 | 18.1419 (91) |
| MIT                    | 18.2369 | 18.5970 | 19.2000 | 19.7949 | 20.1645 | 20.3248 | 20.3603 | 20.3573 | 20.2494 | 19.7549 | 18.9025 | 18.1419 (92) |
| Temperature adjustment |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT           | 18.2369 | 18.5970 | 19.2000 | 19.7949 | 20.1645 | 20.3248 | 20.3603 | 20.3573 | 20.2494 | 19.7549 | 18.9025 | 18.1419 (93) |

## 8. Space heating requirement

|                                                                                | Jan       | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov      | Dec            |
|--------------------------------------------------------------------------------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|----------|----------------|
| Utilisation                                                                    | 0.8394    | 0.7976   | 0.7167   | 0.5923   | 0.4478   | 0.2903   | 0.1840   | 0.2045   | 0.4115   | 0.6491        | 0.7926   | 0.8521 (94)    |
| Useful gains                                                                   | 576.2663  | 623.2550 | 653.5381 | 628.3804 | 509.0609 | 337.4512 | 202.9490 | 209.6534 | 374.4930 | 496.3740      | 532.1794 | 552.4523 (95)  |
| Ext temp.                                                                      | 5.1000    | 5.7000   | 7.4000   | 9.9000   | 12.9000  | 15.8000  | 17.7000  | 17.6000  | 15.0000  | 11.5000       | 8.0000   | 5.1000 (96)    |
| Heat loss rate W                                                               | 1013.8170 | 995.3037 | 910.6433 | 763.6267 | 560.6245 | 349.1954 | 205.3077 | 212.7936 | 405.1106 | 637.0630      | 841.3822 | 1006.4894 (97) |
| Space heating kWh                                                              | 325.5377  | 250.0167 | 191.2863 | 97.3773  | 38.3633  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 104.6726      | 222.6260 | 337.8036 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |          |          |          |          |          |          |          |          |               |          | 1567.6836      |
| Solar heating kWh                                                              | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000   | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |           |          |          |          |          |          |          |          |          |               |          | 0.0000         |
| Space heating kWh                                                              | 325.5377  | 250.0167 | 191.2863 | 97.3773  | 38.3633  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 104.6726      | 222.6260 | 337.8036 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |          |          |          |          |          |          |          |          |               |          | 1567.6836      |
| Space heating per m2                                                           |           |          |          |          |          |          |          |          |          | (98c) / (4) = |          | 21.0710 (99)   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |                 |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)    |
| Fraction of space heat from main system(s)                                                           |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)    |
| Fraction of main heating from main system 2                                                          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (203)    |
| Fraction of total heating from main system 1                                                         |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (204)    |
| Fraction of total heating from main system 2                                                         |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (205)    |
| Efficiency of main space heating system 1 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 100.0000 (206)  |
| Efficiency of main space heating system 2 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                              |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
| Space heating requirement                                                                            | 325.5377 | 250.0167 | 191.2863 | 97.3773  | 38.3633  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 104.6726 | 222.6260 | 337.8036 (98)   |
| Space heating efficiency (main heating system 1)                                                     | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 100.0000 | 100.0000 | 100.0000 (210)  |
| Space heating fuel (main heating system)                                                             | 325.5377 | 250.0167 | 191.2863 | 97.3773  | 38.3633  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 104.6726 | 222.6260 | 337.8036 (211)  |
| Space heating efficiency (main heating system 2)                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |
| Space heating fuel (secondary)                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Space heating fuel used, main system 2                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Water heating                                                                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| Water heating requirement                                                                            | 265.1947 | 234.0774 | 247.2128 | 213.4908 | 204.4030 | 181.3778 | 176.8083 | 185.2957 | 188.9820 | 214.1205 | 231.8729 | 261.7608 (64)   |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 313.4050 (216)  |
| (217)m                                                                                               | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 (217)  |
| Fuel for water heating, kWh/month                                                                    | 84.6172  | 74.6885  | 78.8797  | 68.1198  | 65.2201  | 57.8733  | 56.4153  | 59.1234  | 60.2996  | 68.3207  | 73.9851  | 83.5216 (219)   |
| Space cooling fuel requirement                                                                       |          |          |          |          |          |          |          |          |          |          |          |                 |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                                         | 15.0751  | 13.6162  | 15.0751  | 14.5888  | 15.0751  | 14.5888  | 15.0751  | 15.0751  | 14.5888  | 15.0751  | 14.5888  | 15.0751 (231)   |
| Lighting                                                                                             | 27.8306  | 22.3267  | 20.1027  | 14.7281  | 11.3764  | 9.2946   | 10.3780  | 13.4897  | 17.5217  | 22.9895  | 25.9666  | 28.6041 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| (233a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (233a)   |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |                 |
| (234a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |                 |
| (235a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |                 |
| (235c)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| (233b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (233b)   |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |                 |
| (234b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |                 |
| (235b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |                 |
| (235d)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 1567.6836 (211) |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 313.4050        |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          | 831.0641 (219)  |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (221)    |
| Electricity for pumps and fans:                                                                      |          |          |          |          |          |          |          |          |          |          |          |                 |
| (MEVCentralised, Database: in-use factor = 1.3000, SFP = 0.6630)                                     |          |          |          |          |          |          |          |          |          |          |          |                 |
| mechanical ventilation fans (SFP = 0.6630)                                                           |          |          |          |          |          |          |          |          |          |          |          | 177.4970 (230a) |
| Total electricity for the above, kWh/year                                                            |          |          |          |          |          |          |          |          |          |          |          | 177.4970 (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |          |          |          |          |          |          |          |          | 224.6087 (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| PV generation                                                                                        |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (233)    |
| Wind generation                                                                                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (234)    |

# Full SAP Calculation Printout



|                                                |                 |
|------------------------------------------------|-----------------|
| Hydro-electric generation (Appendix N)         | 0.0000 (235a)   |
| Electricity generated - Micro CHP (Appendix N) | 0.0000 (235)    |
| Appendix Q - special features                  |                 |
| Energy saved or generated                      | -0.0000 (236)   |
| Energy used                                    | 0.0000 (237)    |
| Total delivered energy for all uses            | 2800.8535 (238) |

## 10a. Fuel costs - using BEDF prices (585)

|                                             | Fuel<br>kWh/year | Fuel price<br>p/kWh | Fuel cost<br>£/year |
|---------------------------------------------|------------------|---------------------|---------------------|
| Space heating - main system 1               | 1567.6836        | 28.4300             | 445.6925 (240)      |
| Space heating - main system 2               | 0.0000           | 28.4300             | 0.0000 (241)        |
| Total CO2 associated with community systems |                  |                     | 0.0000 (473)        |
| Water heating (other fuel)                  | 831.0641         | 28.4300             | 236.2715 (247)      |
| Energy for instantaneous electric shower(s) | 0.0000           | 28.4300             | 0.0000 (247a)       |
| Pumps, fans and electric keep-hot           | 177.4970         | 28.4300             | 50.4624 (249)       |
| Energy for lighting                         | 224.6087         | 28.4300             | 63.8563 (250)       |
| Additional standing charges                 |                  |                     | 0.0000 (251)        |
| Total energy cost                           |                  |                     | 796.2826 (255)      |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|---------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1               | 1567.6836          | 0.1558                        | 244.2350 (261)           |
| Space heating - main system 2               | 0.0000             | 0.0000                        | 0.0000 (262)             |
| Total CO2 associated with community systems |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                  | 831.0641           | 0.1413                        | 117.4242 (264)           |
| Space and water heating                     |                    |                               | 361.6592 (265)           |
| Pumps, fans and electric keep-hot           | 177.4970           | 0.1387                        | 24.6210 (267)            |
| Energy for lighting                         | 224.6087           | 0.1443                        | 32.4180 (268)            |
| Total CO2, kg/year                          |                    |                               | 418.6982 (272)           |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 1567.6836          | 1.5768                              | 2471.8745 (275)            |
| Space heating - main system 2               | 0.0000             | 0.0000                              | 0.0000 (276)               |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 831.0641           | 1.5225                              | 1265.2724 (278)            |
| Space and water heating                     |                    |                                     | 3737.1469 (279)            |
| Pumps, fans and electric keep-hot           | 177.4970           | 1.5128                              | 268.5175 (281)             |
| Energy for lighting                         | 224.6087           | 1.5338                              | 344.5124 (282)             |
| Total Primary energy kWh/year               |                    |                                     | 4350.1768 (286)            |

## SAP 10 EPC IMPROVEMENTS

### Electric Panel Heaters HC

|                                      |      |
|--------------------------------------|------|
| Current energy efficiency rating:    | C 75 |
| Current environmental impact rating: | A 95 |

|                             |                |
|-----------------------------|----------------|
| N Solar water heating       | Not applicable |
| U Solar photovoltaic panels | Not applicable |
| V2 Wind turbine             | Not applicable |

| Recommended measures: | SAP change | Cost change | CO2 change |
|-----------------------|------------|-------------|------------|
| (none)                |            |             |            |

| Recommended measures<br>(none) | Typical annual savings |    | Energy efficiency | Environmental impact |
|--------------------------------|------------------------|----|-------------------|----------------------|
|                                | Total Savings          | £0 | 0.00 kg/m²        |                      |

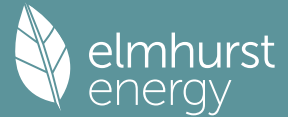
|                                        |      |
|----------------------------------------|------|
| Potential energy efficiency rating:    | C 75 |
| Potential environmental impact rating: | A 95 |

Fuel prices for cost data on this page from database revision number 585 TEST (31 Oct 2025)  
Recommendation texts revision number 6.1 (11 Jun 2019)

### Typical heating and lighting costs of this home (per year, Thames Valley):

|                          | Current<br>£796 | Potential<br>£796 | Saving<br>£0 |
|--------------------------|-----------------|-------------------|--------------|
| Electricity              |                 |                   |              |
| Space heating            | £496            | £496              | £0           |
| Water heating            | £236            | £236              | £0           |
| Lighting                 | £64             | £64               | £0           |
| Total cost of fuels      | £796            | £796              | £0           |
| Total cost of uses       | £796            | £796              | £0           |
| Delivered energy         | 38 kWh/m²       | 38 kWh/m²         | 0 kWh/m²     |
| Carbon dioxide emissions | 0.4 tonnes      | 0.4 tonnes        | 0.0 tonnes   |
| CO2 emissions per m²     | 6 kg/m²         | 6 kg/m²           | 0 kg/m²      |
| Primary energy           | 58 kWh/m²       | 58 kWh/m²         | 0 kWh/m²     |

# Full SAP Calculation Printout



SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)              | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|-----------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                   |                             |
| Ground floor                                           | 45.3000 (1b)              | x 2.7500 (2b)                     | = 124.5750 (1b) - (3b)      |
| First floor                                            | 29.1000 (1c)              | x 3.2600 (2c)                     | = 94.8660 (1c) - (3c)       |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 74.4000                   |                                   | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 219.4410 (5)                |

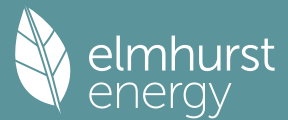
## 2. Ventilation rate

|                                                                                                         | m <sup>3</sup> per hour                                                                                                                   |
|---------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Number of open chimneys                                                                                 | 0 * 80 = 0.0000 (6a)                                                                                                                      |
| Number of open flues                                                                                    | 0 * 20 = 0.0000 (6b)                                                                                                                      |
| Number of chimneys / flues attached to closed fire                                                      | 0 * 10 = 0.0000 (6c)                                                                                                                      |
| Number of flues attached to solid fuel boiler                                                           | 0 * 20 = 0.0000 (6d)                                                                                                                      |
| Number of flues attached to other heater                                                                | 0 * 35 = 0.0000 (6e)                                                                                                                      |
| Number of blocked chimneys                                                                              | 0 * 20 = 0.0000 (6f)                                                                                                                      |
| Number of intermittent extract fans                                                                     | 0 * 10 = 0.0000 (7a)                                                                                                                      |
| Number of passive vents                                                                                 | 0 * 10 = 0.0000 (7b)                                                                                                                      |
| Number of flueless gas fires                                                                            | 0 * 40 = 0.0000 (7c)                                                                                                                      |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =      | 0.0000 / (5) = 0.0000 (8)                                                                                                                 |
| Pressure test                                                                                           | Yes                                                                                                                                       |
| Pressure Test Method                                                                                    | Blower Door                                                                                                                               |
| Measured/design AP50                                                                                    | 4.0000 (17)                                                                                                                               |
| Infiltration rate                                                                                       | 0.2000 (18)                                                                                                                               |
| Number of sides sheltered                                                                               | 1 (19)                                                                                                                                    |
| Shelter factor                                                                                          | (20) = 1 - [0.075 x (19)] = 0.9250 (20)                                                                                                   |
| Infiltration rate adjusted to include shelter factor                                                    | (21) = (18) x (20) = 0.1850 (21)                                                                                                          |
| Wind speed                                                                                              | Jan 5.1000 Feb 5.0000 Mar 4.9000 Apr 4.4000 May 4.3000 Jun 3.8000 Jul 3.8000 Aug 3.7000 Sep 4.0000 Oct 4.3000 Nov 4.5000 Dec 4.7000 (22)  |
| Wind factor                                                                                             | Jan 1.2750 Feb 1.2500 Mar 1.2250 Apr 1.1000 May 1.0750 Jun 0.9500 Jul 0.9500 Aug 0.9250 Sep 1.0000 Oct 1.0750 Nov 1.1250 Dec 1.1750 (22a) |
| Adj infilt rate                                                                                         | 0.2359 0.2313 0.2266 0.2035 0.1989 0.1758 0.1758 0.1711 0.1850 0.1989 0.2081 0.2174 (22b)                                                 |
| Mechanical extract ventilation - centralised                                                            |                                                                                                                                           |
| If mechanical ventilation                                                                               | 0.5000 (23a)                                                                                                                              |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) | 0.5000 (23b)                                                                                                                              |
| Effective ac                                                                                            | 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 (25)                                                  |

## 3. Heat losses and heat loss parameter

| Element                                                                   | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K         | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K                                       |
|---------------------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|----------------------|--------------------------------|-----------------------------------------------------|
| Main dwelling                                                             |                         |                            |                           |                               |                      |                                |                                                     |
| Windows / Glazed Doors                                                    |                         |                            | 9.9200                    | 1.1450                        | 11.3588              |                                | (27)                                                |
| External Wall                                                             | 62.3800                 | 8.9200                     | 53.4600                   | 0.1500                        | 8.0190               | 9.0000                         | 481.1400 (29a)                                      |
| RIR Stud Wall                                                             | 25.3800                 |                            | 25.3800                   | 0.1500                        | 3.8070               | 9.0000                         | 228.4200 (29a)                                      |
| Dormer Walls                                                              | 6.6000                  | 1.0000                     | 5.6000                    | 0.1500                        | 0.8400               | 9.0000                         | 50.4000 (29a)                                       |
| Adj To RIR Ins At Slope                                                   | 16.0500                 |                            | 16.0500                   | 0.1400                        | 2.2470               | 9.0000                         | 144.4500 (30)                                       |
| Slope Roof                                                                | 37.9900                 |                            | 37.9900                   | 0.1400                        | 5.3186               | 9.0000                         | 341.9100 (30)                                       |
| Total net area of external elements Aum(A, m <sup>2</sup> )               |                         |                            | 148.4000                  |                               |                      |                                | (31)                                                |
| Fabric heat loss, W/K = Sum (A x U)                                       |                         |                            |                           |                               | (26)...(30) + (32) = | 31.5904                        | (33)                                                |
| Main dwelling                                                             |                         |                            |                           |                               |                      |                                |                                                     |
| Party Wall 1                                                              |                         |                            | 44.2300                   | 0.0000                        | 0.0000               | 45.0000                        | 1990.3500 (32)                                      |
| Party Floor 1                                                             |                         |                            | 45.3000                   |                               |                      | 30.0000                        | 1359.0000 (32d)                                     |
| Internal Wall 1                                                           |                         |                            | 113.1500                  |                               |                      | 9.0000                         | 1018.3500 (32c)                                     |
| Internal Floor 1                                                          |                         |                            | 29.1000                   |                               |                      | 18.0000                        | 523.8000 (32d)                                      |
| Internal Ceiling 1                                                        |                         |                            | 29.1000                   |                               |                      | 9.0000                         | 261.9000 (32e)                                      |
| Heat capacity Cm = Sum(A x k)                                             |                         |                            |                           |                               |                      |                                | (28)...(30) + (32) + (32a)...(32e) = 6399.7200 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K            |                         |                            |                           |                               |                      |                                | 86.0177 (35)                                        |
| List of Thermal Bridges                                                   |                         |                            |                           |                               |                      |                                |                                                     |
| K1 Element                                                                |                         |                            |                           | Length                        | Psi-value            | Total                          |                                                     |
| E2 Other lintels (including other steel lintels)                          |                         |                            |                           | 7.9700                        | 0.0840               | 0.6695                         |                                                     |
| E3 Sill                                                                   |                         |                            |                           | 7.0600                        | 0.0340               | 0.2400                         |                                                     |
| E4 Jamb                                                                   |                         |                            |                           | 26.6000                       | 0.0430               | 1.1438                         |                                                     |
| E16 Corner (normal)                                                       |                         |                            |                           | 17.5000                       | 0.0300               | 0.5250                         |                                                     |
| E18 Party wall between dwellings                                          |                         |                            |                           | 9.5000                        | 0.0400               | 0.3800                         |                                                     |
| E7 Party floor between dwellings (in blocks of flats)                     |                         |                            |                           | 17.3000                       | 0.0660               | 1.1418                         |                                                     |
| E11 Eaves (insulation at rafter level)                                    |                         |                            |                           | 9.6000                        | 0.0130               | 0.1248                         |                                                     |
| E17 Corner (inverted - internal area greater than external area)          |                         |                            |                           | 8.0000                        | 0.0150               | 0.1200                         |                                                     |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) |                         |                            |                           | 13.6000                       | 0.0000               | 0.0000                         |                                                     |
| E13 Gable (insulation at rafter level)                                    |                         |                            |                           | 16.1000                       | 0.0240               | 0.3864                         |                                                     |
| E6 Intermediate floor within a dwelling                                   |                         |                            |                           | 22.2000                       | 0.0800               | 1.7760                         |                                                     |
| P5 Party wall - Roof (insulation at rafter level)                         |                         |                            |                           | 6.4000                        | 0.2400               | 1.5360                         |                                                     |
| P2 Party wall - Intermediate floor within a dwelling                      |                         |                            |                           | 4.0000                        | 0.0000               | 0.0000                         |                                                     |
| R4 Ridge (vaulted ceiling)                                                |                         |                            |                           | 11.1000                       | 0.1200               | 1.3320                         |                                                     |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                |                         |                            |                           |                               |                      |                                | 9.3753 (36)                                         |
| Point Thermal Bridges                                                     |                         |                            |                           |                               |                      |                                | (36a) = 0.0000                                      |
| Total fabric heat loss                                                    |                         |                            |                           |                               |                      |                                | (33) + (36) + (36a) = 40.9657 (37)                  |
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)       |                         |                            |                           |                               |                      |                                |                                                     |
| (38)m                                                                     | Jan 36.2078             | Feb 36.2078                | Mar 36.2078               | Apr 36.2078                   | May 36.2078          | Jun 36.2078                    | Jul 36.2078                                         |
| Heat transfer coeff                                                       | 77.1735                 | 77.1735                    | 77.1735                   | 77.1735                       | 77.1735              | 77.1735                        | 77.1735                                             |
| Average = Sum(39)m / 12 =                                                 |                         |                            |                           |                               |                      |                                | 77.1735                                             |

# Full SAP Calculation Printout



|               |        |        |        |        |        |        |        |        |        |        |        |        |      |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| HLP           | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |      |
| HLP (average) | 1.0373 | 1.0373 | 1.0373 | 1.0373 | 1.0373 | 1.0373 | 1.0373 | 1.0373 | 1.0373 | 1.0373 | 1.0373 | 1.0373 | (40) |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |      |

## 4. Water heating energy requirements (kWh/year)

|                                                                 |          |          |          |          |          |          |          |          |          |                    |           |              |                                                                                             |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------------|-----------|--------------|---------------------------------------------------------------------------------------------|
| Assumed occupancy                                               |          |          |          |          |          |          |          |          |          |                    |           |              | 2.3480 (42)                                                                                 |
| Hot water usage for mixer showers                               |          |          |          |          |          |          |          |          |          |                    |           |              |                                                                                             |
| 87.4344                                                         | 86.1204  | 84.2057  | 80.5423  | 77.8387  | 74.8238  | 73.1101  | 75.0103  | 77.0933  | 80.3304  | 84.0726            | 87.0994   | (42a)        |                                                                                             |
| Hot water usage for baths                                       |          |          |          |          |          |          |          |          |          |                    |           |              |                                                                                             |
| 27.4684                                                         | 27.0605  | 26.4860  | 25.4268  | 24.6337  | 23.7542  | 23.2792  | 23.8496  | 24.4707  | 25.4118  | 26.4928            | 27.3756   | (42b)        |                                                                                             |
| Hot water usage for other uses                                  |          |          |          |          |          |          |          |          |          |                    |           |              |                                                                                             |
| 38.6763                                                         | 37.2699  | 35.8635  | 34.4571  | 33.0507  | 31.6443  | 31.6443  | 33.0507  | 34.4571  | 35.8635  | 37.2699            | 38.6763   | (42c)        |                                                                                             |
| Average daily hot water use (litres/day)                        |          |          |          |          |          |          |          |          |          |                    |           |              | 141.2394 (43)                                                                               |
| Daily hot water use                                             | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct                | Nov       | Dec          |                                                                                             |
| 153.5791                                                        | 150.4508 | 146.5552 | 140.4261 | 135.5230 | 130.2222 | 128.0335 | 131.9106 | 136.0211 | 141.6057 | 147.8353           | 153.1513  | (44)         |                                                                                             |
| Energy content                                                  | 243.2318 | 214.2399 | 225.2499 | 192.2364 | 182.4401 | 160.1234 | 154.8454 | 163.3328 | 167.7276 | 192.1576           | 210.6185  | 239.7979     | (45)                                                                                        |
| Energy content (annual)                                         |          |          |          |          |          |          |          |          |          | Total = Sum(45)m = | 2346.0013 |              |                                                                                             |
| Distribution loss (46)m = 0.15 x (45)m                          |          |          |          |          |          |          |          |          |          |                    |           |              |                                                                                             |
| 36.4848                                                         | 32.1360  | 33.7875  | 28.8355  | 27.3660  | 24.0185  | 23.2268  | 24.4999  | 25.1591  | 28.8236  | 31.5928            | 35.9697   | (46)         |                                                                                             |
| Water storage loss (or HIU loss):                               |          |          |          |          |          |          |          |          |          |                    |           |              |                                                                                             |
| Store volume                                                    |          |          |          |          |          |          |          |          |          |                    |           |              | 196.0000 (47)                                                                               |
| a) If manufacturer declared loss factor is known (kWh/day):     |          |          |          |          |          |          |          |          |          |                    |           |              | 1.3120 (48)                                                                                 |
| Temperature factor from Table 2b                                |          |          |          |          |          |          |          |          |          |                    |           |              | 0.5400 (49)                                                                                 |
| Enter (49) or (54) in (55)                                      |          |          |          |          |          |          |          |          |          |                    |           |              | 0.7085 (55)                                                                                 |
| Total storage loss                                              |          |          |          |          |          |          |          |          |          |                    |           |              |                                                                                             |
| 21.9629                                                         | 19.8374  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  | 21.9629  | 21.2544  | 21.9629  | 21.2544            | 21.9629   | (56)         |                                                                                             |
| If cylinder contains dedicated solar storage                    |          |          |          |          |          |          |          |          |          |                    |           |              |                                                                                             |
| 21.9629                                                         | 19.8374  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  | 21.9629  | 21.2544  | 21.9629  | 21.2544            | 21.9629   | (57)         |                                                                                             |
| Primary loss                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000    | 0.0000 (59)  |                                                                                             |
| Combi loss                                                      | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000    | 0.0000 (61)  |                                                                                             |
| Total heat required for water heating calculated for each month |          |          |          |          |          |          |          |          |          |                    |           |              |                                                                                             |
| 265.1947                                                        | 234.0774 | 247.2128 | 213.4908 | 204.4030 | 181.3778 | 176.8083 | 185.2957 | 188.9820 | 214.1205 | 231.8729           | 261.7608  | (62)         |                                                                                             |
| WWHRS                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000    | 0.0000 (63a) |                                                                                             |
| PV diverter                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000    | 0.0000 (63b) |                                                                                             |
| Solar input                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000    | 0.0000 (63c) |                                                                                             |
| FGHRS                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000    | 0.0000 (63d) |                                                                                             |
| Output from w/h                                                 |          |          |          |          |          |          |          |          |          |                    |           |              |                                                                                             |
| 265.1947                                                        | 234.0774 | 247.2128 | 213.4908 | 204.4030 | 181.3778 | 176.8083 | 185.2957 | 188.9820 | 214.1205 | 231.8729           | 261.7608  | (64)         |                                                                                             |
|                                                                 |          |          |          |          |          |          |          |          |          |                    |           |              | Total per year (kWh/year) = Sum(64)m = 2604.5965 (64)                                       |
| Electric shower(s)                                              |          |          |          |          |          |          |          |          |          |                    |           |              |                                                                                             |
| 0.0000                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000    | 0.0000 (64a) |                                                                                             |
|                                                                 |          |          |          |          |          |          |          |          |          |                    |           |              | Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a) |
| Heat gains from water heating, kWh/month                        |          |          |          |          |          |          |          |          |          |                    |           |              |                                                                                             |
| 80.8746                                                         | 71.2348  | 74.8956  | 63.9186  | 60.6613  | 53.2410  | 51.4861  | 54.3082  | 55.7694  | 63.8924  | 70.0306            | 79.7328   | (65)         |                                                                                             |

## 5. Internal gains (see Table 5 and 5a)

| Metabolic gains (Table 5), Watts                                                    |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
|                                                                                     | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
| (66)m                                                                               | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 31.7957  | 28.2406  | 22.9668  | 17.3874  | 12.9973  | 10.9728  | 11.8565  | 15.4116  | 20.6854  | 26.2649  | 30.6550  | 32.6794 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 309.4646 | 312.6759 | 304.5836 | 287.3560 | 265.6093 | 245.1705 | 231.5161 | 228.3048 | 236.3971 | 253.6247 | 275.3714 | 295.8102 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363 (69)  |
| Pumps, fans                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (70)   |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 (71) |
| Water heating gains (Table 5)                                                       | 108.7024 | 106.0041 | 100.6661 | 88.7758  | 81.5340  | 73.9459  | 69.2017  | 72.9948  | 77.4575  | 85.8769  | 97.2648  | 107.1677 (72) |
| Total internal gains                                                                | 548.3599 | 545.3179 | 526.6138 | 491.9164 | 458.5378 | 428.4864 | 410.9716 | 415.1084 | 432.9372 | 464.1636 | 501.6883 | 534.0546 (73) |

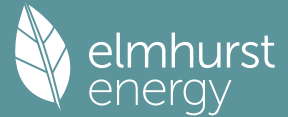
## 6. Solar gains

|             |               |          |          |           |           |           |           |          |          |          |          |          |              |
|-------------|---------------|----------|----------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|--------------|
| [Jan]       |               |          |          |           |           |           |           |          |          |          |          |          |              |
|             | Area          |          |          |           |           |           |           |          |          |          |          |          |              |
|             | m2            |          |          |           |           |           |           |          |          |          |          |          |              |
|             | Solar flux    |          |          |           |           |           |           |          |          |          |          |          |              |
|             | Table 6a      |          |          |           |           |           |           |          |          |          |          |          |              |
|             | W/m2          |          |          |           |           |           |           |          |          |          |          |          |              |
|             | Specific data |          |          |           |           |           |           |          |          |          |          |          |              |
|             | or Table 6b   |          |          |           |           |           |           |          |          |          |          |          |              |
|             | Specific data |          |          |           |           |           |           |          |          |          |          |          |              |
|             | or Table 6c   |          |          |           |           |           |           |          |          |          |          |          |              |
|             | Access        |          |          |           |           |           |           |          |          |          |          |          |              |
|             | factor        |          |          |           |           |           |           |          |          |          |          |          |              |
|             | Table 6d      |          |          |           |           |           |           |          |          |          |          |          |              |
|             | Gains         |          |          |           |           |           |           |          |          |          |          |          |              |
|             | W             |          |          |           |           |           |           |          |          |          |          |          |              |
| East        | 4.9600        |          |          |           |           |           |           |          |          |          |          |          | 57.0077 (76) |
| West        | 4.9600        |          |          |           |           |           |           |          |          |          |          |          | 57.0077 (80) |
| Solar gains | 114.0153      | 223.0382 | 367.3122 | 535.7029  | 656.5240  | 672.0691  | 639.8372  | 549.6107 | 427.1992 | 264.6536 | 142.1637 | 93.7607  | (83)         |
| Total gains | 662.3753      | 768.3561 | 893.9259 | 1027.6193 | 1115.0618 | 1100.5555 | 1050.8088 | 964.7191 | 860.1365 | 728.8172 | 643.8521 | 627.8152 | (84)         |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |                           |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |                           |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |                           |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep                       | Oct     | Nov     | Dec          |
| tau                                                                         | 23.0351 | 23.0351 | 23.0351 | 23.0351 | 23.0351 | 23.0351 | 23.0351 | 23.0351 | 23.0351                   | 23.0351 | 23.0351 | 23.0351      |
| alpha                                                                       | 2.5357  | 2.5357  | 2.5357  | 2.5357  | 2.5357  | 2.5357  | 2.5357  | 2.5357  | 2.5357                    | 2.5357  | 2.5357  | 2.5357       |
| util living area                                                            |         |         |         |         |         |         |         |         |                           |         |         |              |
|                                                                             | 0.9007  | 0.8620  | 0.7923  | 0.6821  | 0.5486  | 0.4143  | 0.3104  | 0.3490  | 0.5335                    | 0.7508  | 0.8689  | 0.9112 (86)  |
| MIT                                                                         | 18.8362 | 19.1864 | 19.7160 | 20.2720 | 20.6686 | 20.8814 | 20.9583 | 20.9427 | 20.7698                   | 20.2017 | 19.3955 | 18.7354 (87) |
| Th 2                                                                        | 20.0524 | 20.0524 | 20.0524 | 20.0524 | 20.0524 | 20.0524 | 20.0524 | 20.0524 | 20.0524                   | 20.0524 | 20.0524 | 20.0524 (88) |
| util rest of house                                                          |         |         |         |         |         |         |         |         |                           |         |         |              |
|                                                                             | 0.8895  | 0.8471  | 0.7709  | 0.6512  | 0.5071  | 0.3610  | 0.2477  | 0.2829  | 0.4771                    | 0.7175  | 0.8521  | 0.9010 (89)  |
| MIT 2                                                                       | 17.5395 | 17.9728 | 18.6215 | 19.2842 | 19.7349 | 19.9582 | 20.0276 | 20.0166 | 19.8560                   | 19.2239 | 18.2436 | 17.4141 (90) |
| Living area fraction                                                        |         |         |         |         |         |         |         |         |                           |         |         |              |
|                                                                             |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         | 0.3347 (91)  |
| MIT                                                                         | 17.9735 | 18.3790 | 18.9878 | 19.6148 | 20.0474 | 20.2672 | 20.3391 | 20.3265 | 20.1618                   | 19.5511 | 18.6291 | 17.8563 (92) |

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|                        |         |         |         |         |         |         |         |         |         |         |         |              |
|------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature adjustment |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT           | 17.9735 | 18.3790 | 18.9878 | 19.6148 | 20.0474 | 20.2672 | 20.3391 | 20.3265 | 20.1618 | 19.5511 | 18.6291 | 17.8563 (93) |

## 8. Space heating requirement

|                                                                                | Jan       | Feb       | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov           | Dec       |       |
|--------------------------------------------------------------------------------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|-----------|-------|
| Utilisation                                                                    | 0.8584    | 0.8156    | 0.7436   | 0.6357   | 0.5068   | 0.3734   | 0.2670   | 0.3025   | 0.4840   | 0.6977   | 0.8214        | 0.8706    | (94)  |
| Useful gains                                                                   | 568.5877  | 626.6506  | 664.7046 | 653.2992 | 565.1648 | 410.9573 | 280.5760 | 291.8104 | 416.2816 | 508.4967 | 528.8551      | 546.5524  | (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000   | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000  | 7.1000        | 4.2000    | (96)  |
| Heat loss rate W                                                               | 1055.2283 | 1040.2175 | 963.7279 | 826.8955 | 644.1957 | 437.3558 | 288.5573 | 303.0251 | 467.8131 | 690.7898 | 889.7426      | 1053.9027 | (97)  |
| Space heating kWh                                                              | 362.0606  | 277.9170  | 222.4733 | 124.9893 | 58.7990  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 135.6260 | 259.8390      | 377.4686  | (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |          |          |          |          |          |          |          |          |               | 1819.1729 |       |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | (98b) |
| Solar heating contribution - total per year (kWh/year)                         |           |           |          |          |          |          |          |          |          |          |               | 0.0000    |       |
| Space heating kWh                                                              | 362.0606  | 277.9170  | 222.4733 | 124.9893 | 58.7990  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 135.6260 | 259.8390      | 377.4686  | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |          |          |          |          |          |          |          |          |               | 1819.1729 |       |
| Space heating per m2                                                           |           |           |          |          |          |          |          |          |          |          |               | 24.4512   | (99)  |
|                                                                                |           |           |          |          |          |          |          |          |          |          | (98c) / (4) = |           |       |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |           |                 |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                |          |          |          |          |          |          |          |          |          |          |          |           | 0.0000 (201)    |
| Fraction of space heat from main system(s)                                                           |          |          |          |          |          |          |          |          |          |          |          |           | 1.0000 (202)    |
| Fraction of main heating from main system 2                                                          |          |          |          |          |          |          |          |          |          |          |          |           | 0.0000 (203)    |
| Fraction of total heating from main system 1                                                         |          |          |          |          |          |          |          |          |          |          |          |           | 1.0000 (204)    |
| Fraction of total heating from main system 2                                                         |          |          |          |          |          |          |          |          |          |          |          |           | 0.0000 (205)    |
| Efficiency of main space heating system 1 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          |           | 100.0000 (206)  |
| Efficiency of main space heating system 2 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          |           | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                              |          |          |          |          |          |          |          |          |          |          |          |           | 0.0000 (208)    |
|                                                                                                      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec       |                 |
| Space heating requirement                                                                            | 362.0606 | 277.9170 | 222.4733 | 124.9893 | 58.7990  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 135.6260 | 259.8390 | 377.4686  | (98)            |
| Space heating efficiency (main heating system 1)                                                     | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 100.0000 | 100.0000 | 100.0000  | (210)           |
| Space heating fuel (main heating system)                                                             | 362.0606 | 277.9170 | 222.4733 | 124.9893 | 58.7990  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 135.6260 | 259.8390 | 377.4686  | (211)           |
| Space heating efficiency (main heating system 2)                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (212)           |
| Space heating fuel (main heating system 2)                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (213)           |
| Space heating fuel (secondary)                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (215)           |
| Space heating fuel used, main system 2                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (213)           |
| Water heating                                                                                        |          |          |          |          |          |          |          |          |          |          |          |           |                 |
| Water heating requirement                                                                            | 265.1947 | 234.0774 | 247.2128 | 213.4908 | 204.4030 | 181.3778 | 176.8083 | 185.2957 | 188.9820 | 214.1205 | 231.8729 | 261.7608  | (64)            |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          |           | 313.4050 (216)  |
| (217)m                                                                                               | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050  | (217)           |
| Fuel for water heating, kWh/month                                                                    | 84.6172  | 74.6885  | 78.8797  | 68.1198  | 65.2201  | 57.8733  | 56.4153  | 59.1234  | 60.2996  | 68.3207  | 73.9851  | 83.5216   | (219)           |
| Space cooling fuel requirement                                                                       |          |          |          |          |          |          |          |          |          |          |          |           |                 |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (221)           |
| Pumps and Fa                                                                                         | 15.0751  | 13.6162  | 15.0751  | 14.5888  | 15.0751  | 14.5888  | 15.0751  | 15.0751  | 14.5888  | 15.0751  | 14.5888  | 15.0751   | (231)           |
| Lighting                                                                                             | 27.8306  | 22.3267  | 20.1027  | 14.7281  | 11.3764  | 9.2946   | 10.3780  | 13.4897  | 17.5217  | 22.9895  | 25.9666  | 28.6041   | (232)           |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |           |                 |
| (233a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (233a)          |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |           |                 |
| (234a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (234a)          |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |           |                 |
| (235a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235a)          |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |           |                 |
| (235c)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235c)          |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |           |                 |
| (233b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (233b)          |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |           |                 |
| (234b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (234b)          |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |           |                 |
| (235b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235b)          |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |           |                 |
| (235d)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235d)          |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |           |                 |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 1819.1729 | (211)           |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (213)           |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (215)           |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 313.4050  |                 |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          | 831.0641  | (219)           |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (221)           |
| Electricity for pumps and fans:                                                                      |          |          |          |          |          |          |          |          |          |          |          |           |                 |
| (MEVCentralised, Database: in-use factor = 1.3000, SFP = 0.6630)                                     |          |          |          |          |          |          |          |          |          |          |          |           |                 |
| mechanical ventilation fans (SFP = 0.6630)                                                           |          |          |          |          |          |          |          |          |          |          |          |           | 177.4970 (230a) |
| Total electricity for the above, kWh/year                                                            |          |          |          |          |          |          |          |          |          |          |          |           | 177.4970 (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |          |          |          |          |          |          |          |          |           | 224.6087 (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |          |          |          |          |          |          |          |          |           |                 |
| PV generation                                                                                        |          |          |          |          |          |          |          |          |          |          |          |           | 0.0000 (233)    |
| Wind generation                                                                                      |          |          |          |          |          |          |          |          |          |          |          |           | 0.0000 (234)    |
| Hydro-electric generation (Appendix N)                                                               |          |          |          |          |          |          |          |          |          |          |          |           | 0.0000 (235a)   |
| Electricity generated - Micro CHP (Appendix N)                                                       |          |          |          |          |          |          |          |          |          |          |          |           | 0.0000 (235)    |
| Appendix Q - special features                                                                        |          |          |          |          |          |          |          |          |          |          |          |           |                 |
| Energy saved or generated                                                                            |          |          |          |          |          |          |          |          |          |          |          |           | -0.0000 (236)   |
| Energy used                                                                                          |          |          |          |          |          |          |          |          |          |          |          |           | 0.0000 (237)    |
| Total delivered energy for all uses                                                                  |          |          |          |          |          |          |          |          |          |          |          |           | 3052.3428 (238) |

## 10a. Fuel costs - using Table 12 prices

|      |            |           |
|------|------------|-----------|
| Fuel | Fuel price | Fuel cost |
|------|------------|-----------|

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|                                             | kWh/year  | p/kWh   | £/year         |
|---------------------------------------------|-----------|---------|----------------|
| Space heating - main system 1               | 1819.1729 | 16.4900 | 299.9816 (240) |
| Space heating - main system 2               | 0.0000    | 16.4900 | 0.0000 (241)   |
| Total CO2 associated with community systems |           |         | 0.0000 (473)   |
| Water heating (other fuel)                  | 831.0641  | 16.4900 | 137.0425 (247) |
| Energy for instantaneous electric shower(s) | 0.0000    | 16.4900 | 0.0000 (247a)  |
| Pumps, fans and electric keep-hot           | 177.4970  | 16.4900 | 29.2693 (249)  |
| Energy for lighting                         | 224.6087  | 16.4900 | 37.0380 (250)  |
| Additional standing charges                 |           |         | 0.0000 (251)   |
| Total energy cost                           |           |         | 503.3313 (255) |

## 11a. SAP rating - Individual heating systems

|                                  |                                         |              |
|----------------------------------|-----------------------------------------|--------------|
| Energy cost deflator (Table 12): |                                         | 0.3600 (256) |
| Energy cost factor (ECF)         | $[(255) \times (256)] / [(4) + 45.0] =$ | 1.5176 (257) |
| SAP value                        |                                         | 75.4000      |
| SAP rating (Section 12)          |                                         | 75 (258)     |
| SAP band                         |                                         | C            |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|---------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1               | 1819.1729          | 0.1552                        | 282.3642 (261)           |
| Space heating - main system 2               | 0.0000             | 0.0000                        | 0.0000 (262)             |
| Total CO2 associated with community systems |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                  | 831.0641           | 0.1413                        | 117.4242 (264)           |
| Space and water heating                     |                    |                               | 399.7883 (265)           |
| Pumps, fans and electric keep-hot           | 177.4970           | 0.1387                        | 24.6210 (267)            |
| Energy for lighting                         | 224.6087           | 0.1443                        | 32.4180 (268)            |
| Total CO2, kg/year                          |                    |                               | 456.8273 (272)           |
| CO2 emissions per m2                        |                    |                               | 6.1400 (273)             |
| EI value                                    |                    |                               | 94.8731                  |
| EI rating                                   |                    |                               | 95 (274)                 |
| EI band                                     |                    |                               | A                        |

## SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

### 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m)              | Volume<br>(m3)         |
|--------------------------------------------------------|--------------|-----------------------------------|------------------------|
| Main dwelling                                          |              |                                   |                        |
| Ground floor                                           | 45.3000 (1b) | x 2.7500 (2b)                     | = 124.5750 (1b) - (3b) |
| First floor                                            | 29.1000 (1c) | x 3.2600 (2c)                     | = 94.8660 (1c) - (3c)  |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 74.4000      |                                   | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 219.4410 (5)           |

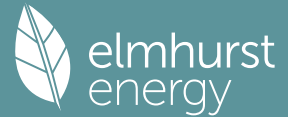
### 2. Ventilation rate

|                                                    | m3 per hour          |
|----------------------------------------------------|----------------------|
| Number of open chimneys                            | 0 * 80 = 0.0000 (6a) |
| Number of open flues                               | 0 * 20 = 0.0000 (6b) |
| Number of chimneys / flues attached to closed fire | 0 * 10 = 0.0000 (6c) |
| Number of flues attached to solid fuel boiler      | 0 * 20 = 0.0000 (6d) |
| Number of flues attached to other heater           | 0 * 35 = 0.0000 (6e) |
| Number of blocked chimneys                         | 0 * 20 = 0.0000 (6f) |
| Number of intermittent extract fans                | 0 * 10 = 0.0000 (7a) |
| Number of passive vents                            | 0 * 10 = 0.0000 (7b) |
| Number of flueless gas fires                       | 0 * 40 = 0.0000 (7c) |

|                                                      |                                                       |                |             |
|------------------------------------------------------|-------------------------------------------------------|----------------|-------------|
| Infiltration due to chimneys, flues and fans         | = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 / (5) = | 0.0000 (8)  |
| Pressure test                                        |                                                       |                | Yes         |
| Pressure Test Method                                 |                                                       |                | Blower Door |
| Measured/design AP50                                 |                                                       |                | 4.0000 (17) |
| Infiltration rate                                    |                                                       |                | 0.2000 (18) |
| Number of sides sheltered                            |                                                       |                | 1 (19)      |
| Shelter factor                                       | (20) = 1 - [0.075 x (19)] =                           |                | 0.9250 (20) |
| Infiltration rate adjusted to include shelter factor | (21) = (18) x (20) =                                  |                | 0.1850 (21) |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 4.3000 | 4.1000 | 4.1000 | 3.8000 | 3.9000 | 3.4000 | 3.4000 | 3.3000 | 3.4000 | 3.8000 | 3.7000 | 4.0000 (22)  |
| Wind factor                                                                                             | 1.0750 | 1.0250 | 1.0250 | 0.9500 | 0.9750 | 0.8500 | 0.8500 | 0.8250 | 0.8500 | 0.9500 | 0.9250 | 1.0000 (22a) |
| Adj infilt rate                                                                                         | 0.1989 | 0.1896 | 0.1896 | 0.1758 | 0.1804 | 0.1573 | 0.1573 | 0.1526 | 0.1573 | 0.1758 | 0.1711 | 0.1850 (22b) |
| Mechanical extract ventilation - centralised                                                            |        |        |        |        |        |        |        |        |        |        |        |              |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

# Full SAP Calculation Printout



## 3. Heat losses and heat loss parameter

| Element                                                                   | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2        | U-value<br>W/m2K | A x U<br>W/K | K-value<br>kJ/m2K                    | A x K<br>kJ/K |         |         |         |         |         |         |
|---------------------------------------------------------------------------|-------------|----------------|----------------------|------------------|--------------|--------------------------------------|---------------|---------|---------|---------|---------|---------|---------|
| Main dwelling                                                             |             |                |                      |                  |              |                                      |               |         |         |         |         |         |         |
| Windows / Glazed Doors                                                    |             |                | 9.9200               | 1.1450           | 11.3588      |                                      |               | (27)    |         |         |         |         |         |
| External Wall                                                             | 62.3800     | 8.9200         | 53.4600              | 0.1500           | 8.0190       | 9.0000                               | 481.1400      | (29a)   |         |         |         |         |         |
| RIR Stud Wall                                                             | 25.3800     |                | 25.3800              | 0.1500           | 3.8070       | 9.0000                               | 228.4200      | (29a)   |         |         |         |         |         |
| Dormer Walls                                                              | 6.6000      | 1.0000         | 5.6000               | 0.1500           | 0.8400       | 9.0000                               | 50.4000       | (29a)   |         |         |         |         |         |
| Adj To RIR Ins At Slope                                                   | 16.0500     |                | 16.0500              | 0.1400           | 2.2470       | 9.0000                               | 144.4500      | (30)    |         |         |         |         |         |
| Slope Roof                                                                | 37.9900     |                | 37.9900              | 0.1400           | 5.3186       | 9.0000                               | 341.9100      | (30)    |         |         |         |         |         |
| Total net area of external elements Aum(A, m2)                            |             |                | 148.4000             |                  |              |                                      |               | (31)    |         |         |         |         |         |
| Fabric heat loss, W/K = Sum (A x U)                                       |             |                | (26)...(30) + (32) = |                  | 31.5904      |                                      |               | (33)    |         |         |         |         |         |
| Main dwelling                                                             |             |                |                      |                  |              |                                      |               |         |         |         |         |         |         |
| Party Wall 1                                                              |             |                | 44.2300              | 0.0000           | 0.0000       | 45.0000                              | 1990.3500     | (32)    |         |         |         |         |         |
| Party Floor 1                                                             |             |                | 45.3000              |                  |              | 30.0000                              | 1359.0000     | (32d)   |         |         |         |         |         |
| Internal Wall 1                                                           |             |                | 113.1500             |                  |              | 9.0000                               | 1018.3500     | (32c)   |         |         |         |         |         |
| Internal Floor 1                                                          |             |                | 29.1000              |                  |              | 18.0000                              | 523.8000      | (32d)   |         |         |         |         |         |
| Internal Ceiling 1                                                        |             |                | 29.1000              |                  |              | 9.0000                               | 261.9000      | (32e)   |         |         |         |         |         |
| Heat capacity Cm = Sum(A x k)                                             |             |                |                      |                  |              | (28)...(30) + (32) + (32a)...(32e) = | 6399.7200     | (34)    |         |         |         |         |         |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K                         |             |                |                      |                  |              |                                      | 86.0177       | (35)    |         |         |         |         |         |
| List of Thermal Bridges                                                   |             |                |                      |                  |              |                                      |               |         |         |         |         |         |         |
| K1 Element                                                                |             |                |                      |                  | Length       | Psi-value                            | Total         |         |         |         |         |         |         |
| E2 Other lintels (including other steel lintels)                          |             |                |                      |                  | 7.9700       | 0.0840                               | 0.6695        |         |         |         |         |         |         |
| E3 Sill                                                                   |             |                |                      |                  | 7.0600       | 0.0340                               | 0.2400        |         |         |         |         |         |         |
| E4 Jamb                                                                   |             |                |                      |                  | 26.6000      | 0.0430                               | 1.1438        |         |         |         |         |         |         |
| E16 Corner (normal)                                                       |             |                |                      |                  | 17.5000      | 0.0300                               | 0.5250        |         |         |         |         |         |         |
| E18 Party wall between dwellings                                          |             |                |                      |                  | 9.5000       | 0.0400                               | 0.3800        |         |         |         |         |         |         |
| E7 Party floor between dwellings (in blocks of flats)                     |             |                |                      |                  | 17.3000      | 0.0660                               | 1.1418        |         |         |         |         |         |         |
| E11 Eaves (insulation at rafter level)                                    |             |                |                      |                  | 9.6000       | 0.0130                               | 0.1248        |         |         |         |         |         |         |
| E17 Corner (inverted - internal area greater than external area)          |             |                |                      |                  | 8.0000       | 0.0150                               | 0.1200        |         |         |         |         |         |         |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) |             |                |                      |                  | 13.6000      | 0.0000                               | 0.0000        |         |         |         |         |         |         |
| E13 Gable (insulation at rafter level)                                    |             |                |                      |                  | 16.1000      | 0.0240                               | 0.3864        |         |         |         |         |         |         |
| E6 Intermediate floor within a dwelling                                   |             |                |                      |                  | 22.2000      | 0.0800                               | 1.7760        |         |         |         |         |         |         |
| P5 Party wall - Roof (insulation at rafter level)                         |             |                |                      |                  | 6.4000       | 0.2400                               | 1.5360        |         |         |         |         |         |         |
| P2 Party wall - Intermediate floor within a dwelling                      |             |                |                      |                  | 4.0000       | 0.0000                               | 0.0000        |         |         |         |         |         |         |
| R4 Ridge (vaulted ceiling)                                                |             |                |                      |                  | 11.1000      | 0.1200                               | 1.3320        |         |         |         |         |         |         |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                |             |                |                      |                  |              |                                      | 9.3753        | (36)    |         |         |         |         |         |
| Point Thermal bridges                                                     |             |                |                      |                  |              |                                      | (36a) =       | 0.0000  |         |         |         |         |         |
| Total fabric heat loss                                                    |             |                |                      |                  |              | (33) + (36) + (36a) =                | 40.9657       | (37)    |         |         |         |         |         |
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)       |             |                |                      |                  |              |                                      |               |         |         |         |         |         |         |
| (38)m                                                                     | Jan         | Feb            | Mar                  | Apr              | May          | Jun                                  | Jul           | Aug     | Sep     | Oct     | Nov     | Dec     |         |
| Heat transfer coeff                                                       | 36.2078     | 36.2078        | 36.2078              | 36.2078          | 36.2078      | 36.2078                              | 36.2078       | 36.2078 | 36.2078 | 36.2078 | 36.2078 | 36.2078 | (38)    |
| Average = Sum(39)m / 12 =                                                 | 77.1735     | 77.1735        | 77.1735              | 77.1735          | 77.1735      | 77.1735                              | 77.1735       | 77.1735 | 77.1735 | 77.1735 | 77.1735 | 77.1735 | (39)    |
|                                                                           |             |                |                      |                  |              |                                      |               |         |         |         |         |         | 77.1735 |
| HLP                                                                       | Jan         | Feb            | Mar                  | Apr              | May          | Jun                                  | Jul           | Aug     | Sep     | Oct     | Nov     | Dec     |         |
| HLP (average)                                                             | 1.0373      | 1.0373         | 1.0373               | 1.0373           | 1.0373       | 1.0373                               | 1.0373        | 1.0373  | 1.0373  | 1.0373  | 1.0373  | 1.0373  | (40)    |
| Days in mont                                                              | 31          | 28             | 31                   | 30               | 31           | 30                                   | 31            | 31      | 30      | 31      | 30      | 31      |         |

## 4. Water heating energy requirements (kWh/year)

|                                                                                |          |          |          |          |          |          |          |          |          |          |          |          |          |       |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-------|
| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |          |          |          | 2.3480   | (42)  |
| Hot water usage for mixer showers                                              |          |          |          |          |          |          |          |          |          |          |          |          |          |       |
| Hot water usage for baths                                                      | 87.4344  | 86.1204  | 84.2057  | 80.5423  | 77.8387  | 74.8238  | 73.1101  | 75.0103  | 77.0933  | 80.3304  | 84.0726  | 87.0994  | 87.0994  | (42a) |
| Hot water usage for other uses                                                 | 27.4684  | 27.0605  | 26.4860  | 25.4268  | 24.6337  | 23.7542  | 23.2792  | 23.8496  | 24.4707  | 25.4118  | 26.4928  | 27.3756  | 27.3756  | (42b) |
| Average daily hot water use (litres/day)                                       | 38.6763  | 37.2699  | 35.8635  | 34.4571  | 33.0507  | 31.6443  | 31.6443  | 33.0507  | 34.4571  | 35.8635  | 37.2699  | 38.6763  | 38.6763  | (42c) |
| Daily hot water use                                                            | 153.5791 | 150.4508 | 146.5552 | 140.4261 | 135.5230 | 130.2222 | 128.0335 | 131.9106 | 136.0211 | 141.6057 | 147.8353 | 153.1513 | 153.1513 | (44)  |
| Energy content (annual)                                                        | 243.2318 | 214.2399 | 225.2499 | 192.2364 | 182.4401 | 160.1234 | 154.8454 | 163.3328 | 167.7276 | 192.1576 | 210.6185 | 239.7979 | 239.7979 | (45)  |
| Distribution loss (46)m = 0.15 x (45)m                                         | 36.4848  | 32.1360  | 33.7875  | 28.8355  | 27.3660  | 24.0185  | 23.2268  | 24.4999  | 25.1591  | 28.8236  | 31.5928  | 35.9697  | 35.9697  | (46)  |
| Water storage loss (or HIU loss):                                              |          |          |          |          |          |          |          |          |          |          |          |          |          |       |
| Store volume                                                                   |          |          |          |          |          |          |          |          |          |          |          |          | 196.0000 | (47)  |
| a) If manufacturer declared loss factor is known (kWh/day):                    |          |          |          |          |          |          |          |          |          |          |          |          | 1.3120   | (48)  |
| Temperature factor from Table 2b                                               |          |          |          |          |          |          |          |          |          |          |          |          | 0.5400   | (49)  |
| Enter (49) or (54) in (55)                                                     |          |          |          |          |          |          |          |          |          |          |          |          | 0.7085   | (55)  |
| Total storage loss                                                             | 21.9629  | 19.8374  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  | 21.9629  | (56)  |
| If cylinder contains dedicated solar storage                                   | 21.9629  | 19.8374  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  | 21.9629  | (57)  |
| Primary loss                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (59)  |
| Combi loss                                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (61)  |
| Total heat required for water heating calculated for each month                | 265.1947 | 234.0774 | 247.2128 | 213.4908 | 204.4030 | 181.3778 | 176.8083 | 185.2957 | 188.9820 | 214.1205 | 231.8729 | 261.7608 | 261.7608 | (62)  |
| WWHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (63a) |
| PV diverter                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (63b) |
| Solar input                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (63c) |
| FGHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (63d) |
| Output from w/h                                                                | 265.1947 | 234.0774 | 247.2128 | 213.4908 | 204.4030 | 181.3778 | 176.8083 | 185.2957 | 188.9820 | 214.1205 | 231.8729 | 261.7608 | 261.7608 | (64)  |
| Electric shower(s)                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (64a) |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000   | (64a) |
| Heat gains from water heating, kWh/month                                       | 80.8746  | 71.2348  | 74.8956  | 63.9186  | 60.6613  | 53.2410  | 51.4861  | 54.3082  | 55.7694  | 63.8924  | 70.0306  | 79.7328  | 79.7328  | (65)  |

## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |          |          |      |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| Metabolic gains (Table 5), Watts                                                    |          |          |          |          |          |          |          |          |          |          |          |          |          |      |
| (66)m                                                                               | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |          |      |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | 140.8826 | (66) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 31.7957  | 28.2406  | 22.9668  | 17.3874  | 12.9973  | 10.9728  | 11.8565  | 15.4116  | 20.6854  | 26.2649  | 30.6550  | 32.6794  | 32.6794  | (67) |

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|                               |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Cooking gains                 | 309.4646 | 312.6759 | 304.5836 | 287.3560 | 265.6093 | 245.1705 | 231.5161 | 228.3048 | 236.3971 | 253.6247 | 275.3714 | 295.8102 (68) |
| Pumps, fans                   | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363  | 51.4363 (69)  |
| Losses e.g. evaporation       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (70)   |
| (negative values) (Table 5)   |          |          |          |          |          |          |          |          |          |          |          |               |
| Water heating gains (Table 5) | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 | -93.9218 (71) |
| Total internal gains          | 108.7024 | 106.0041 | 100.6661 | 88.7758  | 81.5340  | 73.9459  | 69.2017  | 72.9948  | 77.4575  | 85.8769  | 97.2648  | 107.1677 (72) |
|                               | 548.3599 | 545.3179 | 526.6138 | 491.9164 | 458.5378 | 428.4864 | 410.9716 | 415.1084 | 432.9372 | 464.1636 | 501.6883 | 534.0546 (73) |

## 6. Solar gains

| [Jan]       |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W   |          |          |               |
|-------------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|----------|----------|---------------|
| East        |          |          |          | 4.9600     | 23.8018                        | 0.7600                            | 0.0000                             | 0.7700                       | 69.0868 (76) |          |          |               |
| West        |          |          |          | 4.9600     | 23.8018                        | 0.7600                            | 0.0000                             | 0.7700                       | 69.0868 (80) |          |          |               |
|             |          |          |          |            |                                |                                   |                                    |                              |              |          |          |               |
| Solar gains | 138.1736 | 236.0921 | 385.2951 | 569.0054   | 678.1730                       | 733.8699                          | 691.9692                           | 610.2517                     | 477.1980     | 300.5179 | 169.7134 | 114.2818 (83) |
| Total gains | 686.5335 | 781.4100 | 911.9088 | 1060.9218  | 1136.7108                      | 1162.3563                         | 1102.9407                          | 1025.3601                    | 910.1353     | 764.6815 | 671.4017 | 648.3364 (84) |

## 7. Mean internal temperature (heating season)

|                                                                               |         |         |         |         |         |         |         |         |         |         |         |              |
|-------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C)   |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil <sub>m</sub> (see Table 9a) |         |         |         |         |         |         |         |         |         |         |         |              |
| Jan                                                                           | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |              |
| tau                                                                           | 23.0351 | 23.0351 | 23.0351 | 23.0351 | 23.0351 | 23.0351 | 23.0351 | 23.0351 | 23.0351 | 23.0351 | 23.0351 | 23.0351      |
| alpha                                                                         | 2.5357  | 2.5357  | 2.5357  | 2.5357  | 2.5357  | 2.5357  | 2.5357  | 2.5357  | 2.5357  | 2.5357  | 2.5357  | 2.5357       |
| util living area                                                              | 0.8841  | 0.8453  | 0.7656  | 0.6371  | 0.4881  | 0.3296  | 0.2266  | 0.2498  | 0.4592  | 0.7019  | 0.8425  | 0.8955 (86)  |
| MIT                                                                           | 19.0617 | 19.3739 | 19.9015 | 20.4350 | 20.7804 | 20.9433 | 20.9850 | 20.9806 | 20.8589 | 20.3860 | 19.6320 | 18.9792 (87) |
| Th 2                                                                          | 20.0524 | 20.0524 | 20.0524 | 20.0524 | 20.0524 | 20.0524 | 20.0524 | 20.0524 | 20.0524 | 20.0524 | 20.0524 | 20.0524 (88) |
| util rest of house                                                            | 0.8708  | 0.8284  | 0.7412  | 0.6023  | 0.4422  | 0.2740  | 0.1632  | 0.1825  | 0.3984  | 0.6627  | 0.8221  | 0.8832 (89)  |
| MIT 2                                                                         | 17.8220 | 18.2062 | 18.8471 | 19.4730 | 19.8546 | 20.0137 | 20.0461 | 20.0438 | 19.9427 | 19.4375 | 18.5355 | 17.7207 (90) |
| Living area fraction                                                          |         |         |         |         |         |         |         |         |         |         |         | 0.3347 (91)  |
| MIT                                                                           | 18.2369 | 18.5970 | 19.2000 | 19.7949 | 20.1645 | 20.3248 | 20.3603 | 20.3573 | 20.2494 | 19.7549 | 18.9025 | 18.1419 (92) |
| Temperature adjustment                                                        |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                  | 18.2369 | 18.5970 | 19.2000 | 19.7949 | 20.1645 | 20.3248 | 20.3603 | 20.3573 | 20.2494 | 19.7549 | 18.9025 | 18.1419 (93) |

## 8. Space heating requirement

|                                                                                | Jan       | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov      | Dec       |       |
|--------------------------------------------------------------------------------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|----------|-----------|-------|
| Utilisation                                                                    | 0.8394    | 0.7976   | 0.7167   | 0.5923   | 0.4478   | 0.2903   | 0.1840   | 0.2045   | 0.4115   | 0.6491        | 0.7926   | 0.8521    | (94)  |
| Useful gains                                                                   | 576.2663  | 623.2550 | 653.5381 | 628.3804 | 509.0609 | 337.4512 | 202.9490 | 209.6534 | 374.4930 | 496.3740      | 532.1794 | 552.4523  | (95)  |
| Ext temp.                                                                      | 5.1000    | 5.7000   | 7.4000   | 9.9000   | 12.9000  | 15.8000  | 17.7000  | 17.6000  | 15.0000  | 11.5000       | 8.0000   | 5.1000    | (96)  |
| Heat loss rate W                                                               | 1013.8170 | 995.3037 | 910.6433 | 763.6267 | 560.6245 | 349.1954 | 205.3077 | 212.7936 | 405.1106 | 637.0630      | 841.3822 | 1006.4894 | (97)  |
| Space heating kWh                                                              | 325.5377  | 250.0167 | 191.2863 | 97.3773  | 38.3633  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 104.6726      | 222.6260 | 337.8036  | (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |          |          |          |          |          |          |          |          |               |          | 1567.6836 |       |
| Solar heating kWh                                                              | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000   | 0.0000    | (98b) |
| Solar heating contribution - total per year (kWh/year)                         |           |          |          |          |          |          |          |          |          |               |          | 0.0000    |       |
| Space heating kWh                                                              | 325.5377  | 250.0167 | 191.2863 | 97.3773  | 38.3633  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 104.6726      | 222.6260 | 337.8036  | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |          |          |          |          |          |          |          |          |               |          | 1567.6836 |       |
| Space heating per m2                                                           |           |          |          |          |          |          |          |          |          | (98c) / (4) = |          | 21.0710   | (99)  |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                       |          |          |          |          |          |          |          |          |          |          |          |                |
|-----------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Fraction of space heat from secondary/supplementary system (Table 11) |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)   |
| Fraction of space heat from main system(s)                            |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)   |
| Fraction of main heating from main system 2                           |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (203)   |
| Fraction of total heating from main system 1                          |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (204)   |
| Fraction of total heating from main system 2                          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (205)   |
| Efficiency of main space heating system 1 (in %)                      |          |          |          |          |          |          |          |          |          |          |          | 100.0000 (206) |
| Efficiency of main space heating system 2 (in %)                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)   |
| Efficiency of secondary/supplementary heating system, %               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)   |
| Jan                                                                   | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |                |
| Space heating requirement                                             | 325.5377 | 250.0167 | 191.2863 | 97.3773  | 38.3633  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 104.6726 | 222.6260 | 337.8036 (98)  |
| Space heating efficiency (main heating system 1)                      | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 100.0000 | 100.0000 | 100.0000 (210) |
| Space heating fuel (main heating system)                              | 325.5377 | 250.0167 | 191.2863 | 97.3773  | 38.3633  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 104.6726 | 222.6260 | 337.8036 (211) |
| Space heating efficiency (main heating system 2)                      | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)   |
| Space heating fuel (main heating system 2)                            | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)   |
| Space heating fuel (secondary)                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)   |
| Space heating fuel used, main system 2                                |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)   |
| Water heating                                                         |          |          |          |          |          |          |          |          |          |          |          |                |
| Water heating requirement                                             | 265.1947 | 234.0774 | 247.2128 | 213.4908 | 204.4030 | 181.3778 | 176.8083 | 185.2957 | 188.9820 | 214.1205 | 231.8729 | 261.7608 (64)  |
| Efficiency of water heater (217)m                                     | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 (216) |
| Fuel for water heating, kWh/month                                     | 84.6172  | 74.6885  | 78.8797  | 68.1198  | 65.2201  | 57.8733  | 56.4153  | 59.1234  | 60.2996  | 68.3207  | 73.9851  | 83.5216 (219)  |
| Space cooling fuel requirement (221)m                                 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)   |

# Full SAP Calculation Printout



|                                                                                                      |         |         |         |         |         |         |         |         |         |         |         |           |        |
|------------------------------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|-----------|--------|
| Pumps and Fa                                                                                         | 15.0751 | 13.6162 | 15.0751 | 14.5888 | 15.0751 | 14.5888 | 15.0751 | 15.0751 | 14.5888 | 15.0751 | 14.5888 | 15.0751   | (231)  |
| Lighting                                                                                             | 27.8306 | 22.3267 | 20.1027 | 14.7281 | 11.3764 | 9.2946  | 10.3780 | 13.4897 | 17.5217 | 22.9895 | 25.9666 | 28.6041   | (232)  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |         |         |         |         |         |         |         |         |         |         |         |           |        |
| (233a)m                                                                                              | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000    | (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |         |         |         |         |         |         |         |         |         |         |         |           |        |
| (234a)m                                                                                              | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000    | (234a) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |         |         |         |         |         |         |         |         |         |         |         |           |        |
| (235a)m                                                                                              | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000    | (235a) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |         |         |         |         |         |         |         |         |         |         |         |           |        |
| (235c)m                                                                                              | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000    | (235c) |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |         |         |         |         |         |         |         |         |         |         |         |           |        |
| (233b)m                                                                                              | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000    | (233b) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |         |         |         |         |         |         |         |         |         |         |         |           |        |
| (234b)m                                                                                              | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000    | (234b) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |         |         |         |         |         |         |         |         |         |         |         |           |        |
| (235b)m                                                                                              | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000    | (235b) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |         |         |         |         |         |         |         |         |         |         |         |           |        |
| (235d)m                                                                                              | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000    | (235d) |
| Annual totals kWh/year                                                                               |         |         |         |         |         |         |         |         |         |         |         |           |        |
| Space heating fuel - main system 1                                                                   |         |         |         |         |         |         |         |         |         |         |         | 1567.6836 | (211)  |
| Space heating fuel - main system 2                                                                   |         |         |         |         |         |         |         |         |         |         |         | 0.0000    | (213)  |
| Space heating fuel - secondary                                                                       |         |         |         |         |         |         |         |         |         |         |         | 0.0000    | (215)  |
| Efficiency of water heater                                                                           |         |         |         |         |         |         |         |         |         |         |         | 313.4050  |        |
| Water heating fuel used                                                                              |         |         |         |         |         |         |         |         |         |         |         | 831.0641  | (219)  |
| Space cooling fuel                                                                                   |         |         |         |         |         |         |         |         |         |         |         | 0.0000    | (221)  |
| Electricity for pumps and fans:                                                                      |         |         |         |         |         |         |         |         |         |         |         |           |        |
| (MEV)Centralised, Database: in-use factor = 1.3000, SFP = 0.6630)                                    |         |         |         |         |         |         |         |         |         |         |         |           |        |
| mechanical ventilation fans (SFP = 0.6630)                                                           |         |         |         |         |         |         |         |         |         |         |         | 177.4970  | (230a) |
| Total electricity for the above, kWh/year                                                            |         |         |         |         |         |         |         |         |         |         |         | 177.4970  | (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |         |         |         |         |         |         |         |         |         |         |         | 224.6087  | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |         |         |         |         |         |         |         |         |         |         |         |           |        |
| PV generation                                                                                        |         |         |         |         |         |         |         |         |         |         |         | 0.0000    | (233)  |
| Wind generation                                                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000    | (234)  |
| Hydro-electric generation (Appendix N)                                                               |         |         |         |         |         |         |         |         |         |         |         | 0.0000    | (235a) |
| Electricity generated - Micro CHP (Appendix N)                                                       |         |         |         |         |         |         |         |         |         |         |         | 0.0000    | (235)  |
| Appendix Q - special features                                                                        |         |         |         |         |         |         |         |         |         |         |         |           |        |
| Energy saved or generated                                                                            |         |         |         |         |         |         |         |         |         |         |         | -0.0000   | (236)  |
| Energy used                                                                                          |         |         |         |         |         |         |         |         |         |         |         | 0.0000    | (237)  |
| Total delivered energy for all uses                                                                  |         |         |         |         |         |         |         |         |         |         |         | 2800.8535 | (238)  |

## 10a. Fuel costs - using BEDF prices (585)

|                                             | Fuel<br>kWh/year | Fuel price<br>p/kWh | Fuel cost<br>£/year |        |
|---------------------------------------------|------------------|---------------------|---------------------|--------|
| Space heating - main system 1               | 1567.6836        | 28.4300             | 445.6925            | (240)  |
| Space heating - main system 2               | 0.0000           | 28.4300             | 0.0000              | (241)  |
| Total CO2 associated with community systems |                  |                     | 0.0000              | (473)  |
| Water heating (other fuel)                  | 831.0641         | 28.4300             | 236.2715            | (247)  |
| Energy for instantaneous electric shower(s) | 0.0000           | 28.4300             | 0.0000              | (247a) |
| Pumps, fans and electric keep-hot           | 177.4970         | 28.4300             | 50.4624             | (249)  |
| Energy for lighting                         | 224.6087         | 28.4300             | 63.8563             | (250)  |
| Additional standing charges                 |                  |                     | 0.0000              | (251)  |
| Total energy cost                           |                  |                     | 796.2826            | (255)  |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |       |
|---------------------------------------------|--------------------|-------------------------------|--------------------------|-------|
| Space heating - main system 1               | 1567.6836          | 0.1558                        | 244.2350                 | (261) |
| Space heating - main system 2               | 0.0000             | 0.0000                        | 0.0000                   | (262) |
| Total CO2 associated with community systems |                    |                               | 0.0000                   | (373) |
| Water heating (other fuel)                  | 831.0641           | 0.1413                        | 117.4242                 | (264) |
| Space and water heating                     |                    |                               | 361.6592                 | (265) |
| Pumps, fans and electric keep-hot           | 177.4970           | 0.1387                        | 24.6210                  | (267) |
| Energy for lighting                         | 224.6087           | 0.1443                        | 32.4180                  | (268) |
| Total CO2, kg/year                          |                    |                               | 418.6982                 | (272) |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |       |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|-------|
| Space heating - main system 1               | 1567.6836          | 1.5768                              | 2471.8745                  | (275) |
| Space heating - main system 2               | 0.0000             | 0.0000                              | 0.0000                     | (276) |
| Total CO2 associated with community systems |                    |                                     | 0.0000                     | (473) |
| Water heating (other fuel)                  | 831.0641           | 1.5225                              | 1265.2724                  | (278) |
| Space and water heating                     |                    |                                     | 3737.1469                  | (279) |
| Pumps, fans and electric keep-hot           | 177.4970           | 1.5128                              | 268.5175                   | (281) |
| Energy for lighting                         | 224.6087           | 1.5338                              | 344.5124                   | (282) |
| Total Primary energy kWh/year               |                    |                                     | 4350.1768                  | (286) |

# Predicted Energy Assessment



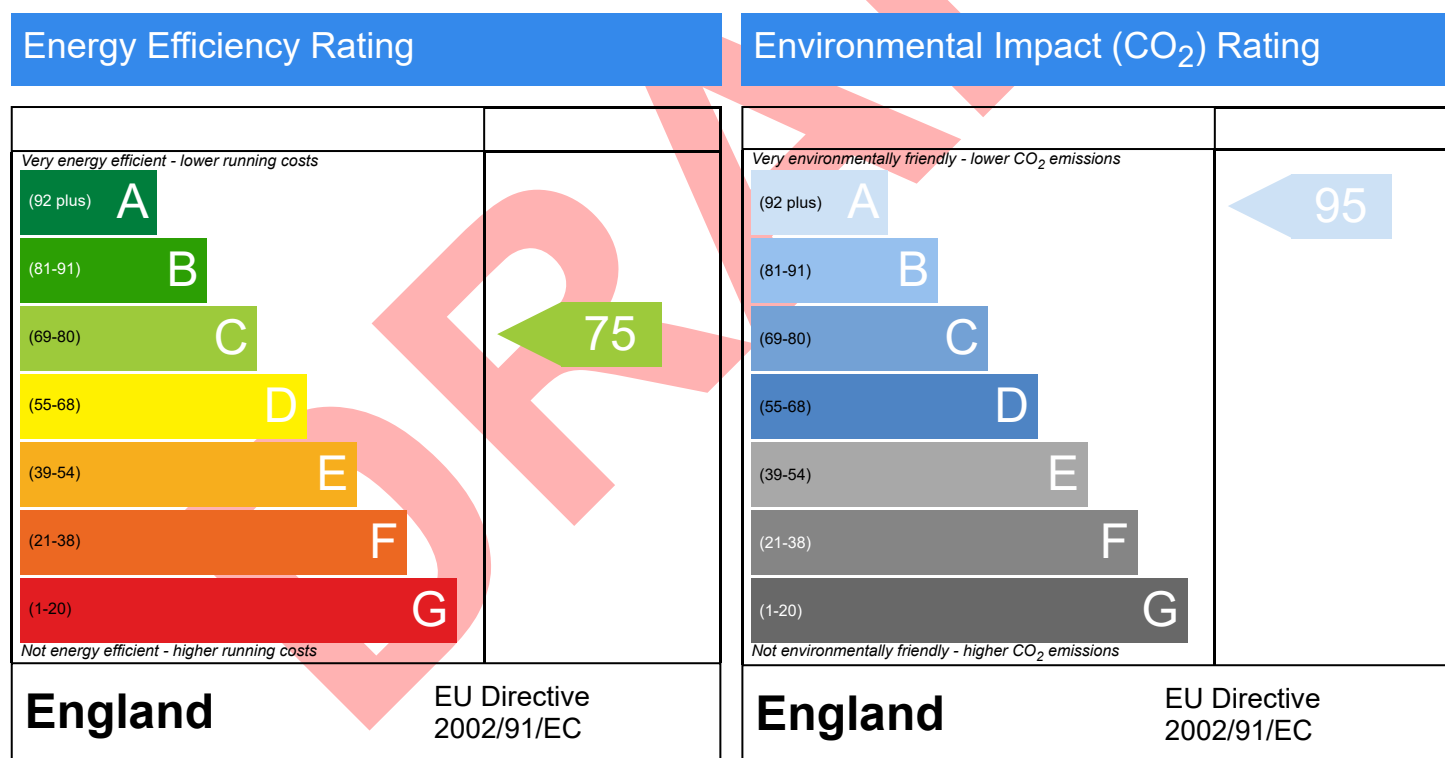
Flat 4, 85, Pell Street, Reading, RG1 2NP

Dwelling type:  
Date of assessment:  
SAP Version:  
Produced by:  
Total floor area:  
DRRN:

Flat, End-Terrace  
28/11/2025  
10.2  
Peter Yearsley  
74.4 m<sup>2</sup>

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO<sub>2</sub>) emissions.



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO<sub>2</sub>) emissions. The higher the rating the less impact it has on the environment.

# Summary for Input Data



|                      |                                           |               |                |            |
|----------------------|-------------------------------------------|---------------|----------------|------------|
| Plot Reference       | Flat 4, 85 Pell Street                    |               | Issued on Date | 28/11/2025 |
| Assessment Reference | Electric Panel Heaters HC                 | Plot Type Ref |                |            |
| Plot Address         | Flat 4, 85, Pell Street, Reading, RG1 2NP |               | SAP Version    | 10.2       |

|                                    |          |               |       |      |       |
|------------------------------------|----------|---------------|-------|------|-------|
| SAP Rating                         | 75 C     | DER           | 6.34  | TER  | 13.17 |
| Environmental                      | 95 A     | % DER < TER   |       |      | 51.86 |
| CO <sub>2</sub> Emissions (t/year) | 0.42     | DFEE          | 35.56 | TFEE | 38.00 |
| Compliance Check                   | See BREL | % DFEE < TFEE |       |      | 6.44  |
| % DPER < TPER                      | 5.33     | DPER          | 65.74 | TPER | 69.44 |

|                  |                    |             |           |
|------------------|--------------------|-------------|-----------|
| Assessor Details | Mr. Peter Yearsley | Assessor ID | R301-0001 |
| Client           |                    |             |           |

## SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

|                                |                     |
|--------------------------------|---------------------|
| Orientation                    | South               |
| Property Tenture               | ND                  |
| Transaction Type               | 6                   |
| Terrain Type                   | Suburban            |
| 1.0 Property Type              | Flat, End-Terrace   |
| Position of Flat               | Mid-floor flat      |
| Which Floor                    | 1                   |
| 2.0 Number of Storeys          | 2                   |
| 3.0 Date Built                 | 2025                |
| 4.0 Sheltered Sides            | 1                   |
| 5.0 Sunlight/Shade             | Average or unknown  |
| 6.0 Thermal Mass Parameter     | Precise calculation |
| Thermal Mass                   | 86.02               |
|                                |                     |
| 7.0 Electricity Tariff         | Standard            |
| Smart electricity meter fitted | No                  |
| Smart gas meter fitted         | No                  |

| 7.0 Measurements | Ground floor: | Heat Loss Perimeter | Internal Floor Area  | Average Storey Height |
|------------------|---------------|---------------------|----------------------|-----------------------|
|                  | 1st Storey:   | 17.30 m             | 45.30 m <sup>2</sup> | 2.75 m                |
|                  |               | 22.20 m             | 29.10 m <sup>2</sup> | 3.26 m                |

|                 |       |                |
|-----------------|-------|----------------|
| 8.0 Living Area | 24.90 | m <sup>2</sup> |
|-----------------|-------|----------------|

| 9.0 External Walls | Description   | Type         | Construction                                   | U-Value (W/m <sup>2</sup> K) | Kappa (kJ/m <sup>2</sup> K) | Gross Area(m <sup>2</sup> ) | Nett Area (m <sup>2</sup> ) | Shelter Res | Shelter | Openings | Area Calculation Type |
|--------------------|---------------|--------------|------------------------------------------------|------------------------------|-----------------------------|-----------------------------|-----------------------------|-------------|---------|----------|-----------------------|
|                    | External Wall | Timber Frame | Timber framed wall (one layer of plasterboard) | 0.15                         | 9.00                        | 62.38                       | 53.46                       | 0.00        | None    | 8.92     | Enter Gross Area      |
|                    | RIR Stud Wall | Timber Frame | Timber framed wall (one layer of plasterboard) | 0.15                         | 9.00                        | 25.38                       | 25.38                       | 0.00        | None    | 0.00     | Enter Gross Area      |
|                    | Dormer Walls  | Timber Frame | Timber framed wall (one layer of plasterboard) | 0.15                         | 9.00                        | 6.60                        | 5.60                        | 0.00        | None    | 1.00     | Enter Gross Area      |

| 9.1 Party Walls | Description  | Type                            | Construction | U-Value (W/m <sup>2</sup> K) | Kappa (kJ/m <sup>2</sup> K) | Area (m <sup>2</sup> ) | Shelter Res | Shelter |
|-----------------|--------------|---------------------------------|--------------|------------------------------|-----------------------------|------------------------|-------------|---------|
|                 | Party Wall 1 | Filled Cavity with Edge Sealing | Other        | 0.00                         | 45.00                       | 44.23                  |             | None    |

| 9.2 Internal Walls | Description     | Construction                 | Kappa (kJ/m <sup>2</sup> K) | Area (m <sup>2</sup> ) |
|--------------------|-----------------|------------------------------|-----------------------------|------------------------|
|                    | Internal Wall 1 | Plasterboard on timber frame | 9.00                        | 113.15                 |

| 10.0 External Roofs | Description             | Type                | Construction                             | U-Value (W/m <sup>2</sup> K) | Kappa (kJ/m <sup>2</sup> K) | Gross Area(m <sup>2</sup> ) | Nett Area (m <sup>2</sup> ) | Shelter Code | Shelter Factor | Calculation Type | Openings |
|---------------------|-------------------------|---------------------|------------------------------------------|------------------------------|-----------------------------|-----------------------------|-----------------------------|--------------|----------------|------------------|----------|
|                     | Adj To RIR Ins At Slope | External Plane Roof | Plasterboard, insulated at ceiling level | 0.14                         | 9.00                        | 16.05                       | 16.05                       | None         | 0.00           | Enter Gross Area | 0.00     |
|                     | Slope Roof              | External Slope Roof | Plasterboard, insulated slope            | 0.14                         | 9.00                        | 37.99                       | 37.99                       | None         | 0.00           | Enter Gross Area | 0.00     |

## 10.2 Internal Ceilings

# Summary for Input Data

|                                          |                                  |                                                                       |                      |                           |
|------------------------------------------|----------------------------------|-----------------------------------------------------------------------|----------------------|---------------------------|
| <b>Description</b><br>Internal Ceiling 1 | <b>Storey</b><br>Lowest occupied | <b>Construction</b><br>Plasterboard ceiling, carpeted chipboard floor | <b>Kappa</b><br>9.00 | <b>Area (m²)</b><br>29.10 |
|------------------------------------------|----------------------------------|-----------------------------------------------------------------------|----------------------|---------------------------|

|                          |                     |                     |                       |                  |
|--------------------------|---------------------|---------------------|-----------------------|------------------|
| <b>11.1 Party Floors</b> |                     |                     |                       |                  |
| <b>Description</b>       | <b>Storey Index</b> | <b>Construction</b> | <b>Kappa (kJ/m²K)</b> | <b>Area (m²)</b> |
| Party Floor 1            | +1                  | Other               | 30.00                 | 45.30            |

|                             |                     |                                                |                       |                  |
|-----------------------------|---------------------|------------------------------------------------|-----------------------|------------------|
| <b>11.2 Internal Floors</b> |                     |                                                |                       |                  |
| <b>Description</b>          | <b>Storey Index</b> | <b>Construction</b>                            | <b>Kappa (kJ/m²K)</b> | <b>Area (m²)</b> |
| Internal Floor 1            | +1                  | Plasterboard ceiling, carpeted chipboard floor | 18.00                 | 29.10            |

|                           |                           |             |                |                    |                     |                |                   |                     |                        |
|---------------------------|---------------------------|-------------|----------------|--------------------|---------------------|----------------|-------------------|---------------------|------------------------|
| <b>12.0 Opening Types</b> |                           |             |                |                    |                     |                |                   |                     |                        |
| <b>Description</b>        | <b>Data Source</b>        | <b>Type</b> | <b>Glazing</b> | <b>Glazing Gap</b> | <b>Filling Type</b> | <b>G-value</b> | <b>Frame Type</b> | <b>Frame Factor</b> | <b>U Value (W/m²K)</b> |
| Solid Door                | Manufacturer              | Solid Door  |                |                    |                     | 0.00           |                   |                     | 1.20                   |
| Windows / Glazed Doors    | BFRC, BSI or CERTASS data | Window      | Double glazed  |                    |                     | 0.76           |                   |                     | 1.20                   |

|                      |                        |                 |                    |                  |              |
|----------------------|------------------------|-----------------|--------------------|------------------|--------------|
| <b>13.0 Openings</b> |                        |                 |                    |                  |              |
| <b>Name</b>          | <b>Opening Type</b>    | <b>Location</b> | <b>Orientation</b> | <b>Area (m²)</b> | <b>Pitch</b> |
| Opening2             | Windows / Glazed Doors | External Wall   | East               | 4.96             |              |
| Opening3             | Windows / Glazed Doors | External Wall   | West               | 3.96             |              |
| Opening4             | Windows / Glazed Doors | Dormer Walls    | West               | 1.00             |              |

|                              |                                                |
|------------------------------|------------------------------------------------|
| <b>14.0 Conservatory</b>     | <input type="text" value="None"/>              |
| <b>15.0 Draught Proofing</b> | <input type="text" value="100"/> %             |
| <b>16.0 Draught Lobby</b>    | <input type="text" value="Yes"/>               |
| <b>17.0 Thermal Bridging</b> | <input type="text" value="Calculate Bridges"/> |

|                                                                           |                        |               |            |                 |                      |                 |
|---------------------------------------------------------------------------|------------------------|---------------|------------|-----------------|----------------------|-----------------|
| <b>17.1 List of Bridges</b>                                               |                        |               |            |                 |                      |                 |
| <b>Bridge Type</b>                                                        | <b>Source Type</b>     | <b>Length</b> | <b>Psi</b> | <b>Adjusted</b> | <b>Reference:</b>    | <b>Imported</b> |
| E2 Other lintels (including other steel lintels)                          | Independently assessed | 7.97          | 0.08       | 0.08            | R.O.I. Psi Value     | No              |
| E3 Sill                                                                   | Independently assessed | 7.06          | 0.03       | 0.03            | R.O.I. Psi Value     | No              |
| E4 Jamb                                                                   | Independently assessed | 26.60         | 0.04       | 0.04            | R.O.I. Psi Value     | No              |
| E16 Corner (normal)                                                       | Independently assessed | 17.50         | 0.03       | 0.03            | R.O.I. Psi Value     | No              |
| E18 Party wall between dwellings                                          | Independently assessed | 9.50          | 0.04       | 0.04            | R.O.I. Psi Value     | No              |
| E7 Party floor between dwellings (in blocks of flats)                     | Independently assessed | 17.30         | 0.07       | 0.07            | R.O.I. Psi Value     | No              |
| E11 Eaves (insulation at rafter level)                                    | Independently assessed | 9.60          | 0.01       | 0.01            | R.O.I. Psi Value     | No              |
| E17 Corner (inverted – internal area greater than external area)          | Independently assessed | 8.00          | 0.01       | 0.01            | R.O.I. Psi Value     | No              |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | Table K1 - Default     | 13.60         | 0.00       | 0.00            |                      | No              |
| E13 Gable (insulation at rafter level)                                    | Independently assessed | 16.10         | 0.02       | 0.02            | R.O.I. Psi Value     | No              |
| E6 Intermediate floor within a dwelling                                   | Independently assessed | 22.20         | 0.08       | 0.08            | R.O.I. Psi Value     | No              |
| P5 Party wall - Roof (insulation at rafter level)                         | Independently assessed | 6.40          | 0.24       | 0.24            | Default Value Halved | No              |
| P2 Party wall - Intermediate floor within a dwelling                      | Table K1 - Default     | 4.00          | 0.00       | 0.00            |                      | No              |
| R4 Ridge (vaulted ceiling)                                                | Table K1 - Default     | 11.10         | 0.12       | 0.12            |                      | No              |

|                |                                         |
|----------------|-----------------------------------------|
| <b>Y-value</b> | <input type="text" value="0.06"/> W/m²K |
|----------------|-----------------------------------------|

|                                       |                                                                           |
|---------------------------------------|---------------------------------------------------------------------------|
| <b>19.0 Mechanical Ventilation</b>    |                                                                           |
| <b>Mechanical Ventilation</b>         |                                                                           |
| Mechanical Ventilation System Present | <input type="text" value="Yes"/>                                          |
| Approved Installation                 | <input type="text" value="Yes"/>                                          |
| Mechanical Ventilation data Type      | <input type="text" value="Database"/>                                     |
| Type                                  | <input type="text" value="Mechanical extract ventilation - centralised"/> |
| MV Reference Number                   | <input type="text" value="500735"/>                                       |
| Configuration                         | <input type="text" value="1"/>                                            |
| Manufacturer SFP                      | <input type="text" value="0.51"/>                                         |
| Duct Type                             | <input type="text" value="Rigid"/>                                        |
| Wet Rooms                             | <input type="text" value="1"/>                                            |

|                                                  |                                |
|--------------------------------------------------|--------------------------------|
| <b>20.0 Fans, Open Fireplaces, Flues</b>         |                                |
| Number of open chimneys                          | <input type="text" value="0"/> |
| Number of open flues                             | <input type="text" value="0"/> |
| Number of chimneys/flues attached to closed fire | <input type="text" value="0"/> |
| Number of flues attached to solid fuel boiler    | <input type="text" value="0"/> |
| Number of flues attached to other heater         | <input type="text" value="0"/> |
| Number of blocked chimneys                       | <input type="text" value="0"/> |

# Summary for Input Data

|                                     |                                |
|-------------------------------------|--------------------------------|
| Number of intermittent extract fans | <input type="text" value="0"/> |
| Number of passive vents             | <input type="text" value="0"/> |
| Number of flueless gas fires        | <input type="text" value="0"/> |

|                                  |                                 |
|----------------------------------|---------------------------------|
| <b>21.0 Fixed Cooling System</b> | <input type="text" value="No"/> |
|----------------------------------|---------------------------------|

|                              |                                          |                                             |
|------------------------------|------------------------------------------|---------------------------------------------|
| <b>22.0 Pressure Testing</b> | <input type="text" value="Yes"/>         |                                             |
| Designed AP <sub>50</sub>    | <input type="text" value="4.00"/>        | m <sup>3</sup> /(h.m <sup>2</sup> ) @ 50 Pa |
| Test Method                  | <input type="text" value="Blower Door"/> |                                             |

|                      |                                 |                 |              |                 |              |
|----------------------|---------------------------------|-----------------|--------------|-----------------|--------------|
| <b>22.0 Lighting</b> | <input type="text" value="No"/> |                 |              |                 |              |
| No Fixed Lighting    | <input type="text" value="No"/> |                 |              |                 |              |
|                      | <b>Name</b>                     | <b>Efficacy</b> | <b>Power</b> | <b>Capacity</b> | <b>Count</b> |
|                      | Lighting 1                      | 90.00           | 5.00         | 450.00          | 9            |

|                            |                                                                   |   |
|----------------------------|-------------------------------------------------------------------|---|
| <b>24.0 Main Heating 1</b> | <input type="text" value="SAP table"/>                            |   |
| Percentage of Heat         | <input type="text" value="100.00"/>                               | % |
| Fuel Type                  | <input type="text" value="Electricity"/>                          |   |
| SAP Code                   | <input type="text" value="691"/>                                  |   |
| In Winter                  | <input type="text" value="100.00"/>                               |   |
| In Summer                  | <input type="text" value="313.40"/>                               |   |
| Controls SAP Code          | <input type="text" value="2603"/>                                 |   |
| Controls description       | <input type="text" value="Programmer and appliance thermostats"/> |   |

|                            |                                                                         |   |
|----------------------------|-------------------------------------------------------------------------|---|
| <b>25.0 Main Heating 2</b> | <input type="text" value="Database"/>                                   |   |
| Percentage of Heat         | <input type="text" value="0.00"/>                                       | % |
| Database Ref. No.          | <input type="text" value="105943"/>                                     |   |
| Fuel Type                  | <input type="text" value="Electricity"/>                                |   |
| In Winter                  | <input type="text" value="0.00"/>                                       |   |
| In Summer                  | <input type="text" value="313.40"/>                                     |   |
| Model Name                 | <input type="text" value="KERS MEV-W200SL"/>                            |   |
| Manufacturer               | <input type="text" value="KERS Innovations UK Ltd"/>                    |   |
| Controls                   | <input type="text" value="2100"/>                                       |   |
| Controls description       | <input type="text" value="Not applicable (heating provides DHW only)"/> |   |

|                           |                                   |
|---------------------------|-----------------------------------|
| <b>26.0 Heat Networks</b> | <input type="text" value="None"/> |
|---------------------------|-----------------------------------|

|                               |                                   |
|-------------------------------|-----------------------------------|
| <b>27.0 Secondary Heating</b> | <input type="text" value="None"/> |
|-------------------------------|-----------------------------------|

|                                                  |                                             |
|--------------------------------------------------|---------------------------------------------|
| <b>28.0 Water Heating</b>                        | <input type="text" value="Main Heating 2"/> |
| Water Heating                                    | <input type="text" value="Main Heating 2"/> |
| SAP Code                                         | <input type="text" value="914"/>            |
| Flue Gas Heat Recovery System                    | <input type="text" value="No"/>             |
| Waste Water Heat Recovery Instantaneous System 1 | <input type="text" value="No"/>             |
| Waste Water Heat Recovery Instantaneous System 2 | <input type="text" value="No"/>             |
| Waste Water Heat Recovery Storage System         | <input type="text" value="No"/>             |
| Solar Panel                                      | <input type="text" value="No"/>             |
| Water use <= 125 litres/person/day               | <input type="text" value="Yes"/>            |
| Cold Water Source                                | <input type="text" value="From mains"/>     |
| Bath Count                                       | <input type="text" value="1"/>              |
| Immersion Only Heating Hot Water                 | <input type="text" value="No"/>             |

|                     |                                           |                  |                    |                  |                     |
|---------------------|-------------------------------------------|------------------|--------------------|------------------|---------------------|
| <b>28.1 Showers</b> |                                           |                  |                    |                  |                     |
| <b>Description</b>  | <b>Shower Type</b>                        | <b>Flow Rate</b> | <b>Rated Power</b> | <b>Connected</b> | <b>Connected To</b> |
| Shower              | Combi boiler or unvented hot water system | 11.00            | [kW]               | No               |                     |

## 28.3 Waste Water Heat Recovery System

# Summary for Input Data

## 29.0 Hot Water Cylinder

|                 |               |
|-----------------|---------------|
| Internal Store  |               |
| Insulation Type | Measured Loss |
| Cylinder Volume | 196.00 L      |
| Loss            | 1.31 kWh/day  |

## 34.0 Small-scale Hydro

None

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

## Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

|                     | Typical Cost | Typical savings per year | Ratings after improvement |                      |
|---------------------|--------------|--------------------------|---------------------------|----------------------|
|                     |              |                          | SAP rating                | Environmental Impact |
| Solar water heating |              |                          | 0                         | 0                    |
| Photovoltaic        |              |                          | 0                         | 0                    |
| Wind turbine        |              |                          | 0                         | 0                    |

# Thermal Bridging

|                      |                                           |               |                  |            |
|----------------------|-------------------------------------------|---------------|------------------|------------|
| Plot Reference       | Flat 4, 85 Pell Street                    |               | Issued on Date   | 28/11/2025 |
| Assessment Reference | Electric Panel Heaters HC                 | Plot Type Ref | End-Terrace Flat |            |
| Plot Address         | Flat 4, 85, Pell Street, Reading, RG1 2NP |               | SAP Version      | 10.2       |

|                                    |          |               |       |      |       |
|------------------------------------|----------|---------------|-------|------|-------|
| SAP Rating                         | 75 C     | DER           | 6.34  | TER  | 13.17 |
| Environmental                      | 95 A     | % DER < TER   |       |      | 51.86 |
| CO <sub>2</sub> Emissions (t/year) | 0.42     | DFEE          | 35.56 | TFEE | 38.00 |
| Compliance Check                   | See BREL | % DFEE < TFEE |       |      | 6.44  |
| % DPER < TPER                      | 5.33     | DPER          | 65.74 | TPER | 69.44 |

|                  |                    |             |           |
|------------------|--------------------|-------------|-----------|
| Assessor Details | Mr. Peter Yearsley | Assessor ID | R301-0001 |
| Client           |                    |             |           |

|               | Junction details                                                          | Source Type            | Psi (W/mK) | Length (m) | Result | Reference            |
|---------------|---------------------------------------------------------------------------|------------------------|------------|------------|--------|----------------------|
| External wall | E2 Other lintels (including other steel lintels)                          | Independently assessed | 0.084      | 7.97       | 0.67   | R.O.I. Psi Value     |
| External wall | E3 Sill                                                                   | Independently assessed | 0.034      | 7.06       | 0.24   | R.O.I. Psi Value     |
| External wall | E4 Jamb                                                                   | Independently assessed | 0.043      | 26.60      | 1.14   | R.O.I. Psi Value     |
| External wall | E16 Corner (normal)                                                       | Independently assessed | 0.030      | 17.50      | 0.53   | R.O.I. Psi Value     |
| External wall | E18 Party wall between dwellings                                          | Independently assessed | 0.040      | 9.50       | 0.38   | R.O.I. Psi Value     |
| External wall | E7 Party floor between dwellings (in blocks of flats)                     | Independently assessed | 0.066      | 17.30      | 1.14   | R.O.I. Psi Value     |
| External wall | E11 Eaves (insulation at rafter level)                                    | Independently assessed | 0.013      | 9.60       | 0.12   | R.O.I. Psi Value     |
| External wall | E17 Corner (inverted – internal area greater than external area)          | Independently assessed | 0.015      | 8.00       | 0.12   | R.O.I. Psi Value     |
| Party wall    | P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | Table K1 - Default     | 0.000      | 13.60      | 0.00   |                      |
| External wall | E13 Gable (insulation at rafter level)                                    | Independently assessed | 0.024      | 16.10      | 0.39   | R.O.I. Psi Value     |
| External wall | E6 Intermediate floor within a dwelling                                   | Independently assessed | 0.080      | 22.20      | 1.78   | R.O.I. Psi Value     |
| Party wall    | P5 Party wall - Roof (insulation at rafter level)                         | Independently assessed | 0.240      | 6.40       | 1.54   | Default Value Halved |
| Party wall    | P2 Party wall - Intermediate floor within a dwelling                      | Table K1 - Default     | 0.000      | 4.00       | 0.00   |                      |
| External roof | R4 Ridge (vaulted ceiling)                                                | Table K1 - Default     | 0.120      | 11.10      | 1.33   |                      |

Total: 176.93 W/mK:  
Y-Value: 0.06 W/m²K:

# Energy Report



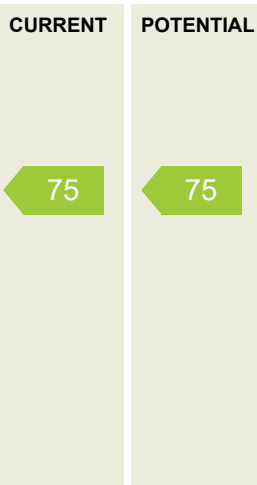
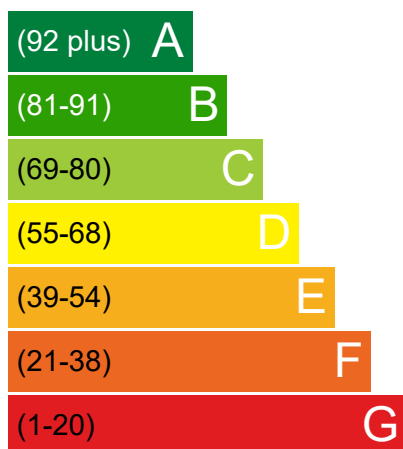
|                  |                                                  |
|------------------|--------------------------------------------------|
| Dwelling Address | Flat 4, 85, Pell Street, Reading, RG1 2NP        |
| Reference        | Flat 4, 85 Pell Street-Electric Panel Heaters HC |
| SAP Version      | 10.2                                             |
| Assessment Date  | 28/11/2025                                       |
| Submission Date  |                                                  |
| Property Type    | Flat, End-Terrace                                |
| Total Floor Area | 74                                               |

This Energy Report has been generated using the UK's National Calculation Methodology for dwellings, Standard Assessment Procedure (SAP). This methodology is used to assess the energy efficiency of dwellings which is calculated based on a dwelling's heating, hot water, ventilation and lighting usage.

This document is not an Energy Performance Certificate (EPC) as required by the Energy Performance of Buildings Regulations

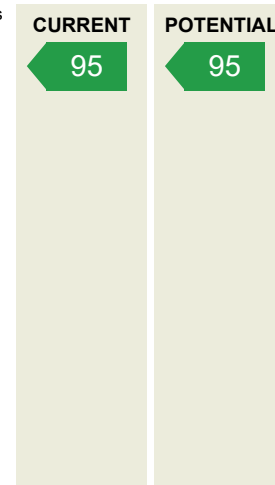
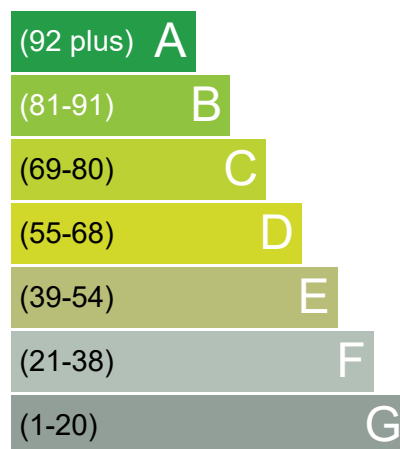
## Energy Efficiency Rating

Most energy efficient - lower running costs



## Carbon Dioxide (CO2) Emissions Rating

Very environmentally friendly - lower CO2 emissions



## Additional ratings for your home

|           | Primary Energy | Energy      | Carbon    | Cost        | HTC       |
|-----------|----------------|-------------|-----------|-------------|-----------|
| CURRENT   | 58.47<br>kWh   | 2801<br>kWh | 419<br>kg | 796.28<br>£ | 77<br>W/K |
| POTENTIAL | 58.47<br>kWh   | 2801<br>kWh | 419<br>kg | 796.28<br>£ | 77<br>W/K |

## Breakdown of property's energy performance

Each feature is assessed as one of the following:

|           |      |         |      |           |
|-----------|------|---------|------|-----------|
| Very Poor | Poor | Average | Good | Very Good |
|-----------|------|---------|------|-----------|

| Feature               | Description                                                              | Energy Performance |
|-----------------------|--------------------------------------------------------------------------|--------------------|
| Walls                 | Average thermal transmittance 0.15 W/m <sup>2</sup> K                    | Very Good          |
| Roof                  | Average thermal transmittance 0.14 W/m <sup>2</sup> K                    | Very Good          |
| Windows               | High performance glazing                                                 | Very Good          |
| Main heating          | Room heaters, electric                                                   | Very Poor          |
| Main heating controls | Programmer and appliance thermostats                                     | Good               |
| Secondary heating     | None                                                                     |                    |
| Hot water             | From main system                                                         | Very Good          |
| Lighting              | Good lighting efficiency                                                 | Good               |
| Air tightness         | Air permeability [AP50] = 4.0 m <sup>3</sup> /h.m <sup>2</sup> (assumed) | Good               |

## Recommendations

The recommended measures provided below will help to improve the energy efficiency of the dwelling. To reach the dwelling's potential energy rating all of the recommended measures shown below would need to be installed. Having these measures installed individually or in any other order may give a different result when compared with the cumulative potential rating.

| Recommended measures | Cumulative savings (per year) | Cumulative rating | Typical costs | Incremental savings (per year) | Cumulative CO2 rating |
|----------------------|-------------------------------|-------------------|---------------|--------------------------------|-----------------------|
|----------------------|-------------------------------|-------------------|---------------|--------------------------------|-----------------------|

The typical cost is based on average installation prices across the country so may not be representative of the actual costs in your area.

## Estimated energy costs of the dwelling

# Energy Report

The table below shows the estimated running costs of the space and water heating and lighting within the dwelling. It does not include the energy used from household appliances. The estimated annual costs after potential improvements indicates the total energy cost if all recommended measures named above were installed.

|                                    |                                                                                   | Estimated annual costs | Estimated annual costs after potential improvements | Potential future savings                                                            |
|------------------------------------|-----------------------------------------------------------------------------------|------------------------|-----------------------------------------------------|-------------------------------------------------------------------------------------|
| Lighting                           |  | £64                    | £64                                                 |  |
| Heating                            |  | £496                   | £496                                                |                                                                                     |
| Hot Water                          |  | £236                   | £236                                                |                                                                                     |
| New Technologies e.g. Impact of PV |                                                                                   | £0                     | £0                                                  |                                                                                     |
| TOTAL                              |                                                                                   | £796                   | £796                                                |                                                                                     |

## Estimated energy use and potential savings



Space Heating

**1568**

kWh per year



Water Heating

**831**

kWh per year

## About this document

Created by:

Company/Trading name:

Phone number:

Email address:

### Disclaimer

This Energy Report should not under any circumstances be treated as a Condition Survey and cannot be used to indicate that any element of the dwelling (e.g. heating system) is working correctly.

This Energy Report must not be used in situations where an Energy Performance Certificate (EPC) is required.

This Energy Report is generated from a set of data inputs which may not reflect the actual dimensions, services or construction of the dwelling.

The calculation used to generate this report reflects the SAP Methodology current at the time of report generation.

## Glossary terms for additional metrics

|                           |                                                                                                                                                                                                                                                                       |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Primary Energy            | The measure of the energy required for lighting, heating and hot water in a property. This includes the efficiency of the property's heating system, power station efficiency for electricity and the energy used to produce the fuel and deliver it to the property. |
| Energy Used               | The estimated amount of fuel energy for lighting, heating and hot water for the property. The estimate is based on typical usage which is likely to be different to actual consumption.                                                                               |
| Carbon (CO <sub>2</sub> ) | The current emissions based on the energy estimates.                                                                                                                                                                                                                  |
| Cost                      | The estimated cost of energy. The cost of each unit of fuel is based on an industry standard which is likely to be different to those the occupier actually pays.                                                                                                     |
| Heat Transfer Coefficient | Heat flow through the property envelope where internal and external temperatures are different.                                                                                                                                                                       |

# Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Fri 28 Nov 2025 14:04:07

| Project Information |                |                 |                    |
|---------------------|----------------|-----------------|--------------------|
| Assessed By         | Peter Yearsley | Building Type   | House, End-terrace |
| OCDEA Registration  | EES/017088     | Assessment Date | 2025-11-28         |

| Dwelling Details |                                        |                  |                        |
|------------------|----------------------------------------|------------------|------------------------|
| Assessment Type  | As designed                            | Total Floor Area | 70 m <sup>2</sup>      |
| Site Reference   | House, 85 Pell Street                  | Plot Reference   | Electric Panel Heaters |
| Address          | 85 House Pell Street, Reading, RG1 2NP |                  |                        |

| Client Details |       |
|----------------|-------|
| Name           | Array |
| Company        | Array |
| Address        |       |

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

| 1a Target emission rate and dwelling emission rate                       |                                         |  |      |
|--------------------------------------------------------------------------|-----------------------------------------|--|------|
| Fuel for main heating system                                             | Electricity                             |  |      |
| Target carbon dioxide emission rate                                      | 13.83 kgCO <sub>2</sub> /m <sup>2</sup> |  |      |
| Dwelling carbon dioxide emission rate                                    | 7.95 kgCO <sub>2</sub> /m <sup>2</sup>  |  | OK   |
| 1b Target primary energy rate and dwelling primary energy                |                                         |  |      |
| Target primary energy                                                    | 72.6 kWh <sub>PE</sub> /m <sup>2</sup>  |  |      |
| Dwelling primary energy                                                  | 82.12 kWh <sub>PE</sub> /m <sup>2</sup> |  | FAIL |
| 1c Target fabric energy efficiency and dwelling fabric energy efficiency |                                         |  |      |
| Target fabric energy efficiency                                          | 46.9 kWh/m <sup>2</sup>                 |  |      |
| Dwelling fabric energy efficiency                                        | 46.0 kWh/m <sup>2</sup>                 |  | OK   |

| 2a Fabric U-values               |                                                        |                                               |                                         |     |
|----------------------------------|--------------------------------------------------------|-----------------------------------------------|-----------------------------------------|-----|
| Element                          | Maximum permitted average U-Value [W/m <sup>2</sup> K] | Dwelling average U-Value [W/m <sup>2</sup> K] | Element with highest individual U-Value |     |
| External walls                   | 0.26                                                   | 0.15                                          | Walls (1) (0.15)                        | OK  |
| Party walls                      | 0.2                                                    | 0                                             | Party Wall (1) (0)                      | N/A |
| Curtain walls                    | 1.6                                                    | 0                                             | N/A                                     | N/A |
| Floors                           | 0.18                                                   | 0.12                                          | Heatloss Floor 1 (0.12)                 | OK  |
| Roofs                            | 0.16                                                   | 0.14                                          | Roof (1) (0.14)                         | OK  |
| Windows, doors, and roof windows | 1.6                                                    | 1.2                                           | Opening1 (1.2)                          | OK  |
| Rooflights                       | 2.2                                                    | N/A                                           | N/A                                     | N/A |

| 2b Envelope elements (better than typically expected values are flagged with a subsequent (!)) |                            |                              |
|------------------------------------------------------------------------------------------------|----------------------------|------------------------------|
| Name                                                                                           | Net area [m <sup>2</sup> ] | U-Value [W/m <sup>2</sup> K] |
| Exposed wall: Walls (1)                                                                        | 51.4585                    | 0.15                         |
| Exposed wall: Walls (2)                                                                        | 41.5                       | 0.15                         |
| Exposed wall: Walls (3)                                                                        | 8                          | 0.15                         |
| Party wall: Party Wall (1)                                                                     | 20.75                      | 0 (!)                        |
| Ground floor: Heatloss Floor 1, Heatloss Floor 1                                               | 39.8                       | 0.12                         |
| Exposed roof: Roof (1)                                                                         | 5.1                        | 0.14                         |
| Exposed roof: Roof (2)                                                                         | 38.77                      | 0.14                         |

| 2c Openings (better than typically expected values are flagged with a subsequent (!)) |                        |             |              |                              |
|---------------------------------------------------------------------------------------|------------------------|-------------|--------------|------------------------------|
| Name                                                                                  | Area [m <sup>2</sup> ] | Orientation | Frame factor | U-Value [W/m <sup>2</sup> K] |
| Opening1, Solid Door                                                                  | 1.785                  | North       | N/A          | 1.2                          |
| Opening2, Windows / Glazed Doors                                                      | 1.3195                 | East        | 1.0          | 1.2                          |
| Opening2, Windows / Glazed Doors                                                      | 1.3195                 | East        | 1.0          | 1.2                          |
| Opening2, Windows / Glazed Doors                                                      | 1.3195                 | East        | 1.0          | 1.2                          |
| Opening2, Windows / Glazed Doors                                                      | 1.3195                 | East        | 1.0          | 1.2                          |
| Opening2, Windows / Glazed Doors                                                      | 0.96                   | East        | 1.0          | 1.2                          |
| Opening2, Windows / Glazed Doors                                                      | 0.96                   | East        | 1.0          | 1.2                          |
| Opening3, Windows / Glazed Doors                                                      | 1.3195                 | West        | 1.0          | 1.2                          |
| Opening3, Windows / Glazed Doors                                                      | 1.3195                 | West        | 1.0          | 1.2                          |
| Opening3, Windows / Glazed Doors                                                      | 1.3195                 | West        | 1.0          | 1.2                          |

| Name                             | Area [m <sup>2</sup> ] | Orientation | Frame factor | U-Value [W/m <sup>2</sup> K] |
|----------------------------------|------------------------|-------------|--------------|------------------------------|
| Opening3, Windows / Glazed Doors | 1                      | West        | 1.0          | 1.2                          |
| Opening3, Windows / Glazed Doors | 1                      | West        | 1.0          | 1.2                          |

## 2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part 1: Thermal bridging calculated from linear thermal transmittances for each junction

| Main element  | Junction detail                                                   | Source                                       | Psi value [W/mK] | Drawing / reference  |
|---------------|-------------------------------------------------------------------|----------------------------------------------|------------------|----------------------|
| External wall | E2: Other lintels (including other steel lintels)                 | Calculated by person with suitable expertise | 0.084            | R.O.I. Psi Value     |
| External wall | E3: Sill                                                          | Calculated by person with suitable expertise | 0.034 (!)        | R.O.I. Psi Value     |
| External wall | E4: Jamb                                                          | Calculated by person with suitable expertise | 0.043            | R.O.I. Psi Value     |
| External wall | E16: Corner (normal)                                              | Calculated by person with suitable expertise | 0.03 (!)         | R.O.I. Psi Value     |
| External wall | E18: Party wall between dwellings                                 | Calculated by person with suitable expertise | 0.04             | R.O.I. Psi Value     |
| External wall | E11: Eaves (insulation at rafter level)                           | Calculated by person with suitable expertise | 0.013 (!)        | R.O.I. Psi Value     |
| External wall | E17: Corner (inverted - internal area greater than external area) | Calculated by person with suitable expertise | 0.015 (!)        | R.O.I. Psi Value     |
| External wall | E13: Gable (insulation at rafter level)                           | Calculated by person with suitable expertise | 0.024 (!)        | R.O.I. Psi Value     |
| External wall | E6: Intermediate floor within a dwelling                          | Calculated by person with suitable expertise | 0.08             | R.O.I. Psi Value     |
| Party wall    | P5: Roof (insulation at rafter level)                             | Calculated by person with suitable expertise | 0.24             | Default Value Halved |
| Party wall    | P2: Intermediate floor within a dwelling                          | SAP table default                            | 0 (!)            |                      |
| Roof          | R4: Ridge (vaulted ceiling)                                       | SAP table default                            | 0.12             |                      |
| External wall | E5: Ground floor (normal)                                         | SAP table default                            | 0.32             |                      |
| External wall | E25: Staggered party wall between dwellings                       | Calculated by person with suitable expertise | 0.12             | Default Value Halved |

## 3 Air permeability (better than typically expected values are flagged with a subsequent (!))

|                                             |                                                      |    |
|---------------------------------------------|------------------------------------------------------|----|
| Maximum permitted air permeability at 50Pa  | 8 m <sup>3</sup> /hm <sup>2</sup>                    |    |
| Dwelling air permeability at 50Pa           | 3 m <sup>3</sup> /hm <sup>2</sup> , Design value (!) | OK |
| Air permeability test certificate reference |                                                      |    |

## 4 Space heating

### Main heating system 1: Room heaters - Electricity

|                  |                                     |
|------------------|-------------------------------------|
| Efficiency       | 100.0%                              |
| Emitter type     |                                     |
| Flow temperature |                                     |
| System type      | Panel, convector or radiant heaters |
| Manufacturer     |                                     |
| Model            |                                     |
| Commissioning    |                                     |

### Main heating system 2: Heat pump with radiators or underfloor heating - Electricity

|                  |                         |
|------------------|-------------------------|
| Efficiency       | 0.0%                    |
| Emitter type     |                         |
| Flow temperature |                         |
| System type      | Heat Pump               |
| Manufacturer     | KERS Innovations UK Ltd |
| Model            | KERS MEV-W200SL         |
| Commissioning    |                         |

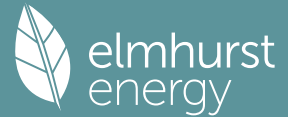
### Secondary heating system: N/A

|               |     |
|---------------|-----|
| Fuel          | N/A |
| Efficiency    | N/A |
| Commissioning |     |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                   |                        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|------------------------|
| <b>5 Hot water</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                   |                        |
| <b>Cylinder/store</b> - type: N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                   |                        |
| Capacity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | N/A               |                        |
| Declared heat loss                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | N/A               |                        |
| Primary pipework insulated                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | N/A               |                        |
| Manufacturer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                   |                        |
| Model                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                        |
| Commissioning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                   |                        |
| <b>Waste water heat recovery system 1</b> - type: N/A                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                        |
| Efficiency                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                   |                        |
| Manufacturer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                   |                        |
| Model                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                        |
| <b>6 Controls</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                   |                        |
| <b>Main heating 1</b> - type: Programmer and appliance thermostats                                                                                                                                                                                                                                                                                                                                                                                                                               |                   |                        |
| Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                   |                        |
| Ecodesign class                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                   |                        |
| Manufacturer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                   |                        |
| Model                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                        |
| <b>Main heating 2</b> - type: Not applicable                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                   |                        |
| Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                   |                        |
| Ecodesign class                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                   |                        |
| Manufacturer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                   |                        |
| Model                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                        |
| <b>Water heating</b> - type: N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                   |                        |
| Manufacturer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                   |                        |
| Model                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                        |
| <b>7 Lighting</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                   |                        |
| Minimum permitted light source efficacy                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 75 lm/W           |                        |
| Lowest light source efficacy                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 90 lm/W           | OK                     |
| External lights control                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | N/A               |                        |
| <b>8 Mechanical ventilation</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                   |                        |
| <b>System type:</b> Centralised mechanical extract                                                                                                                                                                                                                                                                                                                                                                                                                                               |                   |                        |
| Maximum permitted specific fan power                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0.7 W/(l/s)       |                        |
| Specific fan power                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 0.51 W/(l/s)      | OK                     |
| Minimum permitted heat recovery efficiency                                                                                                                                                                                                                                                                                                                                                                                                                                                       | N/A               |                        |
| Heat recovery efficiency                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | N/A               | N/A                    |
| Manufacturer/Model                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | KERS MEV-W200SL   |                        |
| Commissioning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                   |                        |
| <b>9 Local generation</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                   |                        |
| N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                   |                        |
| <b>10 Heat networks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                   |                        |
| N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                   |                        |
| <b>11 Supporting documentary evidence</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                   |                        |
| N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                   |                        |
| <b>12 Declarations</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                   |                        |
| <b>a. Assessor Declaration</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                   |                        |
| This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report. |                   |                        |
| Signed:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>P Yearsley</b> | Assessor ID: R301-0001 |
| Name:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Peter Yearsley    | Date: 28/11/2025       |

| b. Client Declaration |
|-----------------------|
| N/A                   |

# Full SAP Calculation Printout



|                                    |                                          |               |       |               |                |            |  |
|------------------------------------|------------------------------------------|---------------|-------|---------------|----------------|------------|--|
| Plot Reference                     | House, 85 Pell Street                    |               |       |               | Issued on Date | 28/11/2025 |  |
| Assessment Reference               | Electric Panel Heaters                   |               |       | Plot Type Ref |                |            |  |
| Plot Address                       | House, 85, Pell Street, Reading, RG1 2NP |               |       |               | SAP Version    | 10.2       |  |
|                                    |                                          |               |       |               |                |            |  |
| SAP Rating                         | 70 C                                     | DER           | 7.95  | TER           | 13.83          |            |  |
| Environmental                      | 94 A                                     | % DER < TER   |       |               |                | 42.52      |  |
| CO <sub>2</sub> Emissions (t/year) | 0.49                                     | DFEE          | 46.01 | TFEE          | 46.94          |            |  |
| Compliance Check                   | See BREL                                 | % DFEE < TFEE |       |               |                | 1.98       |  |
| % DPER < TPER                      | -13.11                                   | DPER          | 82.12 | TPER          | 72.60          |            |  |
|                                    |                                          |               |       |               |                |            |  |
| Assessor Details                   | Mr. Peter Yearsley                       |               |       |               | Assessor ID    | R301-0001  |  |
| Client                             | ,                                        |               |       |               |                |            |  |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                 |                             |
| Ground floor                                           | 39.8000 (1b)              | x 2.7500 (2b)                   | = 109.4500 (1b) - (3b)      |
| First floor                                            | 29.7000 (1c)              | x 2.5900 (2c)                   | = 76.9230 (1c) - (3c)       |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 69.5000                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 186.3730 (5)              |

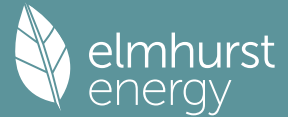
## 2. Ventilation rate

|                                                                                                         | m <sup>3</sup> per hour                                                         |            |            |            |            |            |            |            |            |            |            |                 |
|---------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|-----------------|
| Number of open chimneys                                                                                 | 0 * 80 = 0.0000 (6a)                                                            |            |            |            |            |            |            |            |            |            |            |                 |
| Number of open flues                                                                                    | 0 * 20 = 0.0000 (6b)                                                            |            |            |            |            |            |            |            |            |            |            |                 |
| Number of chimneys / flues attached to closed fire                                                      | 0 * 10 = 0.0000 (6c)                                                            |            |            |            |            |            |            |            |            |            |            |                 |
| Number of flues attached to solid fuel boiler                                                           | 0 * 20 = 0.0000 (6d)                                                            |            |            |            |            |            |            |            |            |            |            |                 |
| Number of flues attached to other heater                                                                | 0 * 35 = 0.0000 (6e)                                                            |            |            |            |            |            |            |            |            |            |            |                 |
| Number of blocked chimneys                                                                              | 0 * 20 = 0.0000 (6f)                                                            |            |            |            |            |            |            |            |            |            |            |                 |
| Number of intermittent extract fans                                                                     | 0 * 10 = 0.0000 (7a)                                                            |            |            |            |            |            |            |            |            |            |            |                 |
| Number of passive vents                                                                                 | 0 * 10 = 0.0000 (7b)                                                            |            |            |            |            |            |            |            |            |            |            |                 |
| Number of flueless gas fires                                                                            | 0 * 40 = 0.0000 (7c)                                                            |            |            |            |            |            |            |            |            |            |            |                 |
| Infiltration due to chimneys, flues and fans                                                            | = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8) |            |            |            |            |            |            |            |            |            |            |                 |
| Pressure test                                                                                           | Yes                                                                             |            |            |            |            |            |            |            |            |            |            |                 |
| Pressure Test Method                                                                                    | Blower Door                                                                     |            |            |            |            |            |            |            |            |            |            |                 |
| Measured/design AP50                                                                                    | 3.0000 (17)                                                                     |            |            |            |            |            |            |            |            |            |            |                 |
| Infiltration rate                                                                                       | 0.1500 (18)                                                                     |            |            |            |            |            |            |            |            |            |            |                 |
| Number of sides sheltered                                                                               | 1 (19)                                                                          |            |            |            |            |            |            |            |            |            |            |                 |
| Shelter factor                                                                                          | (20) = 1 - [0.075 x (19)] = 0.9250 (20)                                         |            |            |            |            |            |            |            |            |            |            |                 |
| Infiltration rate adjusted to include shelter factor                                                    | (21) = (18) x (20) = 0.1388 (21)                                                |            |            |            |            |            |            |            |            |            |            |                 |
| Wind speed                                                                                              | Jan 5.1000                                                                      | Feb 5.0000 | Mar 4.9000 | Apr 4.4000 | May 4.3000 | Jun 3.8000 | Jul 3.8000 | Aug 3.7000 | Sep 4.0000 | Oct 4.3000 | Nov 4.5000 | Dec 4.7000 (22) |
| Wind factor                                                                                             | 1.2750                                                                          | 1.2500     | 1.2250     | 1.1000     | 1.0750     | 0.9500     | 0.9500     | 0.9250     | 1.0000     | 1.0750     | 1.1250     | 1.1750 (22a)    |
| Adj infilt rate                                                                                         | 0.1769                                                                          | 0.1734     | 0.1700     | 0.1526     | 0.1492     | 0.1318     | 0.1318     | 0.1283     | 0.1388     | 0.1492     | 0.1561     | 0.1630 (22b)    |
| Mechanical extract ventilation - centralised                                                            |                                                                                 |            |            |            |            |            |            |            |            |            |            |                 |
| If mechanical ventilation                                                                               | 0.5000 (23a)                                                                    |            |            |            |            |            |            |            |            |            |            |                 |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) | 0.5000 (23b)                                                                    |            |            |            |            |            |            |            |            |            |            |                 |
| Effective ac                                                                                            | 0.5000                                                                          | 0.5000     | 0.5000     | 0.5000     | 0.5000     | 0.5000     | 0.5000     | 0.5000     | 0.5000     | 0.5000     | 0.5000     | 0.5000 (25)     |

## 3. Heat losses and heat loss parameter

| Element                                                      | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K   |
|--------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|-----------------|
| Main dwelling                                                |                         |                            |                           |                               |              |                                |                 |
| Solid Door                                                   |                         |                            | 1.7900                    | 1.2000                        | 2.1480       |                                | (26)            |
| Windows / Glazed Doors                                       |                         |                            | 13.1600                   | 1.1450                        | 15.0687      |                                | (27)            |
| Heatloss Floor 1                                             |                         |                            | 39.8000                   | 0.1200                        | 4.7760       | 75.0000                        | 2985.0000 (28a) |
| External Wall                                                | 66.4000                 | 14.9500                    | 51.4500                   | 0.1500                        | 7.7175       | 9.0000                         | 463.0500 (29a)  |
| RIR Stud Wall                                                | 41.5000                 |                            | 41.5000                   | 0.1500                        | 6.2250       | 9.0000                         | 373.5000 (29a)  |
| Dormer Walls                                                 | 8.0000                  |                            | 8.0000                    | 0.1500                        | 1.2000       | 9.0000                         | 72.0000 (29a)   |
| Adj To RIR Ins At Slope                                      | 5.1000                  |                            | 5.1000                    | 0.1400                        | 0.7140       | 9.0000                         | 45.9000 (30)    |
| Slope Roof                                                   | 38.7700                 |                            | 38.7700                   | 0.1400                        | 5.4278       | 9.0000                         | 348.9300 (30)   |
| Total net area of external elements Aum (A, m <sup>2</sup> ) |                         |                            | 199.5700                  |                               |              |                                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                          |                         |                            |                           | (26)...(30) + (32) =          | 43.2770      |                                | (33)            |
| Main dwelling                                                |                         |                            |                           |                               |              |                                |                 |
| Party Wall 1                                                 |                         |                            | 20.7500                   | 0.0000                        | 0.0000       | 45.0000                        | 933.7500 (32)   |
| Internal Wall 1                                              |                         |                            | 73.5300                   |                               |              | 9.0000                         | 661.7700 (32c)  |
| Internal Floor 1                                             |                         |                            | 29.7000                   |                               |              | 18.0000                        | 534.6000 (32d)  |
| Internal Ceiling 1                                           |                         |                            | 29.7000                   |                               |              | 9.0000                         | 267.3000 (32e)  |

# Full SAP Calculation Printout



|                                                                     |         |         |         |         |         |         |         |         |         |         |         |         |
|---------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Heat capacity Cm = Sum(A x k)                                       |         |         |         |         |         |         |         |         |         |         |         |         |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K                   |         |         |         |         |         |         |         |         |         |         |         |         |
| List of Thermal Bridges                                             |         |         |         |         |         |         |         |         |         |         |         |         |
| K1 Element                                                          |         |         |         |         |         |         |         |         |         |         |         |         |
| E2 Other lintels (including other steel lintels)                    |         |         |         |         |         |         |         |         |         |         |         |         |
| E3 Sill                                                             |         |         |         |         |         |         |         |         |         |         |         |         |
| E4 Jamb                                                             |         |         |         |         |         |         |         |         |         |         |         |         |
| E16 Corner (normal)                                                 |         |         |         |         |         |         |         |         |         |         |         |         |
| E18 Party wall between dwellings                                    |         |         |         |         |         |         |         |         |         |         |         |         |
| E11 Eaves (insulation at rafter level)                              |         |         |         |         |         |         |         |         |         |         |         |         |
| E17 Corner (inverted - internal area greater than external area)    |         |         |         |         |         |         |         |         |         |         |         |         |
| E13 Gable (insulation at rafter level)                              |         |         |         |         |         |         |         |         |         |         |         |         |
| E6 Intermediate floor within a dwelling                             |         |         |         |         |         |         |         |         |         |         |         |         |
| P5 Party wall - Roof (insulation at rafter level)                   |         |         |         |         |         |         |         |         |         |         |         |         |
| P2 Party wall - Intermediate floor within a dwelling                |         |         |         |         |         |         |         |         |         |         |         |         |
| R4 Ridge (vaulted ceiling)                                          |         |         |         |         |         |         |         |         |         |         |         |         |
| E5 Ground floor (normal)                                            |         |         |         |         |         |         |         |         |         |         |         |         |
| E25 Staggered party wall between dwellings                          |         |         |         |         |         |         |         |         |         |         |         |         |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)          |         |         |         |         |         |         |         |         |         |         |         |         |
| Point Thermal bridges                                               |         |         |         |         |         |         |         |         |         |         |         |         |
| Total fabric heat loss                                              |         |         |         |         |         |         |         |         |         |         |         |         |
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) |         |         |         |         |         |         |         |         |         |         |         |         |
| (38)m                                                               | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |
| Heat transfer coeff                                                 | 30.7515 | 30.7515 | 30.7515 | 30.7515 | 30.7515 | 30.7515 | 30.7515 | 30.7515 | 30.7515 | 30.7515 | 30.7515 | 30.7515 |
| Average = Sum(39)m / 12 =                                           | 91.7741 | 91.7741 | 91.7741 | 91.7741 | 91.7741 | 91.7741 | 91.7741 | 91.7741 | 91.7741 | 91.7741 | 91.7741 | 91.7741 |
| HLP                                                                 | 1.3205  | 1.3205  | 1.3205  | 1.3205  | 1.3205  | 1.3205  | 1.3205  | 1.3205  | 1.3205  | 1.3205  | 1.3205  | 1.3205  |
| HLP (average)                                                       |         |         |         |         |         |         |         |         |         |         |         |         |
| Days in month                                                       | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31      |

## 4. Water heating energy requirements (kWh/year)

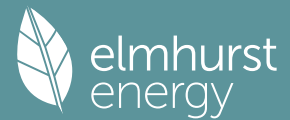
|                                                                 |          |          |          |          |          |          |          |          |          |          |          |          |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Assumed occupancy                                               |          |          |          |          |          |          |          |          |          |          |          |          |
| Hot water usage for mixer showers                               |          |          |          |          |          |          |          |          |          |          |          |          |
| Hot water usage for baths                                       | 84.8034  | 83.5290  | 81.6719  | 78.1187  | 75.4965  | 72.5723  | 70.9101  | 72.7532  | 74.7735  | 77.9132  | 81.5428  | 84.4785  |
| Hot water usage for other uses                                  | 26.6456  | 26.2499  | 25.6926  | 24.6651  | 23.8957  | 23.0426  | 22.5818  | 23.1352  | 23.7377  | 24.6505  | 25.6992  | 26.5555  |
| Average daily hot water use (litres/day)                        | 37.5076  | 36.1437  | 34.7798  | 33.4159  | 32.0520  | 30.6881  | 30.6881  | 32.0520  | 33.4159  | 34.7798  | 36.1437  | 37.5076  |
| Daily hot water use                                             |          |          |          |          |          |          |          |          |          |          |          |          |
| Energy content (annual)                                         | 148.9566 | 145.9226 | 142.1443 | 136.1997 | 131.4442 | 126.3029 | 124.1800 | 127.9403 | 131.9271 | 137.3436 | 143.3857 | 148.5416 |
| Distribution loss (46)m = 0.15 x (45)m                          | 235.9109 | 207.7918 | 218.4705 | 186.4505 | 176.9492 | 155.3042 | 150.1849 | 158.4168 | 162.6792 | 186.3739 | 204.2792 | 232.5803 |
| Water storage loss (or HIU loss):                               | 35.3866  | 31.1688  | 32.7706  | 27.9676  | 26.5424  | 23.2956  | 22.5277  | 23.7625  | 24.4019  | 27.9561  | 30.6419  | 34.8870  |
| Store volume                                                    |          |          |          |          |          |          |          |          |          |          |          |          |
| a) If manufacturer declared loss factor is known (kWh/day):     |          |          |          |          |          |          |          |          |          |          |          |          |
| Temperature factor from Table 2b                                |          |          |          |          |          |          |          |          |          |          |          |          |
| Enter (49) or (54) in (55)                                      |          |          |          |          |          |          |          |          |          |          |          |          |
| Total storage loss                                              | 21.9629  | 19.8374  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  |
| If cylinder contains dedicated solar storage                    | 21.9629  | 19.8374  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  |
| Primary loss                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   |
| Combi loss                                                      | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   |
| Total heat required for water heating calculated for each month | 257.8738 | 227.6292 | 240.4334 | 207.7049 | 198.9120 | 176.5586 | 172.1478 | 180.3797 | 183.9336 | 208.3368 | 225.5336 | 254.5432 |
| WWHRS                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   |
| PV diverter                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   |
| Solar input                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   |
| FGHRS                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   |
| Output from w/h                                                 | 257.8738 | 227.6292 | 240.4334 | 207.7049 | 198.9120 | 176.5586 | 172.1478 | 180.3797 | 183.9336 | 208.3368 | 225.5336 | 254.5432 |
| 12Total per year (kWh/year)                                     |          |          |          |          |          |          |          |          |          |          |          |          |
| Electric shower(s)                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   |
| Heat gains from water heating, kWh/month                        | 78.4404  | 69.0908  | 72.6414  | 61.9948  | 58.8356  | 51.6386  | 49.9365  | 52.6736  | 54.0908  | 61.9693  | 67.9228  | 77.3330  |

## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |          |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Metabolic gains (Table 5), Watts                                                    |          |          |          |          |          |          |          |          |          |          |          |          |
| (66)m                                                                               | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 111.6962 | 111.6962 | 111.6962 | 111.6962 | 111.6962 | 111.6962 | 111.6962 | 111.6962 | 111.6962 | 111.6962 | 111.6962 | 111.6962 |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 100.2805 | 111.0249 | 100.2805 | 103.6232 | 100.2805 | 103.6232 | 100.2805 | 100.2805 | 103.6232 | 100.2805 | 103.6232 | 100.2805 |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 196.1273 | 198.1625 | 193.0339 | 182.1157 | 168.3334 | 155.3800 | 146.7264 | 144.6912 | 149.8198 | 160.7380 | 174.5203 | 187.4736 |
| Pumps, fans                                                                         | 34.1696  | 34.1696  | 34.1696  | 34.1696  | 34.1696  | 34.1696  | 34.1696  | 34.1696  | 34.1696  | 34.1696  | 34.1696  | 34.1696  |
| Losses e.g. evaporation (negative values) (Table 5)                                 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   |
| Water heating gains (Table 5)                                                       | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 |
| Total internal gains                                                                | 105.4306 | 102.8136 | 97.6363  | 86.1039  | 79.0801  | 71.7203  | 67.1189  | 70.7978  | 75.1262  | 83.2921  | 94.3373  | 103.9421 |

## 6. Solar gains

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| [Jan]                                                                                                | Area<br>m2 |           |           |           | Solar flux<br>Table 6a<br>W/m2 | Specific data<br>or Table 6b | g         | Specific data<br>or Table 6c | FF       | Access<br>factor<br>Table 6d | Gains<br>W |                |
|------------------------------------------------------------------------------------------------------|------------|-----------|-----------|-----------|--------------------------------|------------------------------|-----------|------------------------------|----------|------------------------------|------------|----------------|
| East                                                                                                 | 7.2000     |           |           |           | 19.6403                        | 0.7600                       |           | 0.0000                       |          | 0.7700                       | 82.7531    | (76)           |
| West                                                                                                 | 5.9600     |           |           |           | 19.6403                        | 0.7600                       |           | 0.0000                       |          | 0.7700                       | 68.5012    | (80)           |
| Solar gains                                                                                          | 151.2542   | 295.8854  | 487.2810  | 710.6703  | 870.9532                       | 891.5756                     | 848.8163  | 729.1206                     | 566.7280 | 351.0929                     | 188.5962   | 124.3841 (83)  |
| Total gains                                                                                          | 609.6015   | 764.3952  | 934.7406  | 1139.0220 | 1275.1561                      | 1278.8080                    | 1219.4510 | 1101.3991                    | 951.8061 | 751.9124                     | 617.5858   | 572.5893 (84)  |
| 7. Mean internal temperature (heating season)                                                        |            |           |           |           |                                |                              |           |                              |          |                              |            |                |
| Temperature during heating periods in the living area from Table 9, Th1 (C)                          |            |           |           |           |                                |                              |           |                              |          |                              |            | 21.0000 (85)   |
| Utilisation factor for gains for living area, nil,m (see Table 9a)                                   |            |           |           |           |                                |                              |           |                              |          |                              |            |                |
|                                                                                                      | Jan        | Feb       | Mar       | Apr       | May                            | Jun                          | Jul       | Aug                          | Sep      | Oct                          | Nov        | Dec            |
| tau                                                                                                  | 20.2363    | 20.2363   | 20.2363   | 20.2363   | 20.2363                        | 20.2363                      | 20.2363   | 20.2363                      | 20.2363  | 20.2363                      | 20.2363    | 20.2363        |
| alpha                                                                                                | 2.3491     | 2.3491    | 2.3491    | 2.3491    | 2.3491                         | 2.3491                       | 2.3491    | 2.3491                       | 2.3491   | 2.3491                       | 2.3491     | 2.3491         |
| util living area                                                                                     | 0.9276     | 0.8847    | 0.8129    | 0.6925    | 0.5528                         | 0.4162                       | 0.3142    | 0.3574                       | 0.5505   | 0.7797                       | 0.8971     | 0.9363 (86)    |
| MIT                                                                                                  | 18.2614    | 18.7310   | 19.3834   | 20.0889   | 20.5791                        | 20.8439                      | 20.9415   | 20.9193                      | 20.6905  | 19.9575                      | 18.9566    | 18.1523 (87)   |
| Th 2                                                                                                 | 19.8248    | 19.8248   | 19.8248   | 19.8248   | 19.8248                        | 19.8248                      | 19.8248   | 19.8248                      | 19.8248  | 19.8248                      | 19.8248    | 19.8248 (88)   |
| util rest of house                                                                                   | 0.9173     | 0.8692    | 0.7888    | 0.6555    | 0.5022                         | 0.3507                       | 0.2360    | 0.2745                       | 0.4811   | 0.7418                       | 0.8803     | 0.9271 (89)    |
| MIT 2                                                                                                | 16.6797    | 17.2620   | 18.0605   | 18.8949   | 19.4424                        | 19.7119                      | 19.7953   | 19.7813                      | 19.5795  | 18.7753                      | 17.5571    | 16.5434 (90)   |
| Living area fraction                                                                                 | 17.4877    | 18.0124   | 18.7362   | 19.5048   | 20.0230                        | 20.2901                      | 20.3808   | 20.3625                      | 20.1470  | 19.3792                      | 18.2719    | 17.3652 (92)   |
| MIT                                                                                                  | 17.4877    | 18.0124   | 18.7362   | 19.5048   | 20.0230                        | 20.2901                      | 20.3808   | 20.3625                      | 20.1470  | 19.3792                      | 18.2719    | 17.3652 (93)   |
| Temperature adjustment                                                                               |            |           |           |           |                                |                              |           |                              |          |                              |            | 0.0000         |
| adjusted MIT                                                                                         | 17.4877    | 18.0124   | 18.7362   | 19.5048   | 20.0230                        | 20.2901                      | 20.3808   | 20.3625                      | 20.1470  | 19.3792                      | 18.2719    | 17.3652 (93)   |
| 8. Space heating requirement                                                                         |            |           |           |           |                                |                              |           |                              |          |                              |            |                |
| Utilisation                                                                                          | Jan        | Feb       | Mar       | Apr       | May                            | Jun                          | Jul       | Aug                          | Sep      | Oct                          | Nov        | Dec            |
|                                                                                                      | 0.8898     | 0.8392    | 0.7627    | 0.6446    | 0.5112                         | 0.3773                       | 0.2737    | 0.3134                       | 0.5012   | 0.7252                       | 0.8520     | 0.9008 (94)    |
| Useful gains                                                                                         | 542.4301   | 641.4795  | 712.9313  | 734.1885  | 651.8032                       | 482.5412                     | 333.8229  | 345.1698                     | 477.0001 | 545.3198                     | 526.2003   | 515.8028 (95)  |
| Ext temp.                                                                                            | 4.3000     | 4.9000    | 6.5000    | 8.9000    | 11.7000                        | 14.6000                      | 16.6000   | 16.4000                      | 14.1000  | 10.6000                      | 7.1000     | 4.2000 (96)    |
| Heat loss rate W                                                                                     | 1210.2858  | 1203.3759 | 1122.9693 | 973.2454  | 763.8388                       | 522.2037                     | 346.9786  | 363.6583                     | 554.9595 | 805.7011                     | 1025.2940  | 1208.2288 (97) |
| Space heating kWh                                                                                    | 496.8847   | 377.5944  | 305.0683  | 172.1209  | 83.3545                        | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 193.7237                     | 359.3475   | 515.1650 (98a) |
| Space heating requirement - total per year (kWh/year)                                                |            |           |           |           |                                |                              |           |                              |          |                              |            | 2503.2588      |
| Solar heating kWh                                                                                    | 0.0000     | 0.0000    | 0.0000    | 0.0000    | 0.0000                         | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 0.0000                       | 0.0000     | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                                               |            |           |           |           |                                |                              |           |                              |          |                              |            | 0.0000         |
| Space heating kWh                                                                                    | 496.8847   | 377.5944  | 305.0683  | 172.1209  | 83.3545                        | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 193.7237                     | 359.3475   | 515.1650 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year)                       |            |           |           |           |                                |                              |           |                              |          |                              |            | 2503.2588      |
| Space heating per m2                                                                                 |            |           |           |           |                                |                              |           |                              |          | (98c) / (4) =                |            | 36.0181 (99)   |
| 9a. Energy requirements - Individual heating systems, including micro-CHP                            |            |           |           |           |                                |                              |           |                              |          |                              |            |                |
| Fraction of space heat from secondary/supplementary system (Table 11)                                |            |           |           |           |                                |                              |           |                              |          |                              |            | 0.0000 (201)   |
| Fraction of space heat from main system(s)                                                           |            |           |           |           |                                |                              |           |                              |          |                              |            | 1.0000 (202)   |
| Fraction of main heating from main system 2                                                          |            |           |           |           |                                |                              |           |                              |          |                              |            | 0.0000 (203)   |
| Fraction of total heating from main system 1                                                         |            |           |           |           |                                |                              |           |                              |          |                              |            | 1.0000 (204)   |
| Fraction of total heating from main system 2                                                         |            |           |           |           |                                |                              |           |                              |          |                              |            | 0.0000 (205)   |
| Efficiency of main space heating system 1 (in %)                                                     |            |           |           |           |                                |                              |           |                              |          |                              |            | 100.0000 (206) |
| Efficiency of main space heating system 2 (in %)                                                     |            |           |           |           |                                |                              |           |                              |          |                              |            | 0.0000 (207)   |
| Efficiency of secondary/supplementary heating system, %                                              |            |           |           |           |                                |                              |           |                              |          |                              |            | 0.0000 (208)   |
|                                                                                                      | Jan        | Feb       | Mar       | Apr       | May                            | Jun                          | Jul       | Aug                          | Sep      | Oct                          | Nov        | Dec            |
| Space heating requirement                                                                            | 496.8847   | 377.5944  | 305.0683  | 172.1209  | 83.3545                        | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 193.7237                     | 359.3475   | 515.1650 (98)  |
| Space heating efficiency (main heating system 1)                                                     | 100.0000   | 100.0000  | 100.0000  | 100.0000  | 100.0000                       | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 100.0000                     | 100.0000   | 100.0000 (210) |
| Space heating fuel (main heating system)                                                             | 496.8847   | 377.5944  | 305.0683  | 172.1209  | 83.3545                        | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 193.7237                     | 359.3475   | 515.1650 (211) |
| Space heating efficiency (main heating system 2)                                                     | 0.0000     | 0.0000    | 0.0000    | 0.0000    | 0.0000                         | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 0.0000                       | 0.0000     | 0.0000 (212)   |
| Space heating fuel (main heating system 2)                                                           | 0.0000     | 0.0000    | 0.0000    | 0.0000    | 0.0000                         | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 0.0000                       | 0.0000     | 0.0000 (213)   |
| Space heating fuel (secondary)                                                                       | 0.0000     | 0.0000    | 0.0000    | 0.0000    | 0.0000                         | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 0.0000                       | 0.0000     | 0.0000 (215)   |
| Space heating fuel used, main system 2                                                               |            |           |           |           |                                |                              |           |                              |          |                              |            | 0.0000 (213)   |
| Water heating                                                                                        |            |           |           |           |                                |                              |           |                              |          |                              |            |                |
| Water heating requirement                                                                            | 257.8738   | 227.6292  | 240.4334  | 207.7049  | 198.9120                       | 176.5586                     | 172.1478  | 180.3797                     | 183.9336 | 208.3368                     | 225.5336   | 254.5432 (64)  |
| Efficiency of water heater                                                                           | 313.4050   | 313.4050  | 313.4050  | 313.4050  | 313.4050                       | 313.4050                     | 313.4050  | 313.4050                     | 313.4050 | 313.4050                     | 313.4050   | 313.4050 (216) |
| Fuel for water heating, kWh/month                                                                    | 82.2813    | 72.6310   | 76.7165   | 66.2737   | 63.4680                        | 56.3356                      | 54.9282   | 57.5548                      | 58.6888  | 66.4753                      | 71.9623    | 81.2186 (219)  |
| Space cooling fuel requirement                                                                       |            |           |           |           |                                |                              |           |                              |          |                              |            |                |
| (221)m                                                                                               | 0.0000     | 0.0000    | 0.0000    | 0.0000    | 0.0000                         | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 0.0000                       | 0.0000     | 0.0000 (221)   |
| Pumps and Fa                                                                                         | 12.8034    | 11.5644   | 12.8034   | 12.3904   | 12.8034                        | 12.3904                      | 12.8034   | 12.8034                      | 12.3904  | 12.8034                      | 12.3904    | 12.8034 (231)  |
| Lighting                                                                                             | 24.8278    | 19.9178   | 17.9337   | 13.1390   | 10.1490                        | 8.2918                       | 9.2582    | 12.0342                      | 15.6312  | 20.5090                      | 23.1649    | 25.5178 (232)  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | 0.0000     | 0.0000    | 0.0000    | 0.0000    | 0.0000                         | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 0.0000                       | 0.0000     | 0.0000 (233a)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000     | 0.0000    | 0.0000    | 0.0000    | 0.0000                         | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 0.0000                       | 0.0000     | 0.0000 (234a)  |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000     | 0.0000    | 0.0000    | 0.0000    | 0.0000                         | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 0.0000                       | 0.0000     | 0.0000 (235a)  |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000     | 0.0000    | 0.0000    | 0.0000    | 0.0000                         | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 0.0000                       | 0.0000     | 0.0000 (235c)  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | 0.0000     | 0.0000    | 0.0000    | 0.0000    | 0.0000                         | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 0.0000                       | 0.0000     | 0.0000 (233b)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000     | 0.0000    | 0.0000    | 0.0000    | 0.0000                         | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 0.0000                       | 0.0000     | 0.0000 (234b)  |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000     | 0.0000    | 0.0000    | 0.0000    | 0.0000                         | 0.0000                       | 0.0000    | 0.0000                       | 0.0000   | 0.0000                       | 0.0000     | 0.0000 (235b)  |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |            |           |           |           |                                |                              |           |                              |          |                              |            |                |

# Full SAP Calculation Printout



|                                                                  |        |        |        |        |        |        |        |        |        |        |        |           |        |
|------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-----------|--------|
| (235d)m                                                          | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000    | (235d) |
| Annual totals kWh/year                                           |        |        |        |        |        |        |        |        |        |        |        |           |        |
| Space heating fuel - main system 1                               |        |        |        |        |        |        |        |        |        |        |        | 2503.2588 | (211)  |
| Space heating fuel - main system 2                               |        |        |        |        |        |        |        |        |        |        |        | 0.0000    | (213)  |
| Space heating fuel - secondary                                   |        |        |        |        |        |        |        |        |        |        |        | 0.0000    | (215)  |
| Efficiency of water heater                                       |        |        |        |        |        |        |        |        |        |        |        | 313.4050  |        |
| Water heating fuel used                                          |        |        |        |        |        |        |        |        |        |        |        | 808.5342  | (219)  |
| Space cooling fuel                                               |        |        |        |        |        |        |        |        |        |        |        | 0.0000    | (221)  |
| Electricity for pumps and fans:                                  |        |        |        |        |        |        |        |        |        |        |        |           |        |
| (MEVCentralised, Database: in-use factor = 1.3000, SFP = 0.6630) |        |        |        |        |        |        |        |        |        |        |        |           |        |
| mechanical ventilation fans (SFP = 0.6630)                       |        |        |        |        |        |        |        |        |        |        |        | 150.7497  | (230a) |
| Total electricity for the above, kWh/year                        |        |        |        |        |        |        |        |        |        |        |        | 150.7497  | (231)  |
| Electricity for lighting (calculated in Appendix L)              |        |        |        |        |        |        |        |        |        |        |        | 200.3743  | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)    |        |        |        |        |        |        |        |        |        |        |        |           |        |
| PV generation                                                    |        |        |        |        |        |        |        |        |        |        |        | 0.0000    | (233)  |
| Wind generation                                                  |        |        |        |        |        |        |        |        |        |        |        | 0.0000    | (234)  |
| Hydro-electric generation (Appendix N)                           |        |        |        |        |        |        |        |        |        |        |        | 0.0000    | (235a) |
| Electricity generated - Micro CHP (Appendix N)                   |        |        |        |        |        |        |        |        |        |        |        | 0.0000    | (235)  |
| Appendix Q - special features                                    |        |        |        |        |        |        |        |        |        |        |        |           |        |
| Energy saved or generated                                        |        |        |        |        |        |        |        |        |        |        |        | -0.0000   | (236)  |
| Energy used                                                      |        |        |        |        |        |        |        |        |        |        |        | 0.0000    | (237)  |
| Total delivered energy for all uses                              |        |        |        |        |        |        |        |        |        |        |        | 3662.9170 | (238)  |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                                 | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |       |
|-------------------------------------------------|--------------------|-------------------------------|--------------------------|-------|
| Space heating - main system 1                   | 2503.2588          | 0.1551                        | 388.2786                 | (261) |
| Space heating - main system 2                   | 0.0000             | 0.0000                        | 0.0000                   | (262) |
| Total CO2 associated with community systems     |                    |                               | 0.0000                   | (373) |
| Water heating (other fuel)                      | 808.5342           | 0.1413                        | 114.2344                 | (264) |
| Space and water heating                         |                    |                               | 502.5130                 | (265) |
| Pumps, fans and electric keep-hot               | 150.7497           | 0.1387                        | 20.9108                  | (267) |
| Energy for lighting                             | 200.3743           | 0.1443                        | 28.9202                  | (268) |
| Total CO2, kg/year                              |                    |                               | 552.3441                 | (272) |
| EPC Dwelling Carbon Dioxide Emission Rate (DER) |                    |                               | 7.9500                   | (273) |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |       |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|-------|
| Space heating - main system 1               | 2503.2588          | 1.5742                              | 3940.7056                  | (275) |
| Space heating - main system 2               | 0.0000             | 0.0000                              | 0.0000                     | (276) |
| Total CO2 associated with community systems |                    |                                     | 0.0000                     | (473) |
| Water heating (other fuel)                  | 808.5342           | 1.5224                              | 1230.9473                  | (278) |
| Space and water heating                     |                    |                                     | 5171.6529                  | (279) |
| Pumps, fans and electric keep-hot           | 150.7497           | 1.5128                              | 228.0541                   | (281) |
| Energy for lighting                         | 200.3743           | 1.5338                              | 307.3407                   | (282) |
| Total Primary energy kWh/year               |                    |                                     | 5707.0477                  | (286) |
| Dwelling Primary energy Rate (DPER)         |                    |                                     | 82.1200                    | (287) |

## SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET EMISSIONS

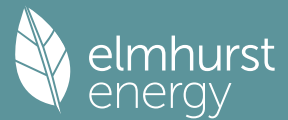
### 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m)            | Volume<br>(m3)         |     |
|--------------------------------------------------------|--------------|---------------------------------|------------------------|-----|
| Main dwelling                                          |              |                                 |                        |     |
| Ground floor                                           | 39.8000 (1b) | x 2.7500 (2b)                   | = 109.4500 (1b) - (3b) |     |
| First floor                                            | 29.7000 (1c) | x 2.5900 (2c)                   | = 76.9230 (1c) - (3c)  |     |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 69.5000      |                                 |                        | (4) |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 186.3730             | (5) |

### 2. Ventilation rate

|                                                                                                    | m3 per hour                 |              |
|----------------------------------------------------------------------------------------------------|-----------------------------|--------------|
| Number of open chimneys                                                                            | 0 * 80 =                    | 0.0000 (6a)  |
| Number of open flues                                                                               | 0 * 20 =                    | 0.0000 (6b)  |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 =                    | 0.0000 (6c)  |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 =                    | 0.0000 (6d)  |
| Number of flues attached to other heater                                                           | 0 * 35 =                    | 0.0000 (6e)  |
| Number of blocked chimneys                                                                         | 0 * 20 =                    | 0.0000 (6f)  |
| Number of intermittent extract fans                                                                | 2 * 10 =                    | 20.0000 (7a) |
| Number of passive vents                                                                            | 0 * 10 =                    | 0.0000 (7b)  |
| Number of flueless gas fires                                                                       | 0 * 40 =                    | 0.0000 (7c)  |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 20.0000 / (5) =             | 0.1073 (8)   |
| Pressure test                                                                                      | Yes                         |              |
| Pressure Test Method                                                                               | Blower Door                 |              |
| Measured/design AP50                                                                               | 5.0000                      | (17)         |
| Infiltration rate                                                                                  | 0.3573                      | (18)         |
| Number of sides sheltered                                                                          | 1                           | (19)         |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = | 0.9250 (20)  |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) =        | 0.3305 (21)  |

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|                 |        |        |        |        |        |        |        |        |        |        |        |        |       |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| Wind speed      | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |       |
| Wind factor     | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 | (22)  |
| Adj infilt rate | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 | (22a) |
| Effective ac    | 0.4214 | 0.4131 | 0.4049 | 0.3636 | 0.3553 | 0.3140 | 0.3140 | 0.3057 | 0.3305 | 0.3553 | 0.3718 | 0.3884 | (22b) |
|                 | 0.5888 | 0.5853 | 0.5820 | 0.5661 | 0.5631 | 0.5493 | 0.5493 | 0.5467 | 0.5546 | 0.5631 | 0.5691 | 0.5754 | (25)  |

## 3. Heat losses and heat loss parameter

| Element                                           | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K     | A x U<br>W/K | K-value<br>kJ/m2K | A x K<br>kJ/K |       |
|---------------------------------------------------|-------------|----------------|---------------|----------------------|--------------|-------------------|---------------|-------|
| Main dwelling                                     |             |                |               |                      |              |                   |               |       |
| TER Opaque door                                   |             |                | 1.7900        | 1.0000               | 1.7900       |                   |               | (26)  |
| TER Opening Type                                  |             |                | 13.1600       | 1.1450               | 15.0687      |                   |               | (27)  |
| Heatloss Floor 1                                  |             |                | 39.8000       | 0.1300               | 5.1740       |                   |               | (28a) |
| External Wall                                     | 66.4000     | 14.9500        | 51.4500       | 0.1800               | 9.2610       |                   |               | (29a) |
| RIR Stud Wall                                     | 41.5000     |                | 41.5000       | 0.1800               | 7.4700       |                   |               | (29a) |
| Dormer Walls                                      | 8.0000      |                | 8.0000        | 0.1800               | 1.4400       |                   |               | (29a) |
| Adj To RIR Ins At Slope                           | 5.1000      |                | 5.1000        | 0.1100               | 0.5610       |                   |               | (30)  |
| Slope Roof                                        | 38.7700     |                | 38.7700       | 0.1100               | 4.2647       |                   |               | (30)  |
| Total net area of external elements Aum(A, m2)    |             |                | 199.5700      |                      |              |                   |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)               |             |                |               | (26)...(30) + (32) = | 45.0294      |                   |               | (33)  |
| Main dwelling                                     |             |                |               |                      |              |                   |               |       |
| Party Wall 1                                      |             |                | 20.7500       | 0.0000               | 0.0000       |                   |               | (32)  |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K |             |                |               |                      |              |                   | 96.1986       | (35)  |

## List of Thermal Bridges

| K1 Element                                                       | Length  | Psi-value             | Total   |              |
|------------------------------------------------------------------|---------|-----------------------|---------|--------------|
| E2 Other lintels (including other steel lintels)                 | 10.4200 | 0.0500                | 0.5210  |              |
| E3 Sill                                                          | 9.5700  | 0.0500                | 0.4785  |              |
| E4 Jamb                                                          | 34.3000 | 0.0500                | 1.7150  |              |
| E16 Corner (normal)                                              | 27.9000 | 0.0900                | 2.5110  |              |
| E18 Party wall between dwellings                                 | 2.7500  | 0.0600                | 0.1650  |              |
| E11 Eaves (insulation at rafter level)                           | 10.6000 | 0.0400                | 0.4240  |              |
| E17 Corner (inverted - internal area greater than external area) | 16.0000 | -0.0900               | -1.4400 |              |
| E13 Gable (insulation at rafter level)                           | 10.8000 | 0.0800                | 0.8640  |              |
| E6 Intermediate floor within a dwelling                          | 27.1000 | 0.0000                | 0.0000  |              |
| P5 Party wall - Roof (insulation at rafter level)                | 6.4000  | 0.0800                | 0.5120  |              |
| P2 Party wall - Intermediate floor within a dwelling             | 2.9000  | 0.0000                | 0.0000  |              |
| R4 Ridge (vaulted ceiling)                                       | 17.7000 | 0.0800                | 1.4160  |              |
| E5 Ground floor (normal)                                         | 21.4000 | 0.1600                | 3.4240  |              |
| E25 Staggered party wall between dwellings                       | 6.7500  | 0.0600                | 0.4050  |              |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)       |         |                       |         | 10.9955 (36) |
| Point Thermal bridges                                            |         |                       |         | 0.0000       |
| Total fabric heat loss                                           |         | (33) + (36) + (36a) = |         | 56.0249 (37) |

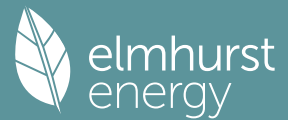
## Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

|                           |         |         |         |         |         |         |         |         |         |         |         |         |      |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| (38)m                     | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |      |
| Heat transfer coeff       | 36.2125 | 36.0004 | 35.7925 | 34.8163 | 34.6336 | 33.7833 | 33.7833 | 33.6258 | 34.1108 | 34.6336 | 35.0031 | 35.3894 | (38) |
| Average = Sum(39)m / 12 = | 92.2374 | 92.0253 | 91.8175 | 90.8412 | 90.6585 | 89.8082 | 89.8082 | 89.6507 | 90.1357 | 90.6585 | 91.0280 | 91.4143 | (39) |
|                           |         |         |         |         |         |         |         |         |         |         |         | 90.8403 |      |
| HLP                       | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |      |
| HLP (average)             | 1.3272  | 1.3241  | 1.3211  | 1.3071  | 1.3044  | 1.2922  | 1.2922  | 1.2899  | 1.2969  | 1.3044  | 1.3098  | 1.3153  | (40) |
| Days in mont              | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31      |      |

## 4. Water heating energy requirements (kWh/year)

|                                                                 |          |          |          |          |          |          |          |          |          |                                        |          |           |        |      |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------------------------------|----------|-----------|--------|------|
| Assumed occupancy                                               |          |          |          |          |          |          |          |          |          |                                        |          |           | 2.2339 | (42) |
| Hot water usage for mixer showers                               | 61.6752  | 60.7484  | 59.3977  | 56.8136  | 54.9065  | 52.7798  | 51.5710  | 52.9114  | 54.3807  | 56.6642                                | 59.3038  | 61.4389   | (42a)  |      |
| Hot water usage for baths                                       | 26.6456  | 26.2499  | 25.6926  | 24.6651  | 23.8957  | 23.0426  | 22.5818  | 23.1352  | 23.7377  | 24.6505                                | 25.6992  | 26.5555   | (42b)  |      |
| Hot water usage for other uses                                  | 37.5076  | 36.1437  | 34.7798  | 33.4159  | 32.0520  | 30.6881  | 30.6881  | 32.0520  | 33.4159  | 34.7798                                | 36.1437  | 37.5076   | (42c)  |      |
| Average daily hot water use (litres/day)                        |          |          |          |          |          |          |          |          |          |                                        |          | 115.6650  | (43)   |      |
| Daily hot water use                                             | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct                                    | Nov      | Dec       |        |      |
| Energy content (annual)                                         | 125.8284 | 123.1419 | 119.8701 | 114.8946 | 110.8542 | 106.5105 | 104.8409 | 108.0985 | 111.5343 | 116.0945                               | 121.1467 | 125.5020  | (44)   |      |
| Distribution loss (46)m = 0.15 x (45)m                          | 199.2815 | 175.3525 | 184.2359 | 157.2849 | 149.2311 | 130.9671 | 126.7959 | 133.8486 | 137.5329 | 157.5392                               | 172.5957 | 196.5059  | (45)   |      |
| Water storage loss (or HIU loss):                               |          |          |          |          |          |          |          |          |          |                                        |          |           |        |      |
| Store volume                                                    | 29.8922  | 26.3029  | 27.6354  | 23.5927  | 22.3847  | 19.6451  | 19.0194  | 20.0773  | 20.6299  | 23.6309                                | 25.8894  | 29.4759   | (46)   |      |
| a) If manufacturer declared loss factor is known (kWh/day):     |          |          |          |          |          |          |          |          |          |                                        |          |           |        |      |
| Temperature factor from Table 2b                                |          |          |          |          |          |          |          |          |          |                                        |          |           | 1.3938 | (48) |
| Enter (49) or (54) in (55)                                      |          |          |          |          |          |          |          |          |          |                                        |          |           | 0.5400 | (49) |
| Total storage loss                                              |          |          |          |          |          |          |          |          |          |                                        |          |           | 0.7527 | (55) |
| If cylinder contains dedicated solar storage                    | 23.3325  | 21.0745  | 23.3325  | 22.5798  | 23.3325  | 22.5798  | 23.3325  | 23.3325  | 22.5798  | 23.3325                                | 22.5798  | 23.3325   | (56)   |      |
| Primary loss                                                    | 23.3325  | 21.0745  | 23.3325  | 22.5798  | 23.3325  | 22.5798  | 23.3325  | 23.3325  | 22.5798  | 23.3325                                | 22.5798  | 23.3325   | (57)   |      |
| Combi loss                                                      | 23.2624  | 21.0112  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624  | 23.2624  | 22.5120  | 23.2624                                | 22.5120  | 23.2624   | (59)   |      |
| Total heat required for water heating calculated for each month | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000    | (61)   |      |
| WWHRS                                                           | 245.8764 | 217.4382 | 230.8308 | 202.3768 | 195.8260 | 176.0589 | 173.3908 | 180.4435 | 182.6248 | 204.1341                               | 217.6876 | 243.1008  | (62)   |      |
| PV diverter                                                     | -28.1953 | -24.9362 | -26.1117 | -21.6215 | -20.1505 | -17.2429 | -16.1625 | -17.1872 | -17.8402 | -21.0316                               | -23.8263 | -27.6732  | (63a)  |      |
| Solar input                                                     | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000                                | -0.0000  | -0.0000   | (63b)  |      |
| FGHRS                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000    | (63c)  |      |
| Output from w/h                                                 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000    | (63d)  |      |
| 12Total per year (kWh/year)                                     | 217.6810 | 192.5020 | 204.7191 | 180.7552 | 175.6755 | 158.8160 | 157.2283 | 163.2563 | 164.7846 | 183.1024                               | 193.8613 | 215.4276  | (64)   |      |
| Electric shower(s)                                              |          |          |          |          |          |          |          |          |          | Total per year (kWh/year) = Sum(64)m = |          | 2207.8094 | (64)   |      |
|                                                                 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000    | (64a)  |      |
| Heat gains from water heating, kWh/month                        |          |          |          |          |          |          |          |          |          |                                        |          | 0.0000    | (64a)  |      |
|                                                                 | 103.5370 | 91.9733  | 98.5344  | 88.3707  | 86.8953  | 79.6200  | 79.4356  | 81.7806  | 81.8032  | 89.6577                                | 93.4616  | 102.6141  | (65)   |      |

# Full SAP Calculation Printout



## 5. Internal gains (see Table 5 and 5a)

| Metabolic gains (Table 5), Watts                                                    | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |      |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| (66)m                                                                               | 111.6962 | 111.6962 | 111.6962 | 111.6962 | 111.6962 | 111.6962 | 111.6962 | 111.6962 | 111.6962 | 111.6962 | 111.6962 | 111.6962 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 100.2805 | 111.0249 | 100.2805 | 103.6232 | 100.2805 | 103.6232 | 100.2805 | 100.2805 | 103.6232 | 100.2805 | 103.6232 | 100.2805 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 196.1273 | 198.1625 | 193.0339 | 182.1157 | 168.3334 | 155.3800 | 146.7264 | 144.6912 | 149.8198 | 160.7380 | 174.5203 | 187.4736 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 34.1696  | 34.1696  | 34.1696  | 34.1696  | 34.1696  | 34.1696  | 34.1696  | 34.1696  | 34.1696  | 34.1696  | 34.1696  | 34.1696  | (69) |
| Pumps, fans                                                                         | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 3.0000   | 3.0000   | 3.0000   | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | (71) |
| Water heating gains (Table 5)                                                       | 139.1627 | 136.8650 | 132.4387 | 122.7371 | 116.7947 | 110.5834 | 106.7682 | 109.9201 | 113.6155 | 120.5076 | 129.8077 | 137.9222 | (72) |
| Total internal gains                                                                | 495.0793 | 505.5612 | 485.2619 | 467.9848 | 444.9175 | 426.0955 | 410.2840 | 411.4007 | 423.5674 | 441.0350 | 467.4600 | 485.1852 | (73) |

## 6. Solar gains

| [Jan]       |          |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c |          |          | Access<br>factor<br>Table 6d |  |  | Gains<br>W    |
|-------------|----------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|----------|----------|------------------------------|--|--|---------------|
| East        |          |          |          |          | 7.2000     | 19.6403                        | 0.6300                            | 0.7000                             |          |          | 0.7700                       |  |  | 43.2167 (76)  |
| West        |          |          |          |          | 5.9600     | 19.6403                        | 0.6300                            | 0.7000                             |          |          | 0.7700                       |  |  | 35.7738 (80)  |
|             |          |          |          |          |            |                                |                                   |                                    |          |          |                              |  |  |               |
| Solar gains | 78.9905  | 154.5222 | 254.4761 | 371.1382 | 454.8438   | 465.6136                       | 443.2831                          | 380.7737                           | 295.9662 | 183.3536 | 98.4919                      |  |  | 64.9580 (83)  |
| Total gains | 574.0699 | 660.0834 | 739.7380 | 839.1231 | 899.7614   | 891.7091                       | 853.5671                          | 792.1744                           | 719.5336 | 624.3887 | 565.9519                     |  |  | 550.1432 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |                           |         |         |         |         |      |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|---------|---------|------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |                           |         |         |         | 21.0000 | (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |                           |         |         |         |         |      |
| tau                                                                         | 20.1346 | 20.1810 | 20.2267 | 20.4441 | 20.4853 | 20.6793 | 20.6793 | 20.7156 | 20.6041                   | 20.4853 | 20.4021 | 20.3159 |         |      |
| alpha                                                                       | 2.3423  | 2.3454  | 2.3484  | 2.3629  | 2.3657  | 2.3786  | 2.3786  | 2.3810  | 2.3736                    | 2.3657  | 2.3601  | 2.3544  |         |      |
| util living area                                                            | 0.9355  | 0.9108  | 0.8701  | 0.7905  | 0.6797  | 0.5403  | 0.4200  | 0.4613  | 0.6508                    | 0.8302  | 0.9113  | 0.9409  | (86)    |      |
| MIT                                                                         | 18.1653 | 18.5100 | 19.0530 | 19.7602 | 20.3408 | 20.7343 | 20.8951 | 20.8657 | 20.5615                   | 19.7915 | 18.8699 | 18.1120 | (87)    |      |
| Th 2                                                                        | 19.8196 | 19.8220 | 19.8243 | 19.8353 | 19.8374 | 19.8469 | 19.8469 | 19.8487 | 19.8432                   | 19.8374 | 19.8332 | 19.8289 | (88)    |      |
| util rest of house                                                          | 0.9261  | 0.8980  | 0.8511  | 0.7593  | 0.6305  | 0.4666  | 0.3237  | 0.3639  | 0.5817                    | 0.7976  | 0.8964  | 0.9322  | (89)    |      |
| MIT 2                                                                       | 16.5572 | 16.9898 | 17.6671 | 18.5352 | 19.2149 | 19.6447 | 19.7907 | 19.7719 | 19.4803                   | 18.5975 | 17.4566 | 16.4954 | (90)    |      |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         | 0.5108  | (91)    |      |
| MIT                                                                         | 17.3786 | 17.7663 | 18.3750 | 19.1609 | 19.7900 | 20.2013 | 20.3548 | 20.3306 | 20.0325                   | 19.2074 | 18.1785 | 17.3211 | (92)    |      |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000  |         |      |
| adjusted MIT                                                                | 17.3786 | 17.7663 | 18.3750 | 19.1609 | 19.7900 | 20.2013 | 20.3548 | 20.3306 | 20.0325                   | 19.2074 | 18.1785 | 17.3211 | (93)    |      |

## 8. Space heating requirement

|                                                                                |           |           |           |          |          |          |          |          |          |               |           |           |       |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|---------------|-----------|-----------|-------|
| Utilisation                                                                    | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec       |       |
| Useful gains                                                                   | 0.8996    | 0.8691    | 0.8222    | 0.7386   | 0.6283   | 0.4905   | 0.3676   | 0.4065   | 0.5940   | 0.7766        | 0.8689    | 0.9068    | (94)  |
| Ext temp.                                                                      | 516.4067  | 573.6551  | 608.2144  | 619.7813 | 565.3505 | 437.3657 | 313.7985 | 321.9860 | 427.4227 | 484.8765      | 491.7811  | 498.8602  | (95)  |
| Heat loss rate W                                                               | 4.3000    | 4.9000    | 6.5000    | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000    | 4.2000    | (96)  |
| Space heating kWh                                                              | 1206.3353 | 1184.0262 | 1090.3316 | 932.1150 | 733.4268 | 503.0386 | 337.2140 | 352.3802 | 534.7336 | 780.3305      | 1008.4568 | 1199.4606 | (97)  |
| Space heating requirement - total per year (kWh/year)                          | 513.3068  | 410.1694  | 358.6952  | 224.8803 | 125.0488 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 219.8178      | 372.0065  | 521.2467  | (98a) |
| Solar heating kWh                                                              |           |           |           |          |          |          |          |          |          |               |           | 2745.1714 |       |
| Solar heating contribution - total per year (kWh/year)                         | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000    | (98b) |
| Space heating kWh                                                              | 513.3068  | 410.1694  | 358.6952  | 224.8803 | 125.0488 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 219.8178      | 372.0065  | 521.2467  | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |               |           | 2745.1714 |       |
| Space heating per m2                                                           |           |           |           |          |          |          |          |          |          | (98c) / (4) = |           | 39.4989   | (99)  |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                       |          |          |          |          |          |          |          |          |          |          |          |          |       |
|-----------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-------|
| Fraction of space heat from secondary/supplementary system (Table 11) |          |          |          |          |          |          |          |          |          |          |          | 0.0000   | (201) |
| Fraction of space heat from main system(s)                            |          |          |          |          |          |          |          |          |          |          |          | 1.0000   | (202) |
| Efficiency of main space heating system 1 (in %)                      |          |          |          |          |          |          |          |          |          |          |          | 92.3000  | (206) |
| Efficiency of main space heating system 2 (in %)                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000   | (207) |
| Efficiency of secondary/supplementary heating system, %               |          |          |          |          |          |          |          |          |          |          |          | 0.0000   | (208) |
|                                                                       | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |       |
| Space heating requirement                                             | 513.3068 | 410.1694 | 358.6952 | 224.8803 | 125.0488 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 219.8178 | 372.0065 | 521.2467 | (98)  |
| Space heating efficiency (main heating system 1)                      | 92.3000  | 92.3000  | 92.3000  | 92.3000  | 92.3000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 92.3000  | 92.3000  | 92.3000  | (210) |
| Space heating fuel (main heating system)                              | 556.1287 | 444.3872 | 388.6188 | 243.6406 | 135.4808 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 238.1557 | 403.0406 | 564.7310 | (211) |
| Space heating efficiency (main heating system 2)                      | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (212) |
| Space heating fuel (main heating system 2)                            | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (213) |
| Space heating fuel (secondary)                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (215) |
| Water heating                                                         |          |          |          |          |          |          |          |          |          |          |          |          |       |
| Water heating requirement                                             | 217.6810 | 192.5020 | 204.7191 | 180.7552 | 175.6755 | 158.8160 | 157.2283 | 163.2563 | 164.7846 | 183.1024 | 193.8613 | 215.4276 | (64)  |

# Full SAP Calculation Printout



|                                                                                                              |          |          |          |           |           |           |           |           |           |          |          |                  |
|--------------------------------------------------------------------------------------------------------------|----------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|------------------|
| Efficiency of water heater (217)m                                                                            | 85.9145  | 85.7123  | 85.3042  | 84.5508   | 83.3111   | 79.8000   | 79.8000   | 79.8000   | 79.8000   | 84.4707  | 85.4966  | 79.8000 (216)    |
| Fuel for water heating, kWh/month                                                                            | 253.3693 | 224.5909 | 239.9870 | 213.7831  | 210.8669  | 199.0175  | 197.0280  | 204.5818  | 206.4969  | 216.7645 | 226.7474 | 85.9648 (217)    |
| Space cooling fuel requirement                                                                               |          |          |          |           |           |           |           |           |           |          |          | 250.5998 (219)   |
| (221)m                                                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000 (221)     |
| Pumps and Fa                                                                                                 | 7.3041   | 6.5973   | 7.3041   | 7.0685    | 7.3041    | 7.0685    | 7.3041    | 7.3041    | 7.0685    | 7.3041   | 7.0685   | 7.3041 (231)     |
| Lighting                                                                                                     | 20.8363  | 16.7157  | 15.0506  | 11.0267   | 8.5174    | 6.9587    | 7.7698    | 10.0995   | 13.1182   | 17.2119  | 19.4407  | 21.4154 (232)    |
| Electricity generated by PVs (Appendix M) (negative quantity) (233a)m                                        | -36.2185 | -50.5489 | -71.9533 | -80.1110  | -85.7513  | -79.8381  | -78.8622  | -74.7578  | -67.4159  | -57.4389 | -39.6401 | -31.3747 (233a)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000 (234a)    |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000 (235a)    |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000 (235c)    |
| Electricity generated by PVs (Appendix M) (negative quantity) (233b)m                                        | -22.0565 | -46.2067 | -91.4811 | -136.8798 | -180.4846 | -181.1438 | -178.9976 | -151.7751 | -111.5482 | -65.8884 | -29.3873 | -17.4551 (233b)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000 (234b)    |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000 (235b)    |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000 (235d)    |
| Annual totals kWh/year                                                                                       |          |          |          |           |           |           |           |           |           |          |          |                  |
| Space heating fuel - main system 1                                                                           |          |          |          |           |           |           |           |           |           |          |          | 2974.1835 (211)  |
| Space heating fuel - main system 2                                                                           |          |          |          |           |           |           |           |           |           |          |          | 0.0000 (213)     |
| Space heating fuel - secondary                                                                               |          |          |          |           |           |           |           |           |           |          |          | 0.0000 (215)     |
| Efficiency of water heater                                                                                   |          |          |          |           |           |           |           |           |           |          |          | 79.8000          |
| Water heating fuel used                                                                                      |          |          |          |           |           |           |           |           |           |          |          | 2643.8332 (219)  |
| Space cooling fuel                                                                                           |          |          |          |           |           |           |           |           |           |          |          | 0.0000 (221)     |
| Electricity for pumps and fans:                                                                              |          |          |          |           |           |           |           |           |           |          |          |                  |
| Total electricity for the above, kWh/year                                                                    |          |          |          |           |           |           |           |           |           |          |          | 86.0000 (231)    |
| Electricity for lighting (calculated in Appendix L)                                                          |          |          |          |           |           |           |           |           |           |          |          | 168.1610 (232)   |
| Energy saving/generation technologies (Appendices M ,N and Q)                                                |          |          |          |           |           |           |           |           |           |          |          |                  |
| PV generation                                                                                                |          |          |          |           |           |           |           |           |           |          |          | -1967.2147 (233) |
| Wind generation                                                                                              |          |          |          |           |           |           |           |           |           |          |          | 0.0000 (234)     |
| Hydro-electric generation (Appendix N)                                                                       |          |          |          |           |           |           |           |           |           |          |          | 0.0000 (235a)    |
| Electricity generated - Micro CHP (Appendix N)                                                               |          |          |          |           |           |           |           |           |           |          |          | 0.0000 (235)     |
| Appendix Q - special features                                                                                |          |          |          |           |           |           |           |           |           |          |          |                  |
| Energy saved or generated                                                                                    |          |          |          |           |           |           |           |           |           |          |          | -0.0000 (236)    |
| Energy used                                                                                                  |          |          |          |           |           |           |           |           |           |          |          | 0.0000 (237)     |
| Total delivered energy for all uses                                                                          |          |          |          |           |           |           |           |           |           |          |          | 3904.9630 (238)  |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                               | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|-----------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1                 | 2974.1835          | 0.2100                        | 624.5785 (261)           |
| Total CO2 associated with community systems   |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                    | 2643.8332          | 0.2100                        | 555.2050 (264)           |
| Space and water heating                       |                    |                               | 1179.7835 (265)          |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293 (267)            |
| Energy for lighting                           | 168.1610           | 0.1443                        | 24.2708 (268)            |
| Energy saving/generation technologies         |                    |                               |                          |
| PV Unit electricity used in dwelling          | -753.9106          | 0.1348                        | -101.6186                |
| PV Unit electricity exported                  | -1213.3041         | 0.1260                        | -152.8888                |
| Total                                         |                    |                               | -254.5074 (269)          |
| Total CO2, kg/year                            |                    |                               | 961.4762 (272)           |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 13.8300 (273)            |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 2974.1835          | 1.1300                              | 3360.8273 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2643.8332          | 1.1300                              | 2987.5316 (278)            |
| Space and water heating                     |                    |                                     | 6348.3589 (279)            |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008 (281)             |
| Energy for lighting                         | 168.1610           | 1.5338                              | 257.9309 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -753.9106          | 1.4982                              | -1129.4843                 |
| PV Unit electricity exported                | -1213.3041         | 0.4625                              | -561.2136                  |
| Total                                       |                    |                                     | -1690.6979 (283)           |
| Total Primary energy kWh/year               |                    |                                     | 5045.6927 (286)            |
| Target Primary Energy Rate (TPER)           |                    |                                     | 72.6000 (287)              |

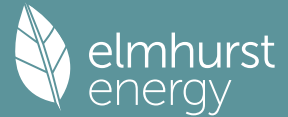
## SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

### CALCULATION OF FABRIC ENERGY EFFICIENCY

#### 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m)              | Volume<br>(m3)         |
|--------------------------------------------------------|--------------|-----------------------------------|------------------------|
| Main dwelling                                          |              |                                   |                        |
| Ground floor                                           | 39.8000 (1b) | x 2.7500 (2b)                     | = 109.4500 (1b) - (3b) |
| First floor                                            | 29.7000 (1c) | x 2.5900 (2c)                     | = 76.9230 (1c) - (3c)  |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 69.5000      |                                   | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 186.3730 (5)           |

# Full SAP Calculation Printout



## 2. Ventilation rate

|                                                                                                         |                                                       |        |        |        |        |        |        |        |        |        |                             |                      |       |
|---------------------------------------------------------------------------------------------------------|-------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-----------------------------|----------------------|-------|
|                                                                                                         |                                                       |        |        |        |        |        |        |        |        |        |                             | m3 per hour          |       |
| Number of open chimneys                                                                                 |                                                       |        |        |        |        |        |        |        |        |        | 0 * 80 =                    | 0.0000 (6a)          |       |
| Number of open flues                                                                                    |                                                       |        |        |        |        |        |        |        |        |        | 0 * 20 =                    | 0.0000 (6b)          |       |
| Number of chimneys / flues attached to closed fire                                                      |                                                       |        |        |        |        |        |        |        |        |        | 0 * 10 =                    | 0.0000 (6c)          |       |
| Number of flues attached to solid fuel boiler                                                           |                                                       |        |        |        |        |        |        |        |        |        | 0 * 20 =                    | 0.0000 (6d)          |       |
| Number of flues attached to other heater                                                                |                                                       |        |        |        |        |        |        |        |        |        | 0 * 35 =                    | 0.0000 (6e)          |       |
| Number of blocked chimneys                                                                              |                                                       |        |        |        |        |        |        |        |        |        | 0 * 20 =                    | 0.0000 (6f)          |       |
| Number of intermittent extract fans                                                                     |                                                       |        |        |        |        |        |        |        |        |        | 2 * 10 =                    | 20.0000 (7a)         |       |
| Number of passive vents                                                                                 |                                                       |        |        |        |        |        |        |        |        |        | 0 * 10 =                    | 0.0000 (7b)          |       |
| Number of flueless gas fires                                                                            |                                                       |        |        |        |        |        |        |        |        |        | 0 * 40 =                    | 0.0000 (7c)          |       |
|                                                                                                         |                                                       |        |        |        |        |        |        |        |        |        |                             | Air changes per hour |       |
| Infiltration due to chimneys, flues and fans                                                            | = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = |        |        |        |        |        |        |        |        |        | 20.0000 / (5) =             | 0.1073 (8)           |       |
| Pressure test                                                                                           |                                                       |        |        |        |        |        |        |        |        |        | Yes                         |                      |       |
| Pressure Test Method                                                                                    |                                                       |        |        |        |        |        |        |        |        |        | Blower Door                 |                      |       |
| Measured/design AP50                                                                                    |                                                       |        |        |        |        |        |        |        |        |        | 3.0000 (17)                 |                      |       |
| Infiltration rate                                                                                       |                                                       |        |        |        |        |        |        |        |        |        | 0.2573 (18)                 |                      |       |
| Number of sides sheltered                                                                               |                                                       |        |        |        |        |        |        |        |        |        | 1 (19)                      |                      |       |
| Shelter factor                                                                                          |                                                       |        |        |        |        |        |        |        |        |        | (20) = 1 - [0.075 x (19)] = | 0.9250 (20)          |       |
| Infiltration rate adjusted to include shelter factor                                                    |                                                       |        |        |        |        |        |        |        |        |        | (21) = (18) x (20) =        | 0.2380 (21)          |       |
|                                                                                                         |                                                       |        |        |        |        |        |        |        |        |        |                             |                      |       |
| Wind speed                                                                                              | Jan                                                   | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov                         | Dec                  |       |
| Wind factor                                                                                             | 5.1000                                                | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000                      | 4.7000               | (22)  |
| Wind factor                                                                                             | 1.2750                                                | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250                      | 1.1750               | (22a) |
| Adj infilt rate                                                                                         | 0.3035                                                | 0.2975 | 0.2916 | 0.2618 | 0.2559 | 0.2261 | 0.2261 | 0.2202 | 0.2380 | 0.2559 | 0.2678                      | 0.2797               | (22b) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |                                                       |        |        |        |        |        |        |        |        |        |                             |                      |       |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =            |                                                       |        |        |        |        |        |        |        |        |        |                             |                      |       |
| Effective ac                                                                                            | 0.5460                                                | 0.5443 | 0.5425 | 0.5343 | 0.5327 | 0.5256 | 0.5256 | 0.5242 | 0.5283 | 0.5327 | 0.5358                      | 0.5391               | (25)  |
|                                                                                                         |                                                       |        |        |        |        |        |        |        |        |        |                             |                      |       |
|                                                                                                         |                                                       |        |        |        |        |        |        |        |        |        |                             |                      |       |

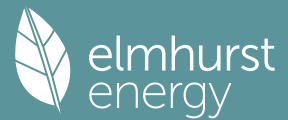
## 3. Heat losses and heat loss parameter

| Element                                                          | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K     | A x U<br>W/K | K-value<br>kJ/m2K                    | A x K<br>kJ/K |       |
|------------------------------------------------------------------|-------------|----------------|---------------|----------------------|--------------|--------------------------------------|---------------|-------|
| Main dwelling                                                    |             |                |               |                      |              |                                      |               |       |
| Solid Door                                                       |             |                | 1.7900        | 1.2000               | 2.1480       |                                      |               | (26)  |
| Windows / Glazed Doors                                           |             |                | 13.1600       | 1.1450               | 15.0687      |                                      |               | (27)  |
| Heatloss Floor 1                                                 |             |                | 39.8000       | 0.1200               | 4.7760       | 75.0000                              | 2985.0000     | (28a) |
| External Wall                                                    | 66.4000     | 14.9500        | 51.4500       | 0.1500               | 7.7175       | 9.0000                               | 463.0500      | (29a) |
| RIR Stud Wall                                                    | 41.5000     |                | 41.5000       | 0.1500               | 6.2250       | 9.0000                               | 373.5000      | (29a) |
| Dormer Walls                                                     | 8.0000      |                | 8.0000        | 0.1500               | 1.2000       | 9.0000                               | 72.0000       | (29a) |
| Adj To RIR Ins At Slope                                          | 5.1000      |                | 5.1000        | 0.1400               | 0.7140       | 9.0000                               | 45.9000       | (30)  |
| Slope Roof                                                       | 38.7700     |                | 38.7700       | 0.1400               | 5.4278       | 9.0000                               | 348.9300      | (30)  |
| Total net area of external elements Aum(A, m2)                   |             |                | 199.5700      |                      |              |                                      |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)                              |             |                |               | (26)...(30) + (32) = | 43.2770      |                                      |               | (33)  |
| Main dwelling                                                    |             |                |               |                      |              |                                      |               |       |
| Party Wall 1                                                     |             |                | 20.7500       | 0.0000               | 0.0000       | 45.0000                              | 933.7500      | (32)  |
| Internal Wall 1                                                  |             |                | 73.5300       |                      |              | 9.0000                               | 661.7700      | (32c) |
| Internal Floor 1                                                 |             |                | 29.7000       |                      |              | 18.0000                              | 534.6000      | (32d) |
| Internal Ceiling 1                                               |             |                | 29.7000       |                      |              | 9.0000                               | 267.3000      | (32e) |
| Heat capacity Cm = Sum(A x k)                                    |             |                |               |                      |              | (28)...(30) + (32) + (32a)...(32e) = | 6685.8000     | (34)  |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K                |             |                |               |                      |              |                                      | 96.1986       | (35)  |
| List of Thermal Bridges                                          |             |                |               |                      |              |                                      |               |       |
| K1 Element                                                       |             |                |               | Length               | Psi-value    | Total                                |               |       |
| E2 Other lintels (including other steel lintels)                 |             |                |               | 10.4200              | 0.0840       | 0.8753                               |               |       |
| E3 Sill                                                          |             |                |               | 9.5700               | 0.0340       | 0.3254                               |               |       |
| E4 Jamb                                                          |             |                |               | 34.3000              | 0.0430       | 1.4749                               |               |       |
| E16 Corner (normal)                                              |             |                |               | 27.9000              | 0.0300       | 0.8370                               |               |       |
| E18 Party wall between dwellings                                 |             |                |               | 2.7500               | 0.0400       | 0.1100                               |               |       |
| E11 Eaves (insulation at rafter level)                           |             |                |               | 10.6000              | 0.0130       | 0.1378                               |               |       |
| E17 Corner (inverted - internal area greater than external area) |             |                |               | 16.0000              | 0.0150       | 0.2400                               |               |       |
| E13 Gable (insulation at rafter level)                           |             |                |               | 10.8000              | 0.0240       | 0.2592                               |               |       |
| E6 Intermediate floor within a dwelling                          |             |                |               | 27.1000              | 0.0800       | 2.1680                               |               |       |
| P5 Party wall - Roof (insulation at rafter level)                |             |                |               | 6.4000               | 0.2400       | 1.5360                               |               |       |
| P2 Party wall - Intermediate floor within a dwelling             |             |                |               | 2.9000               | 0.0000       | 0.0000                               |               |       |
| R4 Ridge (vaulted ceiling)                                       |             |                |               | 17.7000              | 0.1200       | 2.1240                               |               |       |
| E5 Ground floor (normal)                                         |             |                |               | 21.4000              | 0.3200       | 6.8480                               |               |       |
| E25 Staggered party wall between dwellings                       |             |                |               | 6.7500               | 0.1200       | 0.8100                               |               |       |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)       |             |                |               |                      |              |                                      | 17.7456       | (36)  |
| Point Thermal bridges                                            |             |                |               |                      |              | (36a) =                              | 0.0000        |       |
| Total fabric heat loss                                           |             |                |               |                      |              | (33) + (36) + (36a) =                | 61.0226       | (37)  |

## 4. Water heating energy requirements (kWh/year)

|                                          |         |         |         |         |         |         |         |         |         |         |         |         |
|------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Assumed occupancy                        | 2.2339  |         |         |         |         |         |         |         |         |         |         |         |
| Hot water usage for mixer showers        | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  |
| Hot water usage for baths                | 26.6456 | 26.2499 | 25.6926 | 24.6651 | 23.8957 | 23.0426 | 22.5818 | 23.1352 | 23.7377 | 24.6505 | 25.6992 | 26.5555 |
| Hot water usage for other uses           | 37.5076 | 36.1437 | 34.7798 | 33.4159 | 32.0520 | 30.6881 | 30.6881 | 32.0520 | 33.4159 | 34.7798 | 36.1437 | 37.5076 |
| Average daily hot water use (litres/day) |         |         |         |         |         |         |         |         |         |         |         | 58.8025 |

# Full SAP Calculation Printout



|                                                                 | Jan                                                  | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec      |          |
|-----------------------------------------------------------------|------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------|----------|
| Daily hot water use                                             | 64.1532                                              | 62.3936 | 60.4724 | 58.0810 | 55.9477 | 53.7307 | 53.2699 | 55.1871 | 57.1536 | 59.4303 | 61.8429 | 64.0631  | (44)     |
| Energy content (annual)                                         | 101.6030                                             | 88.8476 | 92.9438 | 79.5100 | 75.3164 | 66.0681 | 64.4253 | 68.3332 | 70.4761 | 80.6464 | 88.1066 | 100.3074 | (45)     |
| Distribution loss (46)m = 0.15 x (45)m                          | 0.0000                                               | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | (46)     |
| Water storage loss (or HIU loss):                               | 0.0000                                               | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | (56)     |
| Total storage loss                                              | 0.0000                                               | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | (57)     |
| If cylinder contains dedicated solar storage                    | 0.0000                                               | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | (59)     |
| Primary loss                                                    | 0.0000                                               | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | (61)     |
| Combi loss                                                      | 0.0000                                               | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | (62)     |
| Total heat required for water heating calculated for each month | 86.3626                                              | 75.5205 | 79.0023 | 67.5835 | 64.0189 | 56.1579 | 54.7615 | 58.0832 | 59.9047 | 68.5495 | 74.8906 | 85.2613  | (63a)    |
| WWHRS                                                           | 0.0000                                               | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | (63b)    |
| PV diverter                                                     | 0.0000                                               | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | (63c)    |
| Solar input                                                     | 0.0000                                               | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | (63d)    |
| FGHRS                                                           | 0.0000                                               | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | (64)     |
| Output from w/h                                                 | 86.3626                                              | 75.5205 | 79.0023 | 67.5835 | 64.0189 | 56.1579 | 54.7615 | 58.0832 | 59.9047 | 68.5495 | 74.8906 | 85.2613  | (64)     |
| 12Total per year (kWh/year)                                     | Total per year (kWh/year) = Sum(64)m = 830.0963 (64) |         |         |         |         |         |         |         |         |         |         |          | 830 (64) |
| Electric shower(s)                                              | 49.3916                                              | 44.0083 | 48.0554 | 45.8587 | 46.7192 | 44.5656 | 46.0511 | 46.7192 | 45.8587 | 48.0554 | 47.1517 | 49.3916  | (64a)    |
| Heat gains from water heating, kWh/month                        | 33.9385                                              | 29.8822 | 31.7644 | 28.3605 | 27.6845 | 25.1809 | 25.2031 | 26.2006 | 26.4408 | 29.1512 | 30.5106 | 33.6632  | (65)     |

## 5. Internal gains (see Table 5 and 5a)

| Metabolic gains (Table 5), Watts                                                    | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |      |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| (66)m                                                                               | 111.6962 | 111.6962 | 111.6962 | 111.6962 | 111.6962 | 111.6962 | 111.6962 | 111.6962 | 111.6962 | 111.6962 | 111.6962 | 111.6962 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 100.2805 | 111.0249 | 100.2805 | 103.6232 | 100.2805 | 103.6232 | 100.2805 | 100.2805 | 103.6232 | 100.2805 | 103.6232 | 100.2805 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 196.1273 | 198.1625 | 193.0339 | 182.1157 | 168.3334 | 155.3800 | 146.7264 | 144.6912 | 149.8198 | 160.7380 | 174.5203 | 187.4736 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 34.1696  | 34.1696  | 34.1696  | 34.1696  | 34.1696  | 34.1696  | 34.1696  | 34.1696  | 34.1696  | 34.1696  | 34.1696  | 34.1696  | (69) |
| Pumps, fans                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | (71) |
| Water heating gains (Table 5)                                                       | 45.6163  | 44.4675  | 42.6941  | 39.3896  | 37.2104  | 34.9734  | 33.8752  | 35.2159  | 36.7234  | 39.1817  | 42.3758  | 45.2463  | (72) |
| Total internal gains                                                                | 398.5330 | 410.1638 | 392.5174 | 381.6374 | 362.3332 | 350.4855 | 337.3910 | 336.6964 | 346.6752 | 356.7091 | 377.0281 | 389.5093 | (73) |

## 6. Solar gains

| [Jan]       |          |          |          |           | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b |           | FF<br>Specific data<br>or Table 6c |          | Access<br>factor<br>Table 6d |               | Gains<br>W   |  |
|-------------|----------|----------|----------|-----------|------------|--------------------------------|-----------------------------------|-----------|------------------------------------|----------|------------------------------|---------------|--------------|--|
| East        |          |          |          |           | 7.2000     | 19.6403                        | 0.7600                            |           | 0.0000                             |          | 0.7700                       |               | 82.7531 (76) |  |
| West        |          |          |          |           | 5.9600     | 19.6403                        | 0.7600                            |           | 0.0000                             |          | 0.7700                       |               | 68.5012 (80) |  |
|             |          |          |          |           |            |                                |                                   |           |                                    |          |                              |               |              |  |
| Solar gains | 151.2542 | 295.8854 | 487.2810 | 710.6703  | 870.9532   | 891.5756                       | 848.8163                          | 729.1206  | 566.7280                           | 351.0929 | 188.5962                     | 124.3841 (83) |              |  |
| Total gains | 549.7872 | 706.0491 | 879.7984 | 1092.3077 | 1233.2864  | 1242.0611                      | 1186.2072                         | 1065.8171 | 913.4032                           | 707.8020 | 565.6244                     | 513.8934 (84) |              |  |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |                           |         |         |              |             |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|-------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |                           |         |         | 21.0000 (85) |             |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |                           |         |         |              |             |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep                       | Oct     | Nov     | Dec          |             |
| tau                                                                         | 19.6305 | 19.6534 | 19.6758 | 19.7819 | 19.8019 | 19.8954 | 19.8954 | 19.9129 | 19.8593                   | 19.8019 | 19.7615 | 19.7195      |             |
| alpha                                                                       | 2.3087  | 2.3102  | 2.3117  | 2.3188  | 2.3201  | 2.3264  | 2.3264  | 2.3275  | 2.3240                    | 2.3201  | 2.3174  | 2.3146       |             |
| util living area                                                            | 0.9412  | 0.9013  | 0.8327  | 0.7123  | 0.5716  | 0.4311  | 0.3265  | 0.3721  | 0.5714                    | 0.8010  | 0.9131  | 0.9488 (86)  |             |
| MIT                                                                         | 18.0320 | 18.5263 | 19.2213 | 19.9965 | 20.5309 | 20.8260 | 20.9341 | 20.9089 | 20.6537                   | 19.8546 | 18.7870 | 17.9358 (87) |             |
| Th 2                                                                        | 19.7932 | 19.7944 | 19.7956 | 19.8012 | 19.8023 | 19.8072 | 19.8072 | 19.8081 | 19.8053                   | 19.8023 | 19.8002 | 19.7979 (88) |             |
| util rest of house                                                          | 0.9324  | 0.8873  | 0.8098  | 0.6756  | 0.5200  | 0.3632  | 0.2446  | 0.2855  | 0.5005                    | 0.7646  | 0.8982  | 0.9410 (89)  |             |
| MIT 2                                                                       | 17.1306 | 17.6115 | 18.2786 | 19.0011 | 19.4697 | 19.7091 | 19.7814 | 19.7699 | 19.5908                   | 18.8996 | 17.8795 | 17.0395 (90) |             |
| Living area fraction                                                        | 17.5910 | 18.0787 | 18.7601 | 19.5096 | 20.0117 | 20.2796 | 20.3702 | 20.3517 | fLA = Living area / (4) = |         |         |              | 0.5108 (91) |
| MIT                                                                         | 17.5910 | 18.0787 | 18.7601 | 19.5096 | 20.0117 | 20.2796 | 20.3702 | 20.3517 | 20.1337                   | 19.3874 | 18.3430 | 17.4974 (92) |             |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |             |
| adjusted MIT                                                                | 17.5910 | 18.0787 | 18.7601 | 19.5096 | 20.0117 | 20.2796 | 20.3702 | 20.3517 | 20.1337                   | 19.3874 | 18.3430 | 17.4974 (93) |             |

## 8. Space heating requirement

| Utilisation                                            | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov       | Dec       |       |
|--------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|-----------|-----------|-------|
| Useful gains                                           | 500.7962  | 608.7669  | 692.1700  | 727.3229 | 653.0123 | 485.6124 | 337.0143 | 347.5812 | 476.0450 | 530.8340 | 494.9676  | 473.2166  | (95)  |
| Ext temp.                                              | 4.3000    | 4.9000    | 6.5000    | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000  | 7.1000    | 4.2000    | (96)  |
| Heat loss rate W                                       | 1257.4105 | 1245.3397 | 1157.2129 | 996.0477 | 779.5359 | 530.1713 | 351.9310 | 368.5550 | 564.2513 | 824.1461 | 1056.6077 | 1252.3349 | (97)  |
| Space heating kWh                                      | 562.9210  | 427.7770  | 345.9919  | 193.4818 | 94.1336  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 218.2242 | 404.3809  | 579.6640  | (98a) |
| Space heating requirement - total per year (kWh/year)  | 2826.5744 |           |           |          |          |          |          |          |          |          |           |           |       |
| Solar heating kWh                                      | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | (98b) |
| Solar heating contribution - total per year (kWh/year) | 0.0000    |           |           |          |          |          |          |          |          |          |           |           |       |
| Space heating kWh                                      | 562.9210  | 427.7770  | 345.9919  | 193.4818 | 94.1336  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 218.2242 | 404.3809  | 579.6640  | (98c) |

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Space heating requirement after solar contribution - total per year (kWh/year)  
Space heating per m2

2826.5744  
(98c) / (4) = 40.6701 (99)

## 8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

|                                  | Jan    | Feb    | Mar    | Apr    | May     | Jun       | Jul       | Aug       | Sep     | Oct     | Nov    | Dec            |
|----------------------------------|--------|--------|--------|--------|---------|-----------|-----------|-----------|---------|---------|--------|----------------|
| Ext. temp.                       | 4.3000 | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000   | 16.6000   | 16.4000   | 14.1000 | 10.6000 | 7.1000 | 4.2000         |
| Heat loss rate W                 |        |        |        |        |         |           |           |           |         |         |        |                |
| Utilisation                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.8426    | 0.8848    | 0.8567    | 0.0000  | 0.0000  | 0.0000 | 0.0000 (100)   |
| Useful loss                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 739.3846  | 611.2143  | 607.2257  | 0.0000  | 0.0000  | 0.0000 | 0.0000 (101)   |
| Total gains                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 1413.0753 | 1349.7895 | 1211.0312 | 0.0000  | 0.0000  | 0.0000 | 0.0000 (102)   |
| Space cooling kWh                |        |        |        |        |         |           |           |           |         |         |        |                |
| 0.0000                           | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 485.0574  | 549.4999  | 449.2313  | 0.0000  | 0.0000  | 0.0000 | 0.0000 (103)   |
| Cooled fraction                  |        |        |        |        |         |           |           |           |         |         |        |                |
| Intermittency factor (Table 10b) |        |        |        |        |         |           |           |           |         |         |        |                |
| 0.2500                           | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500  | 0.2500    | 0.2500    | 0.2500    | 0.2500  | 0.2500  | 0.2500 | 0.2500 (104)   |
| Space cooling kWh                |        |        |        |        |         |           |           |           |         |         |        |                |
| 0.0000                           | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 121.2643  | 137.3750  | 112.3078  | 0.0000  | 0.0000  | 0.0000 | 0.0000 (105)   |
| Space cooling requirement        |        |        |        |        |         |           |           |           |         |         |        |                |
| Energy for space heating         |        |        |        |        |         |           |           |           |         |         |        | 370.9471 (107) |
| Energy for space cooling         |        |        |        |        |         |           |           |           |         |         |        | 40.6701 (99)   |
| Total                            |        |        |        |        |         |           |           |           |         |         |        | 5.3374 (108)   |
| Fabric Energy Efficiency (DFEE)  |        |        |        |        |         |           |           |           |         |         |        | 46.0075 (109)  |
|                                  |        |        |        |        |         |           |           |           |         |         |        | 46.0 (109)     |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m)              | Volume<br>(m3)         |
|--------------------------------------------------------|--------------|-----------------------------------|------------------------|
| Main dwelling                                          |              |                                   |                        |
| Ground floor                                           | 39.8000 (1b) | x 2.7500 (2b)                     | = 109.4500 (1b) - (3b) |
| First floor                                            | 29.7000 (1c) | x 2.5900 (2c)                     | = 76.9230 (1c) - (3c)  |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 69.5000      |                                   | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 186.3730 (5)           |

## 2. Ventilation rate

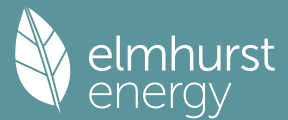
|                                                                                                    | m3 per hour                             |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 2 * 10 = 20.0000 (7a)                   |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 20.0000 / (5) = 0.1073 (8)              |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 5.0000 (17)                             |
| Infiltration rate                                                                                  | 0.3573 (18)                             |
| Number of sides sheltered                                                                          | 1 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.9250 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.3305 (21)        |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate                                                                                         | 0.4214 | 0.4131 | 0.4049 | 0.3636 | 0.3553 | 0.3140 | 0.3140 | 0.3057 | 0.3305 | 0.3553 | 0.3718 | 0.3884 (22b) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.0000 (23b) |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =            |        |        |        |        |        |        |        |        |        |        |        | 0.0000 (23c) |
| Effective ac                                                                                            | 0.5888 | 0.5853 | 0.5820 | 0.5661 | 0.5631 | 0.5493 | 0.5493 | 0.5467 | 0.5546 | 0.5631 | 0.5691 | 0.5754 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                        | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K | A x U<br>W/K         | K-value<br>kJ/m2K | A x K<br>kJ/K |
|------------------------------------------------|-------------|----------------|---------------|------------------|----------------------|-------------------|---------------|
| Main dwelling                                  |             |                |               |                  |                      |                   |               |
| TER Opaque door                                |             |                | 1.7900        | 1.0000           | 1.7900               |                   | (26)          |
| TER Opening Type                               |             |                | 13.1600       | 1.1450           | 15.0687              |                   | (27)          |
| Heatloss Floor 1                               |             |                | 39.8000       | 0.1300           | 5.1740               |                   | (28a)         |
| External Wall                                  | 66.4000     | 14.9500        | 51.4500       | 0.1800           | 9.2610               |                   | (29a)         |
| RIR Stud Wall                                  | 41.5000     |                | 41.5000       | 0.1800           | 7.4700               |                   | (29a)         |
| Dormer Walls                                   | 8.0000      |                | 8.0000        | 0.1800           | 1.4400               |                   | (29a)         |
| Adj To RIR Ins At Slope                        | 5.1000      |                | 5.1000        | 0.1100           | 0.5610               |                   | (30)          |
| Slope Roof                                     | 38.7700     |                | 38.7700       | 0.1100           | 4.2647               |                   | (30)          |
| Total net area of external elements Aum(A, m2) |             |                | 199.5700      |                  |                      |                   | (31)          |
| Fabric heat loss, W/K = Sum (A x U)            |             |                |               |                  | (26)...(30) + (32) = | 45.0294           | (33)          |
| Main dwelling                                  |             |                |               |                  |                      |                   |               |
| Party Wall 1                                   |             |                | 20.7500       | 0.0000           | 0.0000               |                   | (32)          |

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Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

96.1986 (35)

List of Thermal Bridges

|                                                                  | Length  | Psi-value | Total   |
|------------------------------------------------------------------|---------|-----------|---------|
| K1 Element                                                       |         |           |         |
| E2 Other lintels (including other steel lintels)                 | 10.4200 | 0.0500    | 0.5210  |
| E3 Sill                                                          | 9.5700  | 0.0500    | 0.4785  |
| E4 Jamb                                                          | 34.3000 | 0.0500    | 1.7150  |
| E16 Corner (normal)                                              | 27.9000 | 0.0900    | 2.5110  |
| E18 Party wall between dwellings                                 | 2.7500  | 0.0600    | 0.1650  |
| E11 Eaves (insulation at rafter level)                           | 10.6000 | 0.0400    | 0.4240  |
| E17 Corner (inverted - internal area greater than external area) | 16.0000 | -0.0900   | -1.4400 |
| E13 Gable (insulation at rafter level)                           | 10.8000 | 0.0800    | 0.8640  |
| E6 Intermediate floor within a dwelling                          | 27.1000 | 0.0000    | 0.0000  |
| P5 Party wall - Roof (insulation at rafter level)                | 6.4000  | 0.0800    | 0.5120  |
| P2 Party wall - Intermediate floor within a dwelling             | 2.9000  | 0.0000    | 0.0000  |
| R4 Ridge (vaulted ceiling)                                       | 17.7000 | 0.0800    | 1.4160  |
| E5 Ground floor (normal)                                         | 21.4000 | 0.1600    | 3.4240  |
| E25 Staggered party wall between dwellings                       | 6.7500  | 0.0600    | 0.4050  |

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

10.9955 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 56.0249 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

|                           | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| (38)m                     | 36.2125 | 36.0004 | 35.7925 | 34.8163 | 34.6336 | 33.7833 | 33.7833 | 33.6258 | 34.1108 | 34.6336 | 35.0031 | 35.3894 |
| Heat transfer coeff       | 92.2374 | 92.0253 | 91.8175 | 90.8412 | 90.6585 | 89.8082 | 89.8082 | 89.6507 | 90.1357 | 90.6585 | 91.0280 | 91.4143 |
| Average = Sum(39)m / 12 = |         |         |         |         |         |         |         |         |         |         |         | 90.8403 |

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| HLP           | 1.3272 | 1.3241 | 1.3211 | 1.3071 | 1.3044 | 1.2922 | 1.2922 | 1.2899 | 1.2969 | 1.3044 | 1.3098 | 1.3153 |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 1.3071 |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |

## 4. Water heating energy requirements (kWh/year)

Assumed occupancy

2.2339 (42)

|                                          |         |         |         |         |         |         |         |         |         |         |         |         |
|------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Hot water usage for mixer showers        | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  |
| Hot water usage for baths                | 26.6456 | 26.2499 | 25.6926 | 24.6651 | 23.8957 | 23.0426 | 22.5818 | 23.1352 | 23.7377 | 24.6505 | 25.6992 | 26.5555 |
| Hot water usage for other uses           | 37.5076 | 36.1437 | 34.7798 | 33.4159 | 32.0520 | 30.6881 | 30.6881 | 32.0520 | 33.4159 | 34.7798 | 36.1437 | 37.5076 |
| Average daily hot water use (litres/day) |         |         |         |         |         |         |         |         |         |         |         | 58.8025 |

|                                                                 | Jan      | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct                                    | Nov     | Dec      |
|-----------------------------------------------------------------|----------|---------|---------|---------|---------|---------|---------|---------|---------|----------------------------------------|---------|----------|
| Daily hot water use                                             | 64.1532  | 62.3936 | 60.4724 | 58.0810 | 55.9477 | 53.7307 | 53.2699 | 55.1871 | 57.1536 | 59.4303                                | 61.8429 | 64.0631  |
| Energy conte                                                    | 101.6030 | 88.8476 | 92.9438 | 79.5100 | 75.3164 | 66.0681 | 64.4253 | 68.3332 | 70.4761 | 80.6464                                | 88.1066 | 100.3074 |
| Energy content (annual)                                         |          |         |         |         |         |         |         |         |         | Total = Sum(45)m =                     |         | 976.5839 |
| Distribution loss (46)m = 0.15 x (45)m                          | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000   |
| Water storage loss (or HIU loss):                               |          |         |         |         |         |         |         |         |         |                                        |         |          |
| Total storage loss                                              | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000   |
| If cylinder contains dedicated solar storage                    | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000   |
| Primary loss                                                    | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000   |
| Combi loss                                                      | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000   |
| Total heat required for water heating calculated for each month | 86.3626  | 75.5205 | 79.0023 | 67.5835 | 64.0189 | 56.1579 | 54.7615 | 58.0832 | 59.9047 | 68.5495                                | 74.8906 | 85.2613  |
| WWHRS                                                           | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000   |
| PV diverter                                                     | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000   |
| Solar input                                                     | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000   |
| FGHRS                                                           | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000   |
| Output from w/h                                                 | 86.3626  | 75.5205 | 79.0023 | 67.5835 | 64.0189 | 56.1579 | 54.7615 | 58.0832 | 59.9047 | 68.5495                                | 74.8906 | 85.2613  |
| 12Total per year (kWh/year)                                     |          |         |         |         |         |         |         |         |         | Total per year (kWh/year) = Sum(64)m = |         | 830.0963 |
| Electric shower(s)                                              | 49.3916  | 44.0083 | 48.0554 | 45.8587 | 46.7192 | 44.5656 | 46.0511 | 46.7192 | 45.8587 | 48.0554                                | 47.1517 | 49.3916  |
| Heat gains from water heating, kWh/month                        | 33.9385  | 29.8822 | 31.7644 | 28.3605 | 27.6845 | 25.1809 | 25.2031 | 26.2006 | 26.4408 | 29.1512                                | 30.5106 | 33.6632  |

## 5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

|                                                                                     | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| (66)m                                                                               | 111.6962 | 111.6962 | 111.6962 | 111.6962 | 111.6962 | 111.6962 | 111.6962 | 111.6962 | 111.6962 | 111.6962 | 111.6962 | 111.6962 |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 100.2805 | 111.0249 | 100.2805 | 103.6232 | 100.2805 | 103.6232 | 100.2805 | 100.2805 | 103.6232 | 100.2805 | 103.6232 | 100.2805 |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 196.1273 | 198.1625 | 193.0339 | 182.1157 | 168.3334 | 155.3800 | 146.7264 | 144.6912 | 149.8198 | 160.7380 | 174.5203 | 187.4736 |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 34.1696  | 34.1696  | 34.1696  | 34.1696  | 34.1696  | 34.1696  | 34.1696  | 34.1696  | 34.1696  | 34.1696  | 34.1696  | 34.1696  |
| Pumps, fans                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 |
| Water heating gains (Table 5)                                                       | 45.6163  | 44.4675  | 42.6941  | 39.3896  | 37.2104  | 34.9734  | 33.8752  | 35.2159  | 36.7234  | 39.1817  | 42.3758  | 45.2463  |
| Total internal gains                                                                | 398.5330 | 410.1638 | 392.5174 | 381.6374 | 362.3332 | 350.4855 | 337.3910 | 336.6964 | 346.6752 | 356.7091 | 377.0281 | 389.5093 |

## 6. Solar gains

| [Jan] | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W |
|-------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|------------|
| East  | 7.2000     | 19.6403                        | 0.6300                            | 0.7000                             | 0.7700                       | 43.2167    |

# Full SAP Calculation Printout



|             |          |          |          |          |          |          |          |          |          |          |          |               |        |  |  |  |        |  |  |  |              |  |  |  |
|-------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|--------|--|--|--|--------|--|--|--|--------------|--|--|--|
| West        | 5.9600   |          |          |          | 19.6403  |          |          |          | 0.6300   |          |          |               | 0.7000 |  |  |  | 0.7700 |  |  |  | 35.7738 (80) |  |  |  |
| Solar gains | 78.9905  | 154.5222 | 254.4761 | 371.1382 | 454.8438 | 465.6136 | 443.2831 | 380.7737 | 295.9662 | 183.3536 | 98.4919  | 64.9580 (83)  |        |  |  |  |        |  |  |  |              |  |  |  |
| Total gains | 477.5235 | 564.6860 | 646.9935 | 752.7756 | 817.1770 | 816.0991 | 780.6741 | 717.4701 | 642.6415 | 540.0628 | 475.5200 | 454.4672 (84) |        |  |  |  |        |  |  |  |              |  |  |  |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 20.1346 | 20.1810 | 20.2267 | 20.4441 | 20.4853 | 20.6793 | 20.6793 | 20.7156 | 20.6041 | 20.4853 | 20.4021 | 20.3159      |
| alpha                                                                       | 2.3423  | 2.3454  | 2.3484  | 2.3629  | 2.3657  | 2.3786  | 2.3786  | 2.3810  | 2.3736  | 2.3657  | 2.3601  | 2.3544       |
| util living area                                                            | 0.9547  | 0.9329  | 0.8963  | 0.8211  | 0.7138  | 0.5740  | 0.4512  | 0.4975  | 0.6920  | 0.8650  | 0.9356  | 0.9593 (86)  |
| MIT                                                                         | 17.9360 | 18.2996 | 18.8727 | 19.6316 | 20.2603 | 20.6959 | 20.8773 | 20.8414 | 20.4941 | 19.6457 | 18.6686 | 17.8804 (87) |
| Th 2                                                                        | 19.8196 | 19.8220 | 19.8243 | 19.8353 | 19.8374 | 19.8469 | 19.8469 | 19.8487 | 19.8432 | 19.8374 | 19.8332 | 19.8289 (88) |
| util rest of house                                                          | 0.9477  | 0.9228  | 0.8803  | 0.7926  | 0.6662  | 0.4991  | 0.3502  | 0.3959  | 0.6245  | 0.8370  | 0.9242  | 0.9530 (89)  |
| MIT 2                                                                       | 17.0539 | 17.4121 | 17.9732 | 18.7069 | 19.2869 | 19.6642 | 19.7949 | 19.7767 | 19.5112 | 18.7401 | 17.7882 | 17.0049 (90) |
| Living area fraction                                                        | 17.5045 | 17.8654 | 18.4327 | 19.1792 | 19.7841 | 20.1912 | 20.3478 | 20.3205 | 20.0133 | 19.2027 | 18.2379 | 17.4521 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 17.5045 | 17.8654 | 18.4327 | 19.1792 | 19.7841 | 20.1912 | 20.3478 | 20.3205 | 20.0133 | 19.2027 | 18.2379 | 17.4521 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |          |          |          |          |          |          |          |           |                            |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|-----------|----------------------------|
|                                                                                | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov       | Dec                        |
| Utilisation                                                                    | 0.9291    | 0.9008    | 0.8566    | 0.7740   | 0.6638   | 0.5228   | 0.3959   | 0.4397   | 0.6354   | 0.8183   | 0.9035    | 0.9355 (94)                |
| Useful gains                                                                   | 443.6538  | 508.6463  | 554.1943  | 582.6512 | 542.4196 | 426.6585 | 309.0959 | 315.4692 | 408.3561 | 441.9568 | 429.6280  | 425.1382 (95)              |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000  | 7.1000    | 4.2000 (96)                |
| Heat loss rate W                                                               | 1217.9442 | 1193.1477 | 1095.6263 | 933.7774 | 732.8942 | 502.1361 | 336.5789 | 351.4800 | 532.9960 | 779.9046 | 1013.8630 | 1211.4287 (97)             |
| Space heating kWh                                                              | 576.0721  | 459.9850  | 402.8255  | 252.8108 | 141.7131 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 251.4331 | 420.6492  | 585.0001 (98a)             |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |          |          |          |          |          |          |          |           | 3090.4889                  |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000 (98b)               |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |          |          |          |          |          |          |          |           | 0.0000                     |
| Space heating kWh                                                              | 576.0721  | 459.9850  | 402.8255  | 252.8108 | 141.7131 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 251.4331 | 420.6492  | 585.0001 (98c)             |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |          |           | 3090.4889                  |
| Space heating per m2                                                           |           |           |           |          |          |          |          |          |          |          |           | (98c) / (4) = 44.4675 (99) |

## 8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

|                                  |        |        |        |        |         |          |          |          |                          |         |        |                |
|----------------------------------|--------|--------|--------|--------|---------|----------|----------|----------|--------------------------|---------|--------|----------------|
|                                  | Jan    | Feb    | Mar    | Apr    | May     | Jun      | Jul      | Aug      | Sep                      | Oct     | Nov    | Dec            |
| Ext. temp.                       | 4.3000 | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000  | 16.6000  | 16.4000  | 14.1000                  | 10.6000 | 7.1000 | 4.2000         |
| Heat loss rate W                 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 844.1970 | 664.5806 | 681.3455 | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (100)   |
| Utilisation                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.7319   | 0.7937   | 0.7600   | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (101)   |
| Useful loss                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 617.8544 | 527.4844 | 517.7894 | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (102)   |
| Total gains                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 915.1977 | 875.7897 | 803.8724 | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (103)   |
| Space cooling kWh                | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 214.0872 | 259.1392 | 212.8458 | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (104)   |
| Cooled fraction                  |        |        |        |        |         |          |          |          | fc = cooled area / (4) = |         |        | 1.0000 (105)   |
| Intermittency factor (Table 10b) | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500  | 0.2500   | 0.2500   | 0.2500   | 0.2500                   | 0.2500  | 0.2500 | 0.2500 (106)   |
| Space cooling kWh                | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 53.5218  | 64.7848  | 53.2114  | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (107)   |
| Space cooling requirement        |        |        |        |        |         |          |          |          |                          |         |        | 171.5180 (107) |
| Energy for space heating         |        |        |        |        |         |          |          |          |                          |         |        | 44.4675 (99)   |
| Energy for space cooling         |        |        |        |        |         |          |          |          |                          |         |        | 2.4679 (108)   |
| Total                            |        |        |        |        |         |          |          |          |                          |         |        | 46.9354 (109)  |
| Fabric Energy Efficiency (TFEE)  |        |        |        |        |         |          |          |          |                          |         |        | 46.9 (109)     |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF ENERGY RATING

## 1. Overall dwelling characteristics

|                                                        |              |                                   |                        |
|--------------------------------------------------------|--------------|-----------------------------------|------------------------|
| Main dwelling                                          | Area (m2)    | Storey height (m)                 | Volume (m3)            |
| Ground floor                                           | 39.8000 (1b) | x 2.7500 (2b)                     | = 109.4500 (1b) - (3b) |
| First floor                                            | 29.7000 (1c) | x 2.5900 (2c)                     | = 76.9230 (1c) - (3c)  |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 69.5000      |                                   | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 186.3730 (5)           |

## 2. Ventilation rate

|                         |                      |
|-------------------------|----------------------|
|                         | m3 per hour          |
| Number of open chimneys | 0 * 80 = 0.0000 (6a) |
| Number of open flues    | 0 * 20 = 0.0000 (6b) |

# Full SAP Calculation Printout



Number of chimneys / flues attached to closed fire 0 \* 10 = 0.0000 (6c)  
Number of flues attached to solid fuel boiler 0 \* 20 = 0.0000 (6d)  
Number of flues attached to other heater 0 \* 35 = 0.0000 (6e)  
Number of blocked chimneys 0 \* 20 = 0.0000 (6f)  
Number of intermittent extract fans 0 \* 10 = 0.0000 (7a)  
Number of passive vents 0 \* 10 = 0.0000 (7b)  
Number of flueless gas fires 0 \* 40 = 0.0000 (7c)

Air changes per hour  
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)  
Pressure test Yes  
Pressure Test Method Blower Door  
Measured/design AP50 3.0000 (17)  
Infiltration rate 0.1500 (18)  
Number of sides sheltered 1 (19)  
Shelter factor (20) = 1 - [0.075 x (19)] = 0.9250 (20)  
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1388 (21)

|                                                                                                         |        |        |        |        |        |        |        |        |        |        |        |        |              |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |              |
|                                                                                                         | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 | (22)         |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 | (22a)        |
| Adj infilt rate                                                                                         |        |        |        |        |        |        |        |        |        |        |        |        |              |
|                                                                                                         | 0.1769 | 0.1734 | 0.1700 | 0.1526 | 0.1492 | 0.1318 | 0.1318 | 0.1283 | 0.1388 | 0.1492 | 0.1561 | 0.1630 | (22b)        |
| Mechanical extract ventilation - centralised                                                            |        |        |        |        |        |        |        |        |        |        |        |        |              |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | (25)         |

## 3. Heat losses and heat loss parameter

| Element                                        | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K | A x U<br>W/K         | K-value<br>kJ/m2K | A x K<br>kJ/K |       |
|------------------------------------------------|-------------|----------------|---------------|------------------|----------------------|-------------------|---------------|-------|
| Main dwelling                                  |             |                |               |                  |                      |                   |               |       |
| Solid Door                                     |             |                | 1.7900        | 1.2000           | 2.1480               |                   |               | (26)  |
| Windows / Glazed Doors                         |             |                | 13.1600       | 1.1450           | 15.0687              |                   |               | (27)  |
| Heatloss Floor 1                               |             |                | 39.8000       | 0.1200           | 4.7760               | 75.0000           | 2985.0000     | (28a) |
| External Wall                                  | 66.4000     | 14.9500        | 51.4500       | 0.1500           | 7.7175               | 9.0000            | 463.0500      | (29a) |
| RIR Stud Wall                                  | 41.5000     |                | 41.5000       | 0.1500           | 6.2250               | 9.0000            | 373.5000      | (29a) |
| Dormer Walls                                   | 8.0000      |                | 8.0000        | 0.1500           | 1.2000               | 9.0000            | 72.0000       | (29a) |
| Adj To RIR Ins At Slope                        | 5.1000      |                | 5.1000        | 0.1400           | 0.7140               | 9.0000            | 45.9000       | (30)  |
| Slope Roof                                     | 38.7700     |                | 38.7700       | 0.1400           | 5.4278               | 9.0000            | 348.9300      | (30)  |
| Total net area of external elements Aum(A, m2) |             |                | 199.5700      |                  |                      |                   |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)            |             |                |               |                  | (26)...(30) + (32) = | 43.2770           |               | (33)  |
| Main dwelling                                  |             |                |               |                  |                      |                   |               |       |
| Party Wall 1                                   |             |                | 20.7500       | 0.0000           | 0.0000               | 45.0000           | 933.7500      | (32)  |
| Internal Wall 1                                |             |                | 73.5300       |                  |                      | 9.0000            | 661.7700      | (32c) |
| Internal Floor 1                               |             |                | 29.7000       |                  |                      | 18.0000           | 534.6000      | (32d) |
| Internal Ceiling 1                             |             |                | 29.7000       |                  |                      | 9.0000            | 267.3000      | (32e) |

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 6685.8000 (34)  
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 96.1986 (35)

## List of Thermal Bridges

| K1 Element                                                       | Length  | Psi-value | Total  |
|------------------------------------------------------------------|---------|-----------|--------|
| E2 Other lintels (including other steel lintels)                 | 10.4200 | 0.0840    | 0.8753 |
| E3 Sill                                                          | 9.5700  | 0.0340    | 0.3254 |
| E4 Jamb                                                          | 34.3000 | 0.0430    | 1.4749 |
| E16 Corner (normal)                                              | 27.9000 | 0.0300    | 0.8370 |
| E18 Party wall between dwellings                                 | 2.7500  | 0.0400    | 0.1100 |
| E11 Eaves (insulation at rafter level)                           | 10.6000 | 0.0130    | 0.1378 |
| E17 Corner (inverted - internal area greater than external area) | 16.0000 | 0.0150    | 0.2400 |
| E13 Gable (insulation at rafter level)                           | 10.8000 | 0.0240    | 0.2592 |
| E6 Intermediate floor within a dwelling                          | 27.1000 | 0.0800    | 2.1680 |
| P5 Party wall - Roof (insulation at rafter level)                | 6.4000  | 0.2400    | 1.5360 |
| P2 Party wall - Intermediate floor within a dwelling             | 2.9000  | 0.0000    | 0.0000 |
| R4 Ridge (vaulted ceiling)                                       | 17.7000 | 0.1200    | 2.1240 |
| E5 Ground floor (normal)                                         | 21.4000 | 0.3200    | 6.8480 |
| E25 Staggered party wall between dwellings                       | 6.7500  | 0.1200    | 0.8100 |

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 17.7456 (36)  
Point Thermal bridges (36a) = 0.0000  
Total fabric heat loss (33) + (36) + (36a) = 61.0226 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

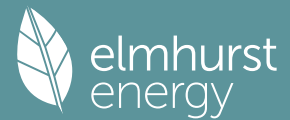
|                           |         |         |         |         |         |         |         |         |         |         |         |         |         |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| (38)m                     | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |         |
|                           | 30.7515 | 30.7515 | 30.7515 | 30.7515 | 30.7515 | 30.7515 | 30.7515 | 30.7515 | 30.7515 | 30.7515 | 30.7515 | 30.7515 | (38)    |
| Heat transfer coeff       | 91.7741 | 91.7741 | 91.7741 | 91.7741 | 91.7741 | 91.7741 | 91.7741 | 91.7741 | 91.7741 | 91.7741 | 91.7741 | 91.7741 | (39)    |
| Average = Sum(39)m / 12 = |         |         |         |         |         |         |         |         |         |         |         |         | 91.7741 |

|               |        |        |        |        |        |        |        |        |        |        |        |        |        |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| HLP           | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |        |
|               | 1.3205 | 1.3205 | 1.3205 | 1.3205 | 1.3205 | 1.3205 | 1.3205 | 1.3205 | 1.3205 | 1.3205 | 1.3205 | 1.3205 | (40)   |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        |        | 1.3205 |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |        |

## 4. Water heating energy requirements (kWh/year)

|                                          |          |          |          |          |          |          |          |          |          |          |          |          |                              |
|------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------------------------------|
| Assumed occupancy                        |          |          |          |          |          |          |          |          |          |          |          |          | 2.2339 (42)                  |
| Hot water usage for mixer showers        |          |          |          |          |          |          |          |          |          |          |          |          |                              |
|                                          | 84.8034  | 83.5290  | 81.6719  | 78.1187  | 75.4965  | 72.5723  | 70.9101  | 72.7532  | 74.7735  | 77.9132  | 81.5428  | 84.4785  | (42a)                        |
| Hot water usage for baths                |          |          |          |          |          |          |          |          |          |          |          |          |                              |
|                                          | 26.6456  | 26.2499  | 25.6926  | 24.6651  | 23.8957  | 23.0426  | 22.5818  | 23.1352  | 23.7377  | 24.6505  | 25.6992  | 26.5555  | (42b)                        |
| Hot water usage for other uses           |          |          |          |          |          |          |          |          |          |          |          |          |                              |
|                                          | 37.5076  | 36.1437  | 34.7798  | 33.4159  | 32.0520  | 30.6881  | 30.6881  | 32.0520  | 33.4159  | 34.7798  | 36.1437  | 37.5076  | (42c)                        |
| Average daily hot water use (litres/day) |          |          |          |          |          |          |          |          |          |          |          |          | 136.9884 (43)                |
| Daily hot water use                      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |                              |
|                                          | 148.9566 | 145.9226 | 142.1443 | 136.1997 | 131.4442 | 126.3029 | 124.1800 | 127.9403 | 131.9271 | 137.3436 | 143.3857 | 148.5416 | (44)                         |
| Energy conte                             | 235.9109 | 207.7918 | 218.4705 | 186.4505 | 176.9492 | 155.3042 | 150.1849 | 158.4168 | 162.6792 | 186.3739 | 204.2792 | 232.5803 | (45)                         |
| Energy content (annual)                  |          |          |          |          |          |          |          |          |          |          |          |          | Total = Sum(45)m = 2275.3915 |
| Distribution loss (46)m = 0.15 x (45)m   |          |          |          |          |          |          |          |          |          |          |          |          |                              |
|                                          | 35.3866  | 31.1688  | 32.7706  | 27.9676  | 26.5424  | 23.2956  | 22.5277  | 23.7625  | 24.4019  | 27.9561  | 30.6419  | 34.8870  | (46)                         |
| Water storage loss (or HIU loss):        |          |          |          |          |          |          |          |          |          |          |          |          |                              |

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|                                                                 |          |          |          |          |          |          |          |          |          |          |          |                                                                                             |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------------------------------------------------------------------------------------|
| Store volume                                                    |          |          |          |          |          |          |          |          |          |          |          | 196.0000 (47)                                                                               |
| a) If manufacturer declared loss factor is known (kWh/day):     |          |          |          |          |          |          |          |          |          |          |          | 1.3120 (48)                                                                                 |
| Temperature factor from Table 2b                                |          |          |          |          |          |          |          |          |          |          |          | 0.5400 (49)                                                                                 |
| Enter (49) or (54) in (55)                                      |          |          |          |          |          |          |          |          |          |          |          | 0.7085 (55)                                                                                 |
| Total storage loss                                              |          |          |          |          |          |          |          |          |          |          |          |                                                                                             |
|                                                                 | 21.9629  | 19.8374  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629 (56)                                                                                |
| If cylinder contains dedicated solar storage                    |          |          |          |          |          |          |          |          |          |          |          |                                                                                             |
|                                                                 | 21.9629  | 19.8374  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629 (57)                                                                                |
| Primary loss                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (59)                                                                                 |
| Combi loss                                                      | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (61)                                                                                 |
| Total heat required for water heating calculated for each month |          |          |          |          |          |          |          |          |          |          |          |                                                                                             |
|                                                                 | 257.8738 | 227.6292 | 240.4334 | 207.7049 | 198.9120 | 176.5586 | 172.1478 | 180.3797 | 183.9336 | 208.3368 | 225.5336 | 254.5432 (62)                                                                               |
| WWHRS                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63a)                                                                                |
| PV diverter                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63b)                                                                                |
| Solar input                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63c)                                                                                |
| FGHRS                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63d)                                                                                |
| Output from w/h                                                 |          |          |          |          |          |          |          |          |          |          |          |                                                                                             |
|                                                                 | 257.8738 | 227.6292 | 240.4334 | 207.7049 | 198.9120 | 176.5586 | 172.1478 | 180.3797 | 183.9336 | 208.3368 | 225.5336 | 254.5432 (64)                                                                               |
|                                                                 |          |          |          |          |          |          |          |          |          |          |          | Total per year (kWh/year) = Sum(64)m = 2533.9867 (64)                                       |
| Electric shower(s)                                              |          |          |          |          |          |          |          |          |          |          |          |                                                                                             |
|                                                                 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (64a)                                                                                |
|                                                                 |          |          |          |          |          |          |          |          |          |          |          | Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a) |
| Heat gains from water heating, kWh/month                        |          |          |          |          |          |          |          |          |          |          |          |                                                                                             |
|                                                                 | 78.4404  | 69.0908  | 72.6414  | 61.9948  | 58.8356  | 51.6386  | 49.9365  | 52.6736  | 54.0908  | 61.9693  | 67.9228  | 77.3330 (65)                                                                                |

## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Metabolic gains (Table 5), Watts                                                    |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                     | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
| (66)m                                                                               | 134.0355 | 134.0355 | 134.0355 | 134.0355 | 134.0355 | 134.0355 | 134.0355 | 134.0355 | 134.0355 | 134.0355 | 134.0355 | 134.0355 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                     | 28.3651  | 25.1936  | 20.4888  | 15.5113  | 11.5949  | 9.7889   | 10.5773  | 13.7487  | 18.4535  | 23.4310  | 27.3474  | 29.1534 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                     | 292.7273 | 295.7649 | 288.1103 | 271.8144 | 251.2439 | 231.9105 | 218.9946 | 215.9570 | 223.6116 | 239.9074 | 260.4780 | 279.8114 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                     | 50.6375  | 50.6375  | 50.6375  | 50.6375  | 50.6375  | 50.6375  | 50.6375  | 50.6375  | 50.6375  | 50.6375  | 50.6375  | 50.6375 (69)  |
| Pumps, fans                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (70)   |
| Losses e.g. evaporation (negative values) (Table 5)                                 |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                     | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 (71) |
| Water heating gains (Table 5)                                                       |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                     | 105.4306 | 102.8136 | 97.6363  | 86.1039  | 79.0801  | 71.7203  | 67.1189  | 70.7978  | 75.1262  | 83.2921  | 94.3373  | 103.9421 (72) |
| Total internal gains                                                                | 521.8389 | 519.0881 | 501.5514 | 468.7456 | 437.2349 | 408.7357 | 392.0068 | 395.8195 | 412.5073 | 441.9465 | 477.4786 | 508.2229 (73) |

## 6. Solar gains

| [Jan]       |            |          |          |           |                                |           |                                   |           |                                    |          |                              |               |              |  |
|-------------|------------|----------|----------|-----------|--------------------------------|-----------|-----------------------------------|-----------|------------------------------------|----------|------------------------------|---------------|--------------|--|
|             | Area<br>m2 |          |          |           | Solar flux<br>Table 6a<br>W/m2 |           | g<br>Specific data<br>or Table 6b |           | FF<br>Specific data<br>or Table 6c |          | Access<br>factor<br>Table 6d |               | Gains<br>W   |  |
| East        | 7.2000     |          |          |           | 19.6403                        |           | 0.7600                            |           | 0.0000                             |          | 0.7700                       |               | 82.7531 (76) |  |
| West        | 5.9600     |          |          |           | 19.6403                        |           | 0.7600                            |           | 0.0000                             |          | 0.7700                       |               | 68.5012 (80) |  |
|             |            |          |          |           |                                |           |                                   |           |                                    |          |                              |               |              |  |
| Solar gains | 151.2542   | 295.8854 | 487.2810 | 710.6703  | 870.9532                       | 891.5756  | 848.8163                          | 729.1206  | 566.7280                           | 351.0929 | 188.5962                     | 124.3841 (83) |              |  |
| Total gains | 673.0932   | 814.9735 | 988.8324 | 1179.4160 | 1308.1881                      | 1300.3113 | 1240.8230                         | 1124.9402 | 979.2353                           | 793.0394 | 666.0749                     | 632.6070 (84) |              |  |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 20.2363 | 20.2363 | 20.2363 | 20.2363 | 20.2363 | 20.2363 | 20.2363 | 20.2363 | 20.2363 | 20.2363 | 20.2363 | 20.2363      |
| alpha                                                                       | 2.3491  | 2.3491  | 2.3491  | 2.3491  | 2.3491  | 2.3491  | 2.3491  | 2.3491  | 2.3491  | 2.3491  | 2.3491  | 2.3491       |
| util living area                                                            | 0.9133  | 0.8717  | 0.7970  | 0.6800  | 0.5431  | 0.4105  | 0.3093  | 0.3509  | 0.5398  | 0.7633  | 0.8829  | 0.9234 (86)  |
| MIT                                                                         | 18.4009 | 18.8277 | 19.4636 | 20.1266 | 20.5951 | 20.8484 | 20.9435 | 20.9224 | 20.7036 | 20.0114 | 19.0530 | 18.2883 (87) |
| Th 2                                                                        | 19.8248 | 19.8248 | 19.8248 | 19.8248 | 19.8248 | 19.8248 | 19.8248 | 19.8248 | 19.8248 | 19.8248 | 19.8248 | 19.8248 (88) |
| util rest of house                                                          | 0.9014  | 0.8549  | 0.7718  | 0.6427  | 0.4928  | 0.3456  | 0.2322  | 0.2692  | 0.4708  | 0.7240  | 0.8644  | 0.9126 (89)  |
| MIT 2                                                                       | 16.8524 | 17.3795 | 18.1544 | 18.9360 | 19.4579 | 19.7154 | 19.7963 | 19.7831 | 19.5908 | 18.8348 | 17.6737 | 16.7123 (90) |
| Living area fraction                                                        |         |         |         |         |         |         |         |         |         |         |         |              |
| MIT                                                                         | 17.6434 | 18.1192 | 18.8231 | 19.5441 | 20.0388 | 20.2941 | 20.3823 | 20.3650 | 20.1592 | 19.4358 | 18.3782 | 17.5173 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 17.6434 | 18.1192 | 18.8231 | 19.5441 | 20.0388 | 20.2941 | 20.3823 | 20.3650 | 20.1592 | 19.4358 | 18.3782 | 17.5173 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |          |          |          |          |          |          |          |           |                            |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|-----------|----------------------------|
| Utilisation                                                                    | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov       | Dec                        |
|                                                                                | 0.8724    | 0.8249    | 0.7469    | 0.6330   | 0.5024   | 0.3722   | 0.2695   | 0.3077   | 0.4914   | 0.7092   | 0.8359    | 0.8846 (94)                |
| Useful gains                                                                   | 587.2058  | 672.2568  | 738.5830  | 746.5830 | 657.2043 | 484.0313 | 334.3957 | 346.1102 | 481.2286 | 562.4084 | 556.8025  | 559.5943 (95)              |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000  | 7.1000    | 4.2000 (96)                |
| Heat loss rate W                                                               | 1224.5758 | 1213.1798 | 1130.9409 | 976.8560 | 765.2838 | 522.5735 | 347.1161 | 363.8865 | 556.0795 | 810.8974 | 1035.0483 | 1222.1822 (97)             |
| Space heating kWh                                                              | 474.2033  | 363.5003  | 291.9143  | 165.7966 | 80.4112  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 184.8758 | 344.3370  | 492.9654 (98a)             |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |          |          |          |          |          |          |          |           | 2398.0038                  |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000 (98b)               |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |          |          |          |          |          |          |          |           | 0.0000                     |
| Space heating kWh                                                              | 474.2033  | 363.5003  | 291.9143  | 165.7966 | 80.4112  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 184.8758 | 344.3370  | 492.9654 (98c)             |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |          |           | 2398.0038                  |
| Space heating per m <sup>2</sup>                                               |           |           |           |          |          |          |          |          |          |          |           | (98c) / (4) = 34.5037 (99) |

# Full SAP Calculation Printout



## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |          |           |        |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|--------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (201)  |
| Fraction of space heat from main system(s)                                                           |          |          |          |          |          |          |          |          |          |          |          |          | 1.0000    | (202)  |
| Fraction of main heating from main system 2                                                          |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (203)  |
| Fraction of total heating from main system 1                                                         |          |          |          |          |          |          |          |          |          |          |          |          | 1.0000    | (204)  |
| Fraction of total heating from main system 2                                                         |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (205)  |
| Efficiency of main space heating system 1 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          |          | 100.0000  | (206)  |
| Efficiency of main space heating system 2 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (207)  |
| Efficiency of secondary/supplementary heating system, %                                              |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (208)  |
|                                                                                                      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |           |        |
| Space heating requirement                                                                            | 474.2033 | 363.5003 | 291.9143 | 165.7966 | 80.4112  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 184.8758 | 344.3370 | 492.9654 | (98)      |        |
| Space heating efficiency (main heating system 1)                                                     | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 100.0000 | 100.0000 | 100.0000 | (210)     |        |
| Space heating fuel (main heating system)                                                             | 474.2033 | 363.5003 | 291.9143 | 165.7966 | 80.4112  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 184.8758 | 344.3370 | 492.9654 | (211)     |        |
| Space heating efficiency (main heating system 2)                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (212)     |        |
| Space heating fuel (main heating system 2)                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (213)     |        |
| Space heating fuel (secondary)                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (215)     |        |
| Space heating fuel used, main system 2                                                               |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (213)  |
| Water heating                                                                                        |          |          |          |          |          |          |          |          |          |          |          |          |           |        |
| Water heating requirement                                                                            | 257.8738 | 227.6292 | 240.4334 | 207.7049 | 198.9120 | 176.5586 | 172.1478 | 180.3797 | 183.9336 | 208.3368 | 225.5336 | 254.5432 | (64)      |        |
| Efficiency of water heater (217)m                                                                    | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | (216)     |        |
| Fuel for water heating, kWh/month                                                                    | 82.2813  | 72.6310  | 76.7165  | 66.2737  | 63.4680  | 56.3356  | 54.9282  | 57.5548  | 58.6888  | 66.4753  | 71.9623  | 81.2186  | (219)     |        |
| Space cooling fuel requirement                                                                       |          |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (221)     |        |
| Pumps and Fa                                                                                         | 12.8034  | 11.5644  | 12.8034  | 12.3904  | 12.8034  | 12.3904  | 12.8034  | 12.8034  | 12.3904  | 12.8034  | 12.3904  | 12.8034  | (231)     |        |
| Lighting                                                                                             | 24.8278  | 19.9178  | 17.9337  | 13.1390  | 10.1490  | 8.2918   | 9.2582   | 12.0342  | 15.6312  | 20.5090  | 23.1649  | 25.5178  | (232)     |        |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (233a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (233a)    |        |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (234a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (234a)    |        |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (235a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (235a)    |        |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (235c)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (235c)    |        |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (233b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (233b)    |        |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (234b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (234b)    |        |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (235b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (235b)    |        |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (235d)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (235d)    |        |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |          |           |        |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          |          | 2398.0038 | (211)  |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (213)  |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (215)  |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          |          | 313.4050  |        |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          |          | 808.5342  | (219)  |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (221)  |
| Electricity for pumps and fans:                                                                      |          |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (MEV)Centralised, Database: in-use factor = 1.3000, SFP = 0.6630)                                    |          |          |          |          |          |          |          |          |          |          |          |          |           |        |
| mechanical ventilation fans (SFP = 0.6630)                                                           |          |          |          |          |          |          |          |          |          |          |          |          | 150.7497  | (230a) |
| Total electricity for the above, kWh/year                                                            |          |          |          |          |          |          |          |          |          |          |          |          | 150.7497  | (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |          |          |          |          |          |          |          |          |          | 200.3743  | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |          |          |          |          |          |          |          |          |          |           |        |
| PV generation                                                                                        |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (233)  |
| Wind generation                                                                                      |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (234)  |
| Hydro-electric generation (Appendix N)                                                               |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (235a) |
| Electricity generated - Micro CHP (Appendix N)                                                       |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (235)  |
| Appendix Q - special features                                                                        |          |          |          |          |          |          |          |          |          |          |          |          |           |        |
| Energy saved or generated                                                                            |          |          |          |          |          |          |          |          |          |          |          |          | -0.0000   | (236)  |
| Energy used                                                                                          |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (237)  |
| Total delivered energy for all uses                                                                  |          |          |          |          |          |          |          |          |          |          |          |          | 3557.6619 | (238)  |

## 10a. Fuel costs - using Table 12 prices

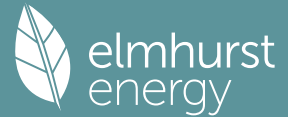
|                                             | Fuel kWh/year | Fuel price p/kWh | Fuel cost £/year |        |
|---------------------------------------------|---------------|------------------|------------------|--------|
| Space heating - main system 1               | 2398.0038     | 16.4900          | 395.4308         | (240)  |
| Space heating - main system 2               | 0.0000        | 16.4900          | 0.0000           | (241)  |
| Total CO2 associated with community systems |               |                  | 0.0000           | (473)  |
| Water heating (other fuel)                  | 808.5342      | 16.4900          | 133.3273         | (247)  |
| Energy for instantaneous electric shower(s) | 0.0000        | 16.4900          | 0.0000           | (247a) |
| Pumps, fans and electric keep-hot           | 150.7497      | 16.4900          | 24.8586          | (249)  |
| Energy for lighting                         | 200.3743      | 16.4900          | 33.0417          | (250)  |
| Additional standing charges                 |               |                  | 0.0000           | (251)  |
| Total energy cost                           |               |                  | 586.6585         | (255)  |

## 11a. SAP rating - Individual heating systems

|                                  |                                         |         |       |
|----------------------------------|-----------------------------------------|---------|-------|
| Energy cost deflator (Table 12): |                                         | 0.3600  | (256) |
| Energy cost factor (ECF)         |                                         | 1.8445  | (257) |
| SAP value                        | $[(255) \times (256)] / [(4) + 45.0] =$ | 70.1004 |       |
| SAP rating (Section 12)          |                                         | 70      | (258) |
| SAP band                         |                                         | C       |       |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

# Full SAP Calculation Printout



|                                             | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |       |
|---------------------------------------------|--------------------|-------------------------------|--------------------------|-------|
| Space heating - main system 1               | 2398.0038          | 0.1551                        | 371.9326                 | (261) |
| Space heating - main system 2               | 0.0000             | 0.0000                        | 0.0000                   | (262) |
| Total CO2 associated with community systems |                    |                               | 0.0000                   | (263) |
| Water heating (other fuel)                  | 808.5342           | 0.1413                        | 114.2344                 | (264) |
| Space and water heating                     |                    |                               | 486.1670                 | (265) |
| Pumps, fans and electric keep-hot           | 150.7497           | 0.1387                        | 20.9108                  | (267) |
| Energy for lighting                         | 200.3743           | 0.1443                        | 28.9202                  | (268) |
| Total CO2, kg/year                          |                    |                               | 535.9981                 | (272) |
| CO2 emissions per m2                        |                    |                               | 7.7100                   | (273) |
| EI value                                    |                    |                               | 93.7272                  |       |
| EI rating                                   |                    |                               | 94                       | (274) |
| EI band                                     |                    |                               | A                        |       |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m)              | Volume<br>(m3)         |
|--------------------------------------------------------|--------------|-----------------------------------|------------------------|
| Main dwelling                                          |              |                                   |                        |
| Ground floor                                           | 39.8000 (1b) | x 2.7500 (2b)                     | = 109.4500 (1b) - (3b) |
| First floor                                            | 29.7000 (1c) | x 2.5900 (2c)                     | = 76.9230 (1c) - (3c)  |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 69.5000      |                                   | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 186.3730 (5)           |

## 2. Ventilation rate

|                                                                                                    | m3 per hour                             |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 0 * 10 = 0.0000 (7a)                    |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 / (5) = 0.0000 (8)               |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 3.0000 (17)                             |
| Infiltration rate                                                                                  | 0.1500 (18)                             |
| Number of sides sheltered                                                                          | 1 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.9250 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.1388 (21)        |

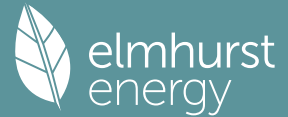
|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 4.3000 | 4.1000 | 4.1000 | 3.8000 | 3.9000 | 3.4000 | 3.4000 | 3.3000 | 3.4000 | 3.8000 | 3.7000 | 4.0000 (22)  |
| Wind factor                                                                                             | 1.0750 | 1.0250 | 1.0250 | 0.9500 | 0.9750 | 0.8500 | 0.8500 | 0.8250 | 0.8500 | 0.9500 | 0.9250 | 1.0000 (22a) |
| Adj infilt rate                                                                                         | 0.1492 | 0.1422 | 0.1422 | 0.1318 | 0.1353 | 0.1179 | 0.1179 | 0.1145 | 0.1179 | 0.1318 | 0.1283 | 0.1388 (22b) |
| Mechanical extract ventilation - centralised                                                            |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        |              |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                           | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2        | U-value<br>W/m2K | A x U<br>W/K | K-value<br>kJ/m2K | A x K<br>kJ/K                                       |
|---------------------------------------------------|-------------|----------------|----------------------|------------------|--------------|-------------------|-----------------------------------------------------|
| Main dwelling                                     |             |                |                      |                  |              |                   |                                                     |
| Solid Door                                        |             |                | 1.7900               | 1.2000           | 2.1480       |                   | (26)                                                |
| Windows / Glazed Doors                            |             |                | 13.1600              | 1.1450           | 15.0687      |                   | (27)                                                |
| Heatloss Floor 1                                  |             |                | 39.8000              | 0.1200           | 4.7760       | 75.0000           | 2985.0000 (28a)                                     |
| External Wall                                     | 66.4000     | 14.9500        | 51.4500              | 0.1500           | 7.7175       | 9.0000            | 463.0500 (29a)                                      |
| RIR Stud Wall                                     | 41.5000     |                | 41.5000              | 0.1500           | 6.2250       | 9.0000            | 373.5000 (29a)                                      |
| Dormer Walls                                      | 8.0000      |                | 8.0000               | 0.1500           | 1.2000       | 9.0000            | 72.0000 (29a)                                       |
| Adj To RIR Ins At Slope                           | 5.1000      |                | 5.1000               | 0.1400           | 0.7140       | 9.0000            | 45.9000 (30)                                        |
| Slope Roof                                        | 38.7700     |                | 38.7700              | 0.1400           | 5.4278       | 9.0000            | 348.9300 (30)                                       |
| Total net area of external elements Aum(A, m2)    |             |                | 199.5700             |                  |              |                   | (31)                                                |
| Fabric heat loss, W/K = Sum (A x U)               |             |                | (26)...(30) + (32) = |                  | 43.2770      |                   | (33)                                                |
| Main dwelling                                     |             |                |                      |                  |              |                   |                                                     |
| Party Wall 1                                      |             |                | 20.7500              | 0.0000           | 0.0000       | 45.0000           | 933.7500 (32)                                       |
| Internal Wall 1                                   |             |                | 73.5300              |                  |              | 9.0000            | 661.7700 (32c)                                      |
| Internal Floor 1                                  |             |                | 29.7000              |                  |              | 18.0000           | 534.6000 (32d)                                      |
| Internal Ceiling 1                                |             |                | 29.7000              |                  |              | 9.0000            | 267.3000 (32e)                                      |
| Heat capacity Cm = Sum(A x k)                     |             |                |                      |                  |              |                   | (28)...(30) + (32) + (32a)...(32e) = 6685.8000 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K |             |                |                      |                  |              |                   | 96.1986 (35)                                        |
| List of Thermal Bridges                           |             |                |                      |                  |              |                   |                                                     |
| K1 Element                                        |             |                |                      | Length           | Psi-value    |                   | Total                                               |
| E2 Other lintels (including other steel lintels)  |             |                |                      | 10.4200          | 0.0840       |                   | 0.8753                                              |
| E3 Sill                                           |             |                |                      | 9.5700           | 0.0340       |                   | 0.3254                                              |
| E4 Jamb                                           |             |                |                      | 34.3000          | 0.0430       |                   | 1.4749                                              |
| E16 Corner (normal)                               |             |                |                      | 27.9000          | 0.0300       |                   | 0.8370                                              |

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| 7. Mean internal temperature (heating season)                                                                |                                       |           |           |          |          |          |          |          |          |          |          |                 |
|--------------------------------------------------------------------------------------------------------------|---------------------------------------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C)                                  |                                       |           |           |          |          |          |          |          |          |          |          | 21.0000 (85)    |
| Utilisation factor for gains for living area, nil,m (see Table 9a)                                           |                                       |           |           |          |          |          |          |          |          |          |          |                 |
|                                                                                                              | Jan                                   | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| tau                                                                                                          | 20.2363                               | 20.2363   | 20.2363   | 20.2363  | 20.2363  | 20.2363  | 20.2363  | 20.2363  | 20.2363  | 20.2363  | 20.2363  | 20.2363         |
| alpha                                                                                                        | 2.3491                                | 2.3491    | 2.3491    | 2.3491   | 2.3491   | 2.3491   | 2.3491   | 2.3491   | 2.3491   | 2.3491   | 2.3491   | 2.3491          |
| util living area                                                                                             | 0.8974                                | 0.8558    | 0.7707    | 0.6349   | 0.4837   | 0.3261   | 0.2254   | 0.2508   | 0.4641   | 0.7141   | 0.8572   | 0.9087 (86)     |
| MIT                                                                                                          | 18.6599                               | 19.0408   | 19.6758   | 20.3153  | 20.7263  | 20.9251  | 20.9787  | 20.9723  | 20.8147  | 20.2310  | 19.3273  | 18.5659 (87)    |
| Th 2                                                                                                         | 19.8248                               | 19.8248   | 19.8248   | 19.8248  | 19.8248  | 19.8248  | 19.8248  | 19.8248  | 19.8248  | 19.8248  | 19.8248  | 19.8248 (88)    |
| util rest of house                                                                                           | 0.8830                                | 0.8365    | 0.7418    | 0.5929   | 0.4280   | 0.2583   | 0.1474   | 0.1672   | 0.3891   | 0.6672   | 0.8344   | 0.8955 (89)     |
| MIT 2                                                                                                        | 17.1770                               | 17.6445   | 18.4112   | 19.1514  | 19.5946  | 19.7800  | 19.8179  | 19.8153  | 19.6942  | 19.0868  | 18.0119  | 17.0617 (90)    |
| Living area fraction                                                                                         | fLA = Living area / (4) = 0.5108 (91) |           |           |          |          |          |          |          |          |          |          |                 |
| MIT                                                                                                          | 17.9345                               | 18.3577   | 19.0571   | 19.7459  | 20.1726  | 20.3649  | 20.4108  | 20.4063  | 20.2666  | 19.6713  | 18.6838  | 17.8300 (92)    |
| Temperature adjustment                                                                                       | 0.0000                                |           |           |          |          |          |          |          |          |          |          |                 |
| adjusted MIT                                                                                                 | 17.9345                               | 18.3577   | 19.0571   | 19.7459  | 20.1726  | 20.3649  | 20.4108  | 20.4063  | 20.2666  | 19.6713  | 18.6838  | 17.8300 (93)    |
| 8. Space heating requirement                                                                                 |                                       |           |           |          |          |          |          |          |          |          |          |                 |
|                                                                                                              |                                       |           |           |          |          |          |          |          |          |          |          |                 |
|                                                                                                              | Jan                                   | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| Utilisation                                                                                                  | 0.8535                                | 0.8074    | 0.7204    | 0.5899   | 0.4451   | 0.2900   | 0.1868   | 0.2092   | 0.4184   | 0.6604   | 0.8073   | 0.8666 (94)     |
| Useful gains                                                                                                 | 601.8141                              | 671.9844  | 729.5519  | 721.8089 | 595.0014 | 400.9308 | 244.6995 | 252.1194 | 437.4460 | 555.1810 | 567.2563 | 571.7996 (95)   |
| Ext temp.                                                                                                    | 5.1000                                | 5.7000    | 7.4000    | 9.9000   | 12.9000  | 15.8000  | 17.7000  | 17.6000  | 15.0000  | 11.5000  | 8.0000   | 5.1000 (96)     |
| Heat loss rate W                                                                                             | 1177.8730                             | 1161.6512 | 1069.8237 | 903.6003 | 667.4390 | 418.9402 | 248.7855 | 257.5445 | 483.3339 | 749.9105 | 980.4948 | 1168.2879 (97)  |
| Space heating kWh                                                                                            | 428.5879                              | 329.0561  | 253.1622  | 130.8899 | 53.8935  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 144.8788 | 297.5317 | 443.7873 (98a)  |
| Space heating requirement - total per year (kWh/year)                                                        |                                       |           |           |          |          |          |          |          |          |          |          | 2081.7873       |
| Solar heating kWh                                                                                            | 0.0000                                | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (98b)    |
| Solar heating contribution - total per year (kWh/year)                                                       |                                       |           |           |          |          |          |          |          |          |          |          | 0.0000          |
| Space heating kWh                                                                                            | 428.5879                              | 329.0561  | 253.1622  | 130.8899 | 53.8935  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 144.8788 | 297.5317 | 443.7873 (98c)  |
| Space heating requirement after solar contribution - total per year (kWh/year)                               |                                       |           |           |          |          |          |          |          |          |          |          | 2081.7873       |
| Space heating per m2                                                                                         | (98c) / (4) =                         |           |           |          |          |          |          |          |          |          |          | 29.9538 (99)    |
| 9a. Energy requirements - Individual heating systems, including micro-CHP                                    |                                       |           |           |          |          |          |          |          |          |          |          |                 |
|                                                                                                              |                                       |           |           |          |          |          |          |          |          |          |          |                 |
| Fraction of space heat from secondary/supplementary system (Table 11)                                        |                                       |           |           |          |          |          |          |          |          |          |          | 0.0000 (201)    |
| Fraction of space heat from main system(s)                                                                   |                                       |           |           |          |          |          |          |          |          |          |          | 1.0000 (202)    |
| Fraction of main heating from main system 2                                                                  |                                       |           |           |          |          |          |          |          |          |          |          | 0.0000 (203)    |
| Fraction of total heating from main system 1                                                                 |                                       |           |           |          |          |          |          |          |          |          |          | 1.0000 (204)    |
| Fraction of total heating from main system 2                                                                 |                                       |           |           |          |          |          |          |          |          |          |          | 0.0000 (205)    |
| Efficiency of main space heating system 1 (in %)                                                             |                                       |           |           |          |          |          |          |          |          |          |          | 100.0000 (206)  |
| Efficiency of main space heating system 2 (in %)                                                             |                                       |           |           |          |          |          |          |          |          |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                                      |                                       |           |           |          |          |          |          |          |          |          |          | 0.0000 (208)    |
|                                                                                                              | Jan                                   | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                                                                    | 428.5879                              | 329.0561  | 253.1622  | 130.8899 | 53.8935  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 144.8788 | 297.5317 | 443.7873 (98)   |
| Space heating efficiency (main heating system 1)                                                             | 100.0000                              | 100.0000  | 100.0000  | 100.0000 | 100.0000 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 100.0000 | 100.0000 | 100.0000 (210)  |
| Space heating fuel (main heating system)                                                                     | 428.5879                              | 329.0561  | 253.1622  | 130.8899 | 53.8935  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 144.8788 | 297.5317 | 443.7873 (211)  |
| Space heating efficiency (main heating system 2)                                                             | 0.0000                                | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                                                                   | 0.0000                                | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |
| Space heating fuel (secondary)                                                                               | 0.0000                                | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Space heating fuel used, main system 2                                                                       |                                       |           |           |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Water heating                                                                                                |                                       |           |           |          |          |          |          |          |          |          |          |                 |
| Water heating requirement                                                                                    | 257.8738                              | 227.6292  | 240.4334  | 207.7049 | 198.9120 | 176.5586 | 172.1478 | 180.3797 | 183.9336 | 208.3368 | 225.5336 | 254.5432 (64)   |
| Efficiency of water heater (217)m                                                                            | 313.4050                              | 313.4050  | 313.4050  | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 (216)  |
| Fuel for water heating, kWh/month                                                                            | 82.2813                               | 72.6310   | 76.7165   | 66.2737  | 63.4680  | 56.3356  | 54.9282  | 57.5548  | 58.6888  | 66.4753  | 71.9623  | 81.2186 (219)   |
| Space cooling fuel requirement (221)m                                                                        | 0.0000                                | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                                                 | 12.8034                               | 11.5644   | 12.8034   | 12.3904  | 12.8034  | 12.3904  | 12.8034  | 12.8034  | 12.3904  | 12.8034  | 12.3904  | 12.8034 (231)   |
| Lighting                                                                                                     | 24.8278                               | 19.9178   | 17.9337   | 13.1390  | 10.1490  | 8.2918   | 9.2582   | 12.0342  | 15.6312  | 20.5090  | 23.1649  | 25.5178 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity) (233a)m                                        | 0.0000                                | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (233a)   |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m                              | 0.0000                                | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m                  | 0.0000                                | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m | 0.0000                                | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity) (233b)m                                        | 0.0000                                | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (233b)   |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m                              | 0.0000                                | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m                  | 0.0000                                | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m | 0.0000                                | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |
| Annual totals kWh/year                                                                                       |                                       |           |           |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system 1                                                                           |                                       |           |           |          |          |          |          |          |          |          |          | 2081.7873 (211) |
| Space heating fuel - main system 2                                                                           |                                       |           |           |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                               |                                       |           |           |          |          |          |          |          |          |          |          | 0.0000 (215)    |
| Efficiency of water heater                                                                                   |                                       |           |           |          |          |          |          |          |          |          |          | 313.4050        |
| Water heating fuel used                                                                                      |                                       |           |           |          |          |          |          |          |          |          |          | 808.5342 (219)  |
| Space cooling fuel                                                                                           |                                       |           |           |          |          |          |          |          |          |          |          | 0.0000 (221)    |
| Electricity for pumps and fans:                                                                              |                                       |           |           |          |          |          |          |          |          |          |          |                 |

# Full SAP Calculation Printout



(MEVCentralised, Database: in-use factor = 1.3000, SFP = 0.6630)  
 mechanical ventilation fans (SFP = 0.6630)  
 Total electricity for the above, kWh/year  
 Electricity for lighting (calculated in Appendix L)

150.7497 (230a)  
 150.7497 (231)  
 200.3743 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

|                                                |                 |
|------------------------------------------------|-----------------|
| PV generation                                  | 0.0000 (233)    |
| Wind generation                                | 0.0000 (234)    |
| Hydro-electric generation (Appendix N)         | 0.0000 (235a)   |
| Electricity generated - Micro CHP (Appendix N) | 0.0000 (235)    |
| Appendix Q - special features                  |                 |
| Energy saved or generated                      | -0.0000 (236)   |
| Energy used                                    | 0.0000 (237)    |
| Total delivered energy for all uses            | 3241.4454 (238) |

## 10a. Fuel costs - using BEDF prices (585)

|                                             | Fuel<br>kWh/year | Fuel price<br>p/kWh | Fuel cost<br>£/year |
|---------------------------------------------|------------------|---------------------|---------------------|
| Space heating - main system 1               | 2081.7873        | 28.4300             | 591.8521 (240)      |
| Space heating - main system 2               | 0.0000           | 28.4300             | 0.0000 (241)        |
| Total CO2 associated with community systems |                  |                     | 0.0000 (473)        |
| Water heating (other fuel)                  | 808.5342         | 28.4300             | 229.8663 (247)      |
| Energy for instantaneous electric shower(s) | 0.0000           | 28.4300             | 0.0000 (247a)       |
| Pumps, fans and electric keep-hot           | 150.7497         | 28.4300             | 42.8581 (249)       |
| Energy for lighting                         | 200.3743         | 28.4300             | 56.9664 (250)       |
| Additional standing charges                 |                  |                     | 0.0000 (251)        |
| Total energy cost                           |                  |                     | 921.5429 (255)      |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|---------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1               | 2081.7873          | 0.1557                        | 324.0419 (261)           |
| Space heating - main system 2               | 0.0000             | 0.0000                        | 0.0000 (262)             |
| Total CO2 associated with community systems |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                  | 808.5342           | 0.1413                        | 114.2344 (264)           |
| Space and water heating                     |                    |                               | 438.2764 (265)           |
| Pumps, fans and electric keep-hot           | 150.7497           | 0.1387                        | 20.9108 (267)            |
| Energy for lighting                         | 200.3743           | 0.1443                        | 28.9202 (268)            |
| Total CO2, kg/year                          |                    |                               | 488.1074 (272)           |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 2081.7873          | 1.5763                              | 3281.4304 (275)            |
| Space heating - main system 2               | 0.0000             | 0.0000                              | 0.0000 (276)               |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 808.5342           | 1.5224                              | 1230.9473 (278)            |
| Space and water heating                     |                    |                                     | 4512.3777 (279)            |
| Pumps, fans and electric keep-hot           | 150.7497           | 1.5128                              | 228.0541 (281)             |
| Energy for lighting                         | 200.3743           | 1.5338                              | 307.3407 (282)             |
| Total Primary energy kWh/year               |                    |                                     | 5047.7725 (286)            |

## SAP 10 EPC IMPROVEMENTS

### Electric Panel Heaters

Current energy efficiency rating: C 70  
 Current environmental impact rating: A 94

|                             |            |             |                 |
|-----------------------------|------------|-------------|-----------------|
| N Solar water heating       |            |             | Recommended     |
| U Solar photovoltaic panels |            |             | Recommended     |
| V2 Wind turbine             |            |             | Not applicable  |
| Recommended measures:       | SAP change | Cost change | CO2 change      |
| N Solar water heating       | + 1.0      | -£ 40       | -17 kg (3.5%)   |
| U Solar photovoltaic panels | + 7.1      | -£ 250      | -119 kg (25.3%) |

|                           | Typical annual savings | Energy efficiency | Environmental impact |
|---------------------------|------------------------|-------------------|----------------------|
| Recommended measures      |                        |                   |                      |
| Solar water heating       | £40                    | 0.25 kg/m²        | C 71 A 94            |
| Solar photovoltaic panels | £250                   | 1.72 kg/m²        | C 78 A 95            |
| Total Savings             | £290                   | 1.97 kg/m²        |                      |

Potential energy efficiency rating: C 78  
 Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 585 TEST (31 Oct 2025)  
 Recommendation texts revision number 6.1 (11 Jun 2019)

### Typical heating and lighting costs of this home (per year, Thames Valley):

|                     | Current<br>£922 | Potential<br>£881 | Saving<br>£40 |
|---------------------|-----------------|-------------------|---------------|
| Electricity         |                 |                   |               |
| Space heating       | £635            | £657              | -£23          |
| Water heating       | £230            | £167              | £63           |
| Lighting            | £57             | £57               | £0            |
| Generated (PV)      | -£0             | -£250             | £250          |
| Total cost of fuels | £922            | £631              | £290          |
| Total cost of uses  | £922            | £631              | £290          |

# Full SAP Calculation Printout



|                                  |                       |                       |                       |
|----------------------------------|-----------------------|-----------------------|-----------------------|
| Delivered energy                 | 47 kWh/m <sup>2</sup> | 32 kWh/m <sup>2</sup> | 15 kWh/m <sup>2</sup> |
| Carbon dioxide emissions         | 0.5 tonnes            | 0.4 tonnes            | 0.1 tonnes            |
| CO2 emissions per m <sup>2</sup> | 7 kg/m <sup>2</sup>   | 5 kg/m <sup>2</sup>   | 2 kg/m <sup>2</sup>   |
| Primary energy                   | 73 kWh/m <sup>2</sup> | 51 kWh/m <sup>2</sup> | 22 kWh/m <sup>2</sup> |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                 |                             |
| Ground floor                                           | 39.8000 (1b)              | x 2.7500 (2b)                   | = 109.4500 (1b) - (3b)      |
| First floor                                            | 29.7000 (1c)              | x 2.5900 (2c)                   | = 76.9230 (1c) - (3c)       |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 69.5000                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 186.3730 (5)              |

## 2. Ventilation rate

|                                                                                                    | m <sup>3</sup> per hour                 |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 0 * 10 = 0.0000 (7a)                    |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 / (5) = 0.0000 (8)               |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 3.0000 (17)                             |
| Infiltration rate                                                                                  | 0.1500 (18)                             |
| Number of sides sheltered                                                                          | 1 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.9250 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.1388 (21)        |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate                                                                                         | 0.1769 | 0.1734 | 0.1700 | 0.1526 | 0.1492 | 0.1318 | 0.1318 | 0.1283 | 0.1388 | 0.1492 | 0.1561 | 0.1630 (22b) |
| Mechanical extract ventilation - centralised                                                            |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        |              |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

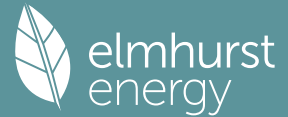
## 3. Heat losses and heat loss parameter

| Element                                                        | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K                                       |
|----------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|-----------------------------------------------------|
| Main dwelling                                                  |                         |                            |                           |                               |              |                                |                                                     |
| Solid Door                                                     |                         |                            | 1.7900                    | 1.2000                        | 2.1480       |                                | (26)                                                |
| Windows / Glazed Doors                                         |                         |                            | 13.1600                   | 1.1450                        | 15.0687      |                                | (27)                                                |
| Heatloss Floor 1                                               |                         |                            | 39.8000                   | 0.1200                        | 4.7760       | 75.0000                        | 2985.0000 (28a)                                     |
| External Wall                                                  | 66.4000                 | 14.9500                    | 51.4500                   | 0.1500                        | 7.7175       | 9.0000                         | 463.0500 (29a)                                      |
| RIR Stud Wall                                                  | 41.5000                 |                            | 41.5000                   | 0.1500                        | 6.2250       | 9.0000                         | 373.5000 (29a)                                      |
| Dormer Walls                                                   | 8.0000                  |                            | 8.0000                    | 0.1500                        | 1.2000       | 9.0000                         | 72.0000 (29a)                                       |
| Adj To RIR Ins At Slope                                        | 5.1000                  |                            | 5.1000                    | 0.1400                        | 0.7140       | 9.0000                         | 45.9000 (30)                                        |
| Slope Roof                                                     | 38.7700                 |                            | 38.7700                   | 0.1400                        | 5.4278       | 9.0000                         | 348.9300 (30)                                       |
| Total net area of external elements Aum(A, m <sup>2</sup> )    |                         |                            | 199.5700                  |                               |              |                                | (31)                                                |
| Fabric heat loss, W/K = Sum (A x U)                            |                         |                            | (26)...(30) + (32) =      |                               | 43.2770      |                                | (33)                                                |
| Main dwelling                                                  |                         |                            |                           |                               |              |                                |                                                     |
| Party Wall 1                                                   |                         |                            | 20.7500                   | 0.0000                        | 0.0000       | 45.0000                        | 933.7500 (32)                                       |
| Internal Wall 1                                                |                         |                            | 73.5300                   |                               |              | 9.0000                         | 661.7700 (32c)                                      |
| Internal Floor 1                                               |                         |                            | 29.7000                   |                               |              | 18.0000                        | 534.6000 (32d)                                      |
| Internal Ceiling 1                                             |                         |                            | 29.7000                   |                               |              | 9.0000                         | 267.3000 (32e)                                      |
| Heat capacity Cm = Sum(A x k)                                  |                         |                            |                           |                               |              |                                | (28)...(30) + (32) + (32a)...(32e) = 6685.8000 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K |                         |                            |                           |                               |              |                                | 96.1986 (35)                                        |

### List of Thermal Bridges

| K1 Element                                                       | Length  | Psi-value | Total  |
|------------------------------------------------------------------|---------|-----------|--------|
| E2 Other lintels (including other steel lintels)                 | 10.4200 | 0.0840    | 0.8753 |
| E3 Sill                                                          | 9.5700  | 0.0340    | 0.3254 |
| E4 Jamb                                                          | 34.3000 | 0.0430    | 1.4749 |
| E16 Corner (normal)                                              | 27.9000 | 0.0300    | 0.8370 |
| E18 Party wall between dwellings                                 | 2.7500  | 0.0400    | 0.1100 |
| E11 Eaves (insulation at rafter level)                           | 10.6000 | 0.0130    | 0.1378 |
| E17 Corner (inverted - internal area greater than external area) | 16.0000 | 0.0150    | 0.2400 |
| E13 Gable (insulation at rafter level)                           | 10.8000 | 0.0240    | 0.2592 |
| E6 Intermediate floor within a dwelling                          | 27.1000 | 0.0800    | 2.1680 |
| P5 Party wall - Roof (insulation at rafter level)                | 6.4000  | 0.2400    | 1.5360 |
| P2 Party wall - Intermediate floor within a dwelling             | 2.9000  | 0.0000    | 0.0000 |
| R4 Ridge (vaulted ceiling)                                       | 17.7000 | 0.1200    | 2.1240 |
| E5 Ground floor (normal)                                         | 21.4000 | 0.3200    | 6.8480 |

# Full SAP Calculation Printout



E25 Staggered party wall between dwellings  
 Thermal bridges (Sum(L x Psi) calculated using Appendix K)  
 Point Thermal bridges  
 Total fabric heat loss

|                                                                     |         |         |         |         |         |         |         |         |         |         |         |              |
|---------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) |         |         |         |         |         |         |         |         |         |         |         |              |
| (38)m                                                               | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
|                                                                     | 30.7515 | 30.7515 | 30.7515 | 30.7515 | 30.7515 | 30.7515 | 30.7515 | 30.7515 | 30.7515 | 30.7515 | 30.7515 | 30.7515 (38) |
| Heat transfer coeff                                                 |         |         |         |         |         |         |         |         |         |         |         |              |
|                                                                     | 91.7741 | 91.7741 | 91.7741 | 91.7741 | 91.7741 | 91.7741 | 91.7741 | 91.7741 | 91.7741 | 91.7741 | 91.7741 | 91.7741 (39) |
| Average = Sum(39)m / 12 =                                           |         |         |         |         |         |         |         |         |         |         |         | 91.7741      |
|                                                                     |         |         |         |         |         |         |         |         |         |         |         |              |
| HLP                                                                 | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| HLP (average)                                                       | 1.3205  | 1.3205  | 1.3205  | 1.3205  | 1.3205  | 1.3205  | 1.3205  | 1.3205  | 1.3205  | 1.3205  | 1.3205  | 1.3205 (40)  |
| Days in mont                                                        | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31           |

## 4. Water heating energy requirements (kWh/year)

|                                                                 |          |          |          |          |           |          |          |          |          |          |          |          |                |
|-----------------------------------------------------------------|----------|----------|----------|----------|-----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Assumed occupancy                                               |          |          |          |          |           |          |          |          |          |          |          |          | 2.2339 (42)    |
| Hot water usage for mixer showers                               | 84.8034  | 83.5290  | 81.6719  | 78.1187  | 75.4965   | 72.5723  | 70.9101  | 72.7532  | 74.7735  | 77.9132  | 81.5428  | 84.4785  | (42a)          |
| Hot water usage for baths                                       | 26.6456  | 26.2499  | 25.6926  | 24.6651  | 23.8957   | 23.0426  | 22.5818  | 23.1352  | 23.7377  | 24.6505  | 25.6992  | 26.5555  | (42b)          |
| Hot water usage for other uses                                  | 37.5076  | 36.1437  | 34.7798  | 33.4159  | 32.0520   | 30.6881  | 30.6881  | 32.0520  | 33.4159  | 34.7798  | 36.1437  | 37.5076  | (42c)          |
| Average daily hot water use (litres/day)                        |          |          |          |          |           |          |          |          |          |          |          |          | 136.9884 (43)  |
| Daily hot water use                                             | Jan      | Feb      | Mar      | Apr      | May       | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |                |
| Energy conte                                                    | 148.9566 | 145.9226 | 142.1443 | 136.1997 | 131.4442  | 126.3029 | 124.1800 | 127.9403 | 131.9271 | 137.3436 | 143.3857 | 148.5416 | (44)           |
| Energy content (annual)                                         | 235.9109 | 207.7918 | 218.4705 | 186.4505 | 176.9492  | 155.3042 | 150.1849 | 158.4168 | 162.6792 | 186.3739 | 204.2792 | 232.5803 | (45)           |
| Distribution loss (46)m = 0.15 x (45)m                          | 35.3866  | 31.1688  | 32.7706  | 27.9676  | 26.5424   | 23.2956  | 22.5277  | 23.7625  | 24.4019  | 27.9561  | 30.6419  | 34.8870  | (46)           |
| Water storage loss (or HIU loss):                               |          |          |          |          |           |          |          |          |          |          |          |          | 196.0000 (47)  |
| Store volume                                                    |          |          |          |          |           |          |          |          |          |          |          |          | 1.3120 (48)    |
| a) If manufacturer declared loss factor is known (kWh/day):     |          |          |          |          |           |          |          |          |          |          |          |          | 0.5400 (49)    |
| Temperature factor from Table 2b                                |          |          |          |          |           |          |          |          |          |          |          |          | 0.7085 (55)    |
| Enter (49) or (54) in (55)                                      |          |          |          |          |           |          |          |          |          |          |          |          |                |
| Total storage loss                                              | 21.9629  | 19.8374  | 21.9629  | 21.2544  | 21.9629   | 21.2544  | 21.9629  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  | (56)           |
| If cylinder contains dedicated solar storage                    | 21.9629  | 19.8374  | 21.9629  | 21.2544  | 21.9629   | 21.2544  | 21.9629  | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629  | (57)           |
| Primary loss                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (59)           |
| Combi loss                                                      | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (61)           |
| Total heat required for water heating calculated for each month | 257.8738 | 227.6292 | 240.4334 | 207.7049 | 198.9120  | 176.5586 | 172.1478 | 180.3797 | 183.9336 | 208.3368 | 225.5336 | 254.5432 | (62)           |
| WWHRS                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (63a)          |
| PV diverter                                                     | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000   | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | (63b)          |
| Aperture area of solar collector                                |          |          |          |          |           |          |          |          |          |          |          |          | 3.0000 (H1)    |
| Zero-loss collector efficiency                                  |          |          |          |          |           |          |          |          |          |          |          |          | 0.8000 (H2)    |
| Collector linear heat loss coefficient                          |          |          |          |          |           |          |          |          |          |          |          |          | 1.8000 (H3)    |
| Collector 2nd order heat loss coefficient                       |          |          |          |          |           |          |          |          |          |          |          |          | 0.0000 (H4)    |
| Collector loop efficiency                                       |          |          |          |          |           |          |          |          |          |          |          |          | 0.9000 (H5)    |
| Incidence angle modifier                                        |          |          |          |          |           |          |          |          |          |          |          |          | 1.0000 (H6)    |
| Overshading factor                                              |          |          |          |          |           |          |          |          |          |          |          |          | 0.8000 (H8)    |
| Overall heat loss coefficient of system                         |          |          |          |          |           |          |          |          |          |          |          |          | 6.5000 (H10)   |
| Heat loss coefficient of collector loop                         |          |          |          |          |           |          |          |          |          |          |          |          | 3.9667 (H11)   |
| Dedicated solar storage volume                                  |          |          |          |          |           |          |          |          |          |          |          |          | 75.0000 (H12)  |
| Effective solar volume                                          |          |          |          |          |           |          |          |          |          |          |          |          | 75.0000 (H14)  |
| Reference volume                                                |          |          |          |          |           |          |          |          |          |          |          |          | 225.0000 (H15) |
| Storage tank correction coefficient                             |          |          |          |          |           |          |          |          |          |          |          |          | 1.3161 (H16)   |
| Heat delivered to hot water                                     |          |          |          |          |           |          |          |          |          |          |          |          | 616.7709 (H24) |
| Heat delivered to space heating                                 |          |          |          |          |           |          |          |          |          |          |          |          | 0.0000 (H29)   |
| Solar input                                                     |          |          |          |          |           |          |          |          |          |          |          |          | 616.7709       |
| Solar input                                                     | -0.0000  | -16.2208 | -57.9727 | -79.5222 | -104.0406 | -95.6226 | -94.6676 | -82.9570 | -57.1689 | -28.5986 | -0.0000  | -0.0000  | (63c)          |
| FGHRS                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (63d)          |
| Output from w/h                                                 | 257.8738 | 211.4084 | 182.4607 | 128.1828 | 94.8715   | 80.9360  | 77.4803  | 97.4228  | 126.7648 | 179.7382 | 225.5336 | 254.5432 | (64)           |
| Electric shower(s)                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (64a)          |
| Heat gains from water heating, kWh/month                        | 78.4404  | 69.0908  | 72.6414  | 61.9948  | 58.8356   | 51.6386  | 49.9365  | 52.6736  | 54.0908  | 61.9693  | 67.9228  | 77.3330  | (65)           |

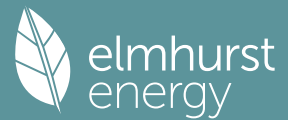
## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |          |      |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| Metabolic gains (Table 5), Watts                                                    | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |      |
| (66)m                                                                               | 134.0355 | 134.0355 | 134.0355 | 134.0355 | 134.0355 | 134.0355 | 134.0355 | 134.0355 | 134.0355 | 134.0355 | 134.0355 | 134.0355 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 28.3651  | 25.1936  | 20.4888  | 15.5113  | 11.5949  | 9.7889   | 10.5773  | 13.7487  | 18.4535  | 23.4310  | 27.3474  | 29.1534  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 292.7273 | 295.7649 | 288.1103 | 271.8144 | 251.2439 | 231.9105 | 218.9946 | 215.9570 | 223.6116 | 239.9074 | 260.4780 | 279.8114 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 50.6375  | 50.6375  | 50.6375  | 50.6375  | 50.6375  | 50.6375  | 50.6375  | 50.6375  | 50.6375  | 50.6375  | 50.6375  | 50.6375  | (69) |
| Pumps, fans                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | (71) |
| Water heating gains (Table 5)                                                       | 105.4306 | 102.8136 | 97.6363  | 86.1039  | 79.0801  | 71.7203  | 67.1189  | 70.7978  | 75.1262  | 83.2921  | 94.3373  | 103.9421 | (72) |
| Total internal gains                                                                | 521.8389 | 519.0881 | 501.5514 | 468.7456 | 437.2349 | 408.7357 | 392.0068 | 395.8195 | 412.5073 | 441.9465 | 477.4786 | 508.2229 | (73) |

## 6. Solar gains

|       |      |            |               |               |          |       |
|-------|------|------------|---------------|---------------|----------|-------|
| [Jan] | Area | Solar flux | g             | FF            | Access   | Gains |
|       | m2   | Table 6a   | Specific data | Specific data | factor   | W     |
|       |      | W/m2       | or Table 6b   | or Table 6c   | Table 6d |       |

# Full SAP Calculation Printout



|      |        |         |        |        |        |              |
|------|--------|---------|--------|--------|--------|--------------|
| East | 7.2000 | 19.6403 | 0.7600 | 0.0000 | 0.7700 | 82.7531 (76) |
| West | 5.9600 | 19.6403 | 0.7600 | 0.0000 | 0.7700 | 68.5012 (80) |

|             |          |          |          |           |           |           |           |           |          |          |          |               |
|-------------|----------|----------|----------|-----------|-----------|-----------|-----------|-----------|----------|----------|----------|---------------|
| Solar gains | 151.2542 | 295.8854 | 487.2810 | 710.6703  | 870.9532  | 891.5756  | 848.8163  | 729.1206  | 566.7280 | 351.0929 | 188.5962 | 124.3841 (83) |
| Total gains | 673.0932 | 814.9735 | 988.8324 | 1179.4160 | 1308.1881 | 1300.3113 | 1240.8230 | 1124.9402 | 979.2353 | 793.0394 | 666.0749 | 632.6070 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |                           |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |                           |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |                           |         |         |         |         |         |         |         |         |         |         |              |
|                                                                             | Jan                       | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 20.2363                   | 20.2363 | 20.2363 | 20.2363 | 20.2363 | 20.2363 | 20.2363 | 20.2363 | 20.2363 | 20.2363 | 20.2363 | 20.2363      |
| alpha                                                                       | 2.3491                    | 2.3491  | 2.3491  | 2.3491  | 2.3491  | 2.3491  | 2.3491  | 2.3491  | 2.3491  | 2.3491  | 2.3491  | 2.3491       |
| util living area                                                            | 0.9133                    | 0.8717  | 0.7970  | 0.6800  | 0.5431  | 0.4105  | 0.3093  | 0.3509  | 0.5398  | 0.7633  | 0.8829  | 0.9234 (86)  |
| MIT                                                                         | 18.4009                   | 18.8277 | 19.4636 | 20.1266 | 20.5951 | 20.8484 | 20.9435 | 20.9224 | 20.7036 | 20.0114 | 19.0530 | 18.2883 (87) |
| Th 2                                                                        | 19.8248                   | 19.8248 | 19.8248 | 19.8248 | 19.8248 | 19.8248 | 19.8248 | 19.8248 | 19.8248 | 19.8248 | 19.8248 | 19.8248 (88) |
| util rest of house                                                          | 0.9014                    | 0.8549  | 0.7718  | 0.6427  | 0.4928  | 0.3456  | 0.2322  | 0.2692  | 0.4708  | 0.7240  | 0.8644  | 0.9126 (89)  |
| MIT 2                                                                       | 16.8524                   | 17.3795 | 18.1544 | 18.9360 | 19.4579 | 19.7154 | 19.7963 | 19.7831 | 19.5908 | 18.8348 | 17.6737 | 16.7123 (90) |
| Living area fraction                                                        | fLA = Living area / (4) = |         |         |         |         |         |         |         |         |         |         | 0.5108 (91)  |
| MIT                                                                         | 17.6434                   | 18.1192 | 18.8231 | 19.5441 | 20.0388 | 20.2941 | 20.3823 | 20.3650 | 20.1592 | 19.4358 | 18.3782 | 17.5173 (92) |
| Temperature adjustment                                                      |                           |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 17.6434                   | 18.1192 | 18.8231 | 19.5441 | 20.0388 | 20.2941 | 20.3823 | 20.3650 | 20.1592 | 19.4358 | 18.3782 | 17.5173 (93) |

## 8. Space heating requirement

|                                                                                |                            |           |           |          |          |          |          |          |          |          |           |                |
|--------------------------------------------------------------------------------|----------------------------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|-----------|----------------|
|                                                                                | Jan                        | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov       | Dec            |
| Utilisation                                                                    | 0.8724                     | 0.8249    | 0.7469    | 0.6330   | 0.5024   | 0.3722   | 0.2695   | 0.3077   | 0.4914   | 0.7092   | 0.8359    | 0.8846 (94)    |
| Useful gains                                                                   | 587.2058                   | 672.2568  | 738.5830  | 746.5830 | 657.2043 | 484.0313 | 334.3957 | 346.1102 | 481.2286 | 562.4084 | 556.8025  | 559.5943 (95)  |
| Ext temp.                                                                      | 4.3000                     | 4.9000    | 6.5000    | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000  | 7.1000    | 4.2000 (96)    |
| Heat loss rate W                                                               | 1224.5758                  | 1213.1798 | 1130.9409 | 976.8560 | 765.2838 | 522.5735 | 347.1161 | 363.8865 | 556.0795 | 810.8974 | 1035.0483 | 1222.1822 (97) |
| Space heating kWh                                                              | 474.2033                   | 363.5003  | 291.9143  | 165.7966 | 80.4112  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 184.8758 | 344.3370  | 492.9654 (98a) |
| Space heating requirement - total per year (kWh/year)                          | 2398.0038                  |           |           |          |          |          |          |          |          |          |           |                |
| Solar heating kWh                                                              | -0.0000                    | -0.0000   | -0.0000   | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000   | -0.0000 (98b)  |
| Solar heating contribution - total per year (kWh/year)                         | 0.0000                     |           |           |          |          |          |          |          |          |          |           |                |
| Space heating kWh                                                              | 474.2033                   | 363.5003  | 291.9143  | 165.7966 | 80.4112  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 184.8758 | 344.3370  | 492.9654 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) | 2398.0038                  |           |           |          |          |          |          |          |          |          |           |                |
| Space heating per m2                                                           | (98c) / (4) = 34.5037 (99) |           |           |          |          |          |          |          |          |          |           |                |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                                                              |                 |          |          |          |           |          |          |          |          |          |          |                 |
|--------------------------------------------------------------------------------------------------------------|-----------------|----------|----------|----------|-----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                        | 0.0000 (201)    |          |          |          |           |          |          |          |          |          |          |                 |
| Fraction of space heat from main system(s)                                                                   | 1.0000 (202)    |          |          |          |           |          |          |          |          |          |          |                 |
| Fraction of main heating from main system 2                                                                  | 0.0000 (203)    |          |          |          |           |          |          |          |          |          |          |                 |
| Fraction of total heating from main system 1                                                                 | 1.0000 (204)    |          |          |          |           |          |          |          |          |          |          |                 |
| Fraction of total heating from main system 2                                                                 | 0.0000 (205)    |          |          |          |           |          |          |          |          |          |          |                 |
| Efficiency of main space heating system 1 (in %)                                                             | 100.0000 (206)  |          |          |          |           |          |          |          |          |          |          |                 |
| Efficiency of main space heating system 2 (in %)                                                             | 0.0000 (207)    |          |          |          |           |          |          |          |          |          |          |                 |
| Efficiency of secondary/supplementary heating system, %                                                      | 0.0000 (208)    |          |          |          |           |          |          |          |          |          |          |                 |
|                                                                                                              | Jan             | Feb      | Mar      | Apr      | May       | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                                                                    | 474.2033        | 363.5003 | 291.9143 | 165.7966 | 80.4112   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 184.8758 | 344.3370 | 492.9654 (98)   |
| Space heating efficiency (main heating system 1)                                                             | 100.0000        | 100.0000 | 100.0000 | 100.0000 | 100.0000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 100.0000 | 100.0000 | 100.0000 (210)  |
| Space heating fuel (main heating system)                                                                     | 474.2033        | 363.5003 | 291.9143 | 165.7966 | 80.4112   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 184.8758 | 344.3370 | 492.9654 (211)  |
| Space heating efficiency (main heating system 2)                                                             | 0.0000          | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                                                                   | 0.0000          | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |
| Space heating fuel (secondary)                                                                               | 0.0000          | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Space heating fuel used, main system 2                                                                       | 0.0000          | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |
| Water heating                                                                                                |                 |          |          |          |           |          |          |          |          |          |          |                 |
| Water heating requirement                                                                                    | 257.8738        | 211.4084 | 182.4607 | 128.1828 | 94.8715   | 80.9360  | 77.4803  | 97.4228  | 126.7648 | 179.7382 | 225.5336 | 254.5432 (64)   |
| Efficiency of water heater (217)m                                                                            | 313.4050        | 313.4050 | 313.4050 | 313.4050 | 313.4050  | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 (216)  |
| Fuel for water heating, kWh/month                                                                            | 82.2813         | 67.4554  | 58.2188  | 40.9000  | 30.2712   | 25.8247  | 24.7221  | 31.0853  | 40.4476  | 57.3501  | 71.9623  | 81.2186 (219)   |
| Space cooling fuel requirement (221)m                                                                        | 0.0000          | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                                                 | 19.5979         | 17.7013  | 19.5979  | 18.9657  | 19.5979   | 18.9657  | 19.5979  | 19.5979  | 18.9657  | 19.5979  | 18.9657  | 19.5979 (231)   |
| Lighting                                                                                                     | 24.8278         | 19.9178  | 17.9337  | 13.1390  | 10.1490   | 8.2918   | 9.2582   | 12.0342  | 15.6312  | 20.5090  | 23.1649  | 25.5178 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity) (233a)m                                        | -39.2501        | -58.8275 | -87.6721 | -98.4257 | -101.1171 | -83.8546 | -82.7700 | -78.4733 | -70.0025 | -66.2618 | -44.0314 | -33.5896 (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m                              | 0.0000          | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m                  | 0.0000          | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m | 0.0000          | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity) (233b)m                                        | 0.0000          | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (233b)   |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m                              | 0.0000          | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m                  | 0.0000          | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m | 0.0000          | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |
| Annual totals kWh/year                                                                                       |                 |          |          |          |           |          |          |          |          |          |          |                 |
| Space heating fuel - main system 1                                                                           | 2398.0038 (211) |          |          |          |           |          |          |          |          |          |          |                 |

# Full SAP Calculation Printout



|                                    |          |       |
|------------------------------------|----------|-------|
| Space heating fuel - main system 2 | 0.0000   | (213) |
| Space heating fuel - secondary     | 0.0000   | (215) |
| Efficiency of water heater         | 313.4050 |       |
| Water heating fuel used            | 611.7375 | (219) |
| Space cooling fuel                 | 0.0000   | (221) |

|                                                                  |          |        |
|------------------------------------------------------------------|----------|--------|
| Electricity for pumps and fans:                                  |          |        |
| (MEVCentralised, Database: in-use factor = 1.3000, SFP = 0.6630) |          |        |
| mechanical ventilation fans (SFP = 0.6630)                       | 150.7497 | (230a) |
| pump for solar water heating                                     | 80.0000  | (230g) |
| Total electricity for the above, kWh/year                        | 230.7497 | (231)  |
| Electricity for lighting (calculated in Appendix L)              | 200.3743 | (232)  |

|                                                               |           |        |
|---------------------------------------------------------------|-----------|--------|
| Energy saving/generation technologies (Appendices M ,N and Q) |           |        |
| PV generation                                                 | -844.2759 | (233)  |
| Wind generation                                               | 0.0000    | (234)  |
| Hydro-electric generation (Appendix N)                        | 0.0000    | (235a) |
| Electricity generated - Micro CHP (Appendix N)                | 0.0000    | (235)  |
| Appendix Q - special features                                 |           |        |
| Energy saved or generated                                     | -0.0000   | (236)  |
| Energy used                                                   | 0.0000    | (237)  |
| Total delivered energy for all uses                           | 2596.5893 | (238)  |

## 10a. Fuel costs - using Table 12 prices

|                                             | Fuel<br>kWh/year | Fuel price<br>p/kWh | Fuel cost<br>£/year |        |
|---------------------------------------------|------------------|---------------------|---------------------|--------|
| Space heating - main system 1               | 2398.0038        | 16.4900             | 395.4308            | (240)  |
| Space heating - main system 2               | 0.0000           | 16.4900             | 0.0000              | (241)  |
| Total CO2 associated with community systems |                  |                     | 0.0000              | (473)  |
| Water heating (other fuel)                  | 611.7375         | 16.4900             | 100.8755            | (247)  |
| Energy for instantaneous electric shower(s) | 0.0000           | 16.4900             | 0.0000              | (247a) |
| Pumps, fans and electric keep-hot           | 150.7497         | 16.4900             | 24.8586             | (249)  |
| Pump for solar water heating                | 80.0000          | 16.4900             | 13.1920             | (249)  |
| Energy for lighting                         | 200.3743         | 16.4900             | 33.0417             | (250)  |
| Additional standing charges                 |                  |                     | 0.0000              | (251)  |
| Energy saving/generation technologies       |                  |                     |                     |        |
| PV Unit electricity used in dwelling        | -844.2759        | 16.4900             | -139.2211           |        |
| PV Unit electricity exported                | 0.0000           | 5.5900              | 0.0000              |        |
| Total                                       |                  |                     | -139.2211           | (252)  |
| Total energy cost                           |                  |                     | 428.1776            | (255)  |

## 11a. SAP rating - Individual heating systems

|                                  |                                         |         |       |
|----------------------------------|-----------------------------------------|---------|-------|
| Energy cost deflator (Table 12): |                                         | 0.3600  | (256) |
| Energy cost factor (ECF)         |                                         | 1.3462  | (257) |
| SAP value                        | $[(255) \times (256)] / [(4) + 45.0] =$ | 78.1775 |       |
| SAP rating (Section 12)          |                                         | 78      | (258) |
| SAP band                         |                                         | C       |       |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |       |
|---------------------------------------------|--------------------|-------------------------------|--------------------------|-------|
| Space heating - main system 1               | 2398.0038          | 0.1551                        | 371.9326                 | (261) |
| Space heating - main system 2               | 0.0000             | 0.0000                        | 0.0000                   | (262) |
| Total CO2 associated with community systems |                    |                               | 0.0000                   | (373) |
| Water heating (other fuel)                  | 611.7375           | 0.1457                        | 89.1205                  | (264) |
| Space and water heating                     |                    |                               | 461.0531                 | (265) |
| Pumps, fans and electric keep-hot           | 230.7497           | 0.1387                        | 32.0078                  | (267) |
| Energy for lighting                         | 200.3743           | 0.1443                        | 28.9202                  | (268) |
| Energy saving/generation technologies       |                    |                               |                          |       |
| PV Unit electricity used in dwelling        | -844.2759          | 0.1355                        | -114.3611                |       |
| PV Unit electricity exported                | 0.0000             | 0.0000                        | 0.0000                   |       |
| Total                                       |                    |                               | -114.3611                | (269) |
| Total CO2, kg/year                          |                    |                               | 407.6200                 | (272) |
| CO2 emissions per m2                        |                    |                               | 5.8700                   | (273) |
| EI value                                    |                    |                               | 95.2296                  |       |
| EI rating                                   |                    |                               | 95                       | (274) |
| EI band                                     |                    |                               | A                        |       |

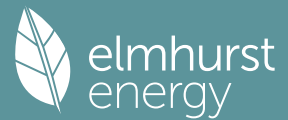
SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) |      | Storey height<br>(m) |                                 | Volume<br>(m3) |                        |
|--------------------------------------------------------|--------------|------|----------------------|---------------------------------|----------------|------------------------|
| Main dwelling                                          |              |      |                      |                                 |                |                        |
| Ground floor                                           | 39.8000      | (1b) | x                    | 2.7500                          | (2b)           | = 109.4500 (1b) - (3b) |
| First floor                                            | 29.7000      | (1c) | x                    | 2.5900                          | (2c)           | = 76.9230 (1c) - (3c)  |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 69.5000      |      |                      |                                 |                | (4)                    |
| Dwelling volume                                        |              |      |                      | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) |                | = 186.3730 (5)         |

## 2. Ventilation rate

# Full SAP Calculation Printout



|                                                                                                         |                                                       |        |        |        |        |        |        |        |        |        |             |                             |                      |
|---------------------------------------------------------------------------------------------------------|-------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|-----------------------------|----------------------|
|                                                                                                         |                                                       |        |        |        |        |        |        |        |        |        | m3 per hour |                             |                      |
| Number of open chimneys                                                                                 |                                                       |        |        |        |        |        |        |        |        |        |             | 0 * 80 =                    | 0.0000 (6a)          |
| Number of open flues                                                                                    |                                                       |        |        |        |        |        |        |        |        |        |             | 0 * 20 =                    | 0.0000 (6b)          |
| Number of chimneys / flues attached to closed fire                                                      |                                                       |        |        |        |        |        |        |        |        |        |             | 0 * 10 =                    | 0.0000 (6c)          |
| Number of flues attached to solid fuel boiler                                                           |                                                       |        |        |        |        |        |        |        |        |        |             | 0 * 20 =                    | 0.0000 (6d)          |
| Number of flues attached to other heater                                                                |                                                       |        |        |        |        |        |        |        |        |        |             | 0 * 35 =                    | 0.0000 (6e)          |
| Number of blocked chimneys                                                                              |                                                       |        |        |        |        |        |        |        |        |        |             | 0 * 20 =                    | 0.0000 (6f)          |
| Number of intermittent extract fans                                                                     |                                                       |        |        |        |        |        |        |        |        |        |             | 0 * 10 =                    | 0.0000 (7a)          |
| Number of passive vents                                                                                 |                                                       |        |        |        |        |        |        |        |        |        |             | 0 * 10 =                    | 0.0000 (7b)          |
| Number of flueless gas fires                                                                            |                                                       |        |        |        |        |        |        |        |        |        |             | 0 * 40 =                    | 0.0000 (7c)          |
|                                                                                                         |                                                       |        |        |        |        |        |        |        |        |        |             |                             | Air changes per hour |
| Infiltration due to chimneys, flues and fans                                                            | = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = |        |        |        |        |        |        |        |        |        |             | 0.0000 / (5) =              | 0.0000 (8)           |
| Pressure test                                                                                           |                                                       |        |        |        |        |        |        |        |        |        |             | Yes                         |                      |
| Pressure Test Method                                                                                    |                                                       |        |        |        |        |        |        |        |        |        |             | Blower Door                 |                      |
| Measured/design AP50                                                                                    |                                                       |        |        |        |        |        |        |        |        |        |             | 3.0000                      | (17)                 |
| Infiltration rate                                                                                       |                                                       |        |        |        |        |        |        |        |        |        |             | 0.1500                      | (18)                 |
| Number of sides sheltered                                                                               |                                                       |        |        |        |        |        |        |        |        |        |             | 1                           | (19)                 |
| Shelter factor                                                                                          |                                                       |        |        |        |        |        |        |        |        |        |             | (20) = 1 - [0.075 x (19)] = | 0.9250 (20)          |
| Infiltration rate adjusted to include shelter factor                                                    |                                                       |        |        |        |        |        |        |        |        |        |             | (21) = (18) x (20) =        | 0.1388 (21)          |
|                                                                                                         | Jan                                                   | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov         | Dec                         |                      |
| Wind speed                                                                                              | 4.3000                                                | 4.1000 | 4.1000 | 3.8000 | 3.9000 | 3.4000 | 3.4000 | 3.3000 | 3.4000 | 3.8000 | 3.7000      | 4.0000 (22)                 |                      |
| Wind factor                                                                                             | 1.0750                                                | 1.0250 | 1.0250 | 0.9500 | 0.9750 | 0.8500 | 0.8500 | 0.8250 | 0.8500 | 0.9500 | 0.9250      | 1.0000 (22a)                |                      |
| Adj infilt rate                                                                                         | 0.1492                                                | 0.1422 | 0.1422 | 0.1318 | 0.1353 | 0.1179 | 0.1179 | 0.1145 | 0.1179 | 0.1318 | 0.1283      | 0.1388 (22b)                |                      |
| Mechanical extract ventilation - centralised                                                            |                                                       |        |        |        |        |        |        |        |        |        |             |                             |                      |
| If mechanical ventilation                                                                               |                                                       |        |        |        |        |        |        |        |        |        |             |                             | 0.5000 (23a)         |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |                                                       |        |        |        |        |        |        |        |        |        |             |                             | 0.5000 (23b)         |
| Effective ac                                                                                            | 0.5000                                                | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000      | 0.5000 (25)                 |                      |

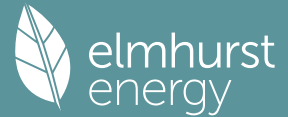
### 3. Heat losses and heat loss parameter

| Element                                                          | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K     | A x U<br>W/K | K-value<br>kJ/m2K     | A x K<br>kJ/K |                                      |
|------------------------------------------------------------------|-------------|----------------|---------------|----------------------|--------------|-----------------------|---------------|--------------------------------------|
| Main dwelling                                                    |             |                |               |                      |              |                       |               |                                      |
| Solid Door                                                       |             |                | 1.7900        | 1.2000               | 2.1480       |                       |               | (26)                                 |
| Windows / Glazed Doors                                           |             |                | 13.1600       | 1.1450               | 15.0687      |                       |               | (27)                                 |
| Heatloss Floor 1                                                 |             |                | 39.8000       | 0.1200               | 4.7760       | 75.0000               | 2985.0000     | (28a)                                |
| External Wall                                                    | 66.4000     | 14.9500        | 51.4500       | 0.1500               | 7.7175       | 9.0000                | 463.0500      | (29a)                                |
| RIR Stud Wall                                                    | 41.5000     |                | 41.5000       | 0.1500               | 6.2250       | 9.0000                | 373.5000      | (29a)                                |
| Dormer Walls                                                     | 8.0000      |                | 8.0000        | 0.1500               | 1.2000       | 9.0000                | 72.0000       | (29a)                                |
| Adj To RIR Ins At Slope                                          | 5.1000      |                | 5.1000        | 0.1400               | 0.7140       | 9.0000                | 45.9000       | (30)                                 |
| Slope Roof                                                       | 38.7700     |                | 38.7700       | 0.1400               | 5.4278       | 9.0000                | 348.9300      | (30)                                 |
| Total net area of external elements Aum(A, m2)                   |             |                | 199.5700      |                      |              |                       |               | (31)                                 |
| Fabric heat loss, W/K = Sum (A x U)                              |             |                |               | (26)...(30) + (32) = | 43.2770      |                       |               | (33)                                 |
| Main dwelling                                                    |             |                |               |                      |              |                       |               |                                      |
| Party Wall 1                                                     |             |                | 20.7500       | 0.0000               | 0.0000       | 45.0000               | 933.7500      | (32)                                 |
| Internal Wall 1                                                  |             |                | 73.5300       |                      |              | 9.0000                | 661.7700      | (32c)                                |
| Internal Floor 1                                                 |             |                | 29.7000       |                      |              | 18.0000               | 534.6000      | (32d)                                |
| Internal Ceiling 1                                               |             |                | 29.7000       |                      |              | 9.0000                | 267.3000      | (32e)                                |
| Heat capacity Cm = Sum(A x k)                                    |             |                |               |                      |              |                       |               | (28)...(30) + (32) + (32a)...(32e) = |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K                |             |                |               |                      |              |                       | 6685.8000     | (34)                                 |
| List of Thermal Bridges                                          |             |                |               |                      |              |                       | 96.1986       | (35)                                 |
| K1 Element                                                       |             |                |               | Length               | Psi-value    | Total                 |               |                                      |
| E2 Other lintels (including other steel lintels)                 |             |                |               | 10.4200              | 0.0840       | 0.8753                |               |                                      |
| E3 Sill                                                          |             |                |               | 9.5700               | 0.0340       | 0.3254                |               |                                      |
| E4 Jamb                                                          |             |                |               | 34.3000              | 0.0430       | 1.4749                |               |                                      |
| E16 Corner (normal)                                              |             |                |               | 27.9000              | 0.0300       | 0.8370                |               |                                      |
| E18 Party wall between dwellings                                 |             |                |               | 2.7500               | 0.0400       | 0.1100                |               |                                      |
| E11 Eaves (insulation at rafter level)                           |             |                |               | 10.6000              | 0.0130       | 0.1378                |               |                                      |
| E17 Corner (inverted - internal area greater than external area) |             |                |               | 16.0000              | 0.0150       | 0.2400                |               |                                      |
| E13 Gable (insulation at rafter level)                           |             |                |               | 10.8000              | 0.0240       | 0.2592                |               |                                      |
| E6 Intermediate floor within a dwelling                          |             |                |               | 27.1000              | 0.0800       | 2.1680                |               |                                      |
| P5 Party wall - Roof (insulation at rafter level)                |             |                |               | 6.4000               | 0.2400       | 1.5360                |               |                                      |
| P2 Party wall - Intermediate floor within a dwelling             |             |                |               | 2.9000               | 0.0000       | 0.0000                |               |                                      |
| R4 Ridge (vaulted ceiling)                                       |             |                |               | 17.7000              | 0.1200       | 2.1240                |               |                                      |
| E5 Ground floor (normal)                                         |             |                |               | 21.4000              | 0.3200       | 6.8480                |               |                                      |
| E25 Staggered party wall between dwellings                       |             |                |               | 6.7500               | 0.1200       | 0.8100                |               |                                      |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)       |             |                |               |                      |              |                       | 17.7456       | (36)                                 |
| Point Thermal bridges                                            |             |                |               |                      |              | (36a) =               | 0.0000        |                                      |
| Total fabric heat loss                                           |             |                |               |                      |              | (33) + (36) + (36a) = | 61.0226       | (37)                                 |

### 4. Water heating energy requirements (kWh/year)

|                                          |                                                                                                       |          |          |          |          |          |          |          |          |          |          |               |
|------------------------------------------|-------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Assumed occupancy                        | 2.2339 (42)                                                                                           |          |          |          |          |          |          |          |          |          |          |               |
| Hot water usage for mixer showers        | 84.8034 83.5290 81.6719 78.1187 75.4965 72.5723 70.9101 72.7532 74.7735 77.9132 81.5428 84.4785 (42a) |          |          |          |          |          |          |          |          |          |          |               |
| Hot water usage for baths                | 26.6456 26.2499 25.6926 24.6651 23.8957 23.0426 22.5818 23.1352 23.7377 24.6505 25.6992 26.5555 (42b) |          |          |          |          |          |          |          |          |          |          |               |
| Hot water usage for other uses           | 37.5076 36.1437 34.7798 33.4159 32.0520 30.6881 30.6881 32.0520 33.4159 34.7798 36.1437 37.5076 (42c) |          |          |          |          |          |          |          |          |          |          |               |
| Average daily hot water use (litres/day) | 136.9884 (43)                                                                                         |          |          |          |          |          |          |          |          |          |          |               |
| Daily hot water use                      | Jan                                                                                                   | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
|                                          | 148.9566                                                                                              | 145.9226 | 142.1443 | 136.1997 | 131.4442 | 126.3029 | 124.1800 | 127.9403 | 131.9271 | 137.3436 | 143.3857 | 148.5416 (44) |

# Full SAP Calculation Printout



|                                                                                |          |          |          |          |           |           |           |          |          |          |          |                |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|-----------|-----------|-----------|----------|----------|----------|----------|----------------|
| Energy content (annual)                                                        | 235.9109 | 207.7918 | 218.4705 | 186.4505 | 176.9492  | 155.3042  | 150.1849  | 158.4168 | 162.6792 | 186.3739 | 204.2792 | 232.5803 (45)  |
| Distribution loss (46)m = 0.15 x (45)m                                         | 35.3866  | 31.1688  | 32.7706  | 27.9676  | 26.5424   | 23.2956   | 22.5277   | 23.7625  | 24.4019  | 27.9561  | 30.6419  | 34.8870 (46)   |
| Water storage loss (or HIU loss):                                              |          |          |          |          |           |           |           |          |          |          |          |                |
| Store volume                                                                   |          |          |          |          |           |           |           |          |          |          |          | 196.0000 (47)  |
| a) If manufacturer declared loss factor is known (kWh/day):                    |          |          |          |          |           |           |           |          |          |          |          | 1.3120 (48)    |
| Temperature factor from Table 2b                                               |          |          |          |          |           |           |           |          |          |          |          | 0.5400 (49)    |
| Enter (49) or (54) in (55)                                                     |          |          |          |          |           |           |           |          |          |          |          | 0.7085 (55)    |
| Total storage loss                                                             | 21.9629  | 19.8374  | 21.9629  | 21.2544  | 21.9629   | 21.2544   | 21.9629   | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629 (56)   |
| If cylinder contains dedicated solar storage                                   | 21.9629  | 19.8374  | 21.9629  | 21.2544  | 21.9629   | 21.2544   | 21.9629   | 21.9629  | 21.2544  | 21.9629  | 21.2544  | 21.9629 (57)   |
| Primary loss                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (59)    |
| Combi loss                                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (61)    |
| Total heat required for water heating calculated for each month                | 257.8738 | 227.6292 | 240.4334 | 207.7049 | 198.9120  | 176.5586  | 172.1478  | 180.3797 | 183.9336 | 208.3368 | 225.5336 | 254.5432 (62)  |
| WWHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63a)   |
| PV diverter                                                                    | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000   | -0.0000   | -0.0000   | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000 (63b)  |
| Aperture area of solar collector                                               |          |          |          |          |           |           |           |          |          |          |          | 3.0000 (H1)    |
| Zero-loss collector efficiency                                                 |          |          |          |          |           |           |           |          |          |          |          | 0.8000 (H2)    |
| Collector linear heat loss coefficient                                         |          |          |          |          |           |           |           |          |          |          |          | 1.8000 (H3)    |
| Collector 2nd order heat loss coefficient                                      |          |          |          |          |           |           |           |          |          |          |          | 0.0000 (H4)    |
| Collector loop efficiency                                                      |          |          |          |          |           |           |           |          |          |          |          | 0.9000 (H5)    |
| Incidence angle modifier                                                       |          |          |          |          |           |           |           |          |          |          |          | 1.0000 (H6)    |
| Overshading factor                                                             |          |          |          |          |           |           |           |          |          |          |          | 0.8000 (H8)    |
| Overall heat loss coefficient of system                                        |          |          |          |          |           |           |           |          |          |          |          | 6.5000 (H10)   |
| Heat loss coefficient of collector loop                                        |          |          |          |          |           |           |           |          |          |          |          | 3.9667 (H11)   |
| Dedicated solar storage volume                                                 |          |          |          |          |           |           |           |          |          |          |          | 75.0000 (H12)  |
| Effective solar volume                                                         |          |          |          |          |           |           |           |          |          |          |          | 75.0000 (H14)  |
| Reference volume                                                               |          |          |          |          |           |           |           |          |          |          |          | 225.0000 (H15) |
| Storage tank correction coefficient                                            |          |          |          |          |           |           |           |          |          |          |          | 1.3161 (H16)   |
| Heat delivered to hot water                                                    |          |          |          |          |           |           |           |          |          |          |          | 695.2054 (H24) |
| Heat delivered to space heating                                                |          |          |          |          |           |           |           |          |          |          |          | 0.0000 (H29)   |
| Solar input                                                                    |          |          |          |          |           |           |           |          |          |          |          | 695.2054       |
| Solar input                                                                    | -1.0207  | -19.5859 | -62.6430 | -86.4726 | -108.8637 | -106.2651 | -103.9997 | -94.8486 | -67.5513 | -38.3040 | -5.6509  | -0.0000 (63c)  |
| FGHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63d)   |
| Output from w/h                                                                | 256.8531 | 208.0433 | 177.7904 | 121.2323 | 90.0483   | 70.2935   | 68.1481   | 85.5312  | 116.3824 | 170.0328 | 219.8827 | 254.5432 (64)  |
| Electric shower(s)                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (64a)   |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |           |           |           |          |          |          |          | 0.0000 (64a)   |
| Heat gains from water heating, kWh/month                                       | 78.4404  | 69.0908  | 72.6414  | 61.9948  | 58.8356   | 51.6386   | 49.9365   | 52.6736  | 54.0908  | 61.9693  | 67.9228  | 77.3330 (65)   |

## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Metabolic gains (Table 5), Watts                                                    | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
| (66)m                                                                               | 134.0355 | 134.0355 | 134.0355 | 134.0355 | 134.0355 | 134.0355 | 134.0355 | 134.0355 | 134.0355 | 134.0355 | 134.0355 | 134.0355 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 28.3651  | 25.1936  | 20.4888  | 15.5113  | 11.5949  | 9.7889   | 10.5773  | 13.7487  | 18.4535  | 23.4310  | 27.3474  | 29.1534 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 292.7273 | 295.7649 | 288.1103 | 271.8144 | 251.2439 | 231.9105 | 218.9946 | 215.9570 | 223.6116 | 239.9074 | 260.4780 | 279.8114 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 50.6375  | 50.6375  | 50.6375  | 50.6375  | 50.6375  | 50.6375  | 50.6375  | 50.6375  | 50.6375  | 50.6375  | 50.6375  | 50.6375 (69)  |
| Pumps, fans                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (70)   |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 | -89.3570 (71) |
| Water heating gains (Table 5)                                                       | 105.4306 | 102.8136 | 97.6363  | 86.1039  | 79.0801  | 71.7203  | 67.1189  | 70.7978  | 75.1262  | 83.2921  | 94.3373  | 103.9421 (72) |
| Total internal gains                                                                | 521.8389 | 519.0881 | 501.5514 | 468.7456 | 437.2349 | 408.7357 | 392.0068 | 395.8195 | 412.5073 | 441.9465 | 477.4786 | 508.2229 (73) |

## 6. Solar gains

| [Jan]       |          |          |           |           | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c |           |          | Access<br>factor<br>Table 6d | Gains<br>W    |  |
|-------------|----------|----------|-----------|-----------|------------|--------------------------------|-----------------------------------|------------------------------------|-----------|----------|------------------------------|---------------|--|
| East        |          |          |           |           | 7.2000     | 23.8018                        | 0.7600                            | 0.0000                             |           |          | 0.7700                       | 100.2873 (76) |  |
| West        |          |          |           |           | 5.9600     | 23.8018                        | 0.7600                            | 0.0000                             |           |          | 0.7700                       | 83.0156 (80)  |  |
| Solar gains | 183.3029 | 313.2028 | 511.1374  | 754.8499  | 899.6730   | 973.5612                       | 917.9753                          | 809.5678                           | 633.0570  | 398.6710 | 225.1440                     | 151.6077 (83) |  |
| Total gains | 705.1419 | 832.2909 | 1012.6888 | 1223.5955 | 1336.9079  | 1382.2969                      | 1309.9820                         | 1205.3873                          | 1045.5643 | 840.6175 | 702.6226                     | 659.8306 (84) |  |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |                           |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |                           |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep                       | Oct     | Nov     | Dec          |
| tau                                                                         | 20.2363 | 20.2363 | 20.2363 | 20.2363 | 20.2363 | 20.2363 | 20.2363 | 20.2363 | 20.2363                   | 20.2363 | 20.2363 | 20.2363      |
| alpha                                                                       | 2.3491  | 2.3491  | 2.3491  | 2.3491  | 2.3491  | 2.3491  | 2.3491  | 2.3491  | 2.3491                    | 2.3491  | 2.3491  | 2.3491       |
| util living area                                                            | 0.8974  | 0.8558  | 0.7707  | 0.6349  | 0.4837  | 0.3261  | 0.2254  | 0.2508  | 0.4641                    | 0.7141  | 0.8572  | 0.9087 (86)  |
| MIT                                                                         | 18.6599 | 19.0408 | 19.6758 | 20.3153 | 20.7263 | 20.9251 | 20.9787 | 20.9723 | 20.8147                   | 20.2310 | 19.3273 | 18.5659 (87) |
| Th 2                                                                        | 19.8248 | 19.8248 | 19.8248 | 19.8248 | 19.8248 | 19.8248 | 19.8248 | 19.8248 | 19.8248                   | 19.8248 | 19.8248 | 19.8248 (88) |
| util rest of house                                                          | 0.8830  | 0.8365  | 0.7418  | 0.5929  | 0.4280  | 0.2583  | 0.1474  | 0.1672  | 0.3891                    | 0.6672  | 0.8344  | 0.8955 (89)  |
| MIT 2                                                                       | 17.1770 | 17.6445 | 18.4112 | 19.1514 | 19.5946 | 19.7800 | 19.8179 | 19.8153 | 19.6942                   | 19.0868 | 18.0119 | 17.0617 (90) |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         | 0.5108 (91)  |
| MIT                                                                         | 17.9345 | 18.3577 | 19.0571 | 19.7459 | 20.1726 | 20.3649 | 20.4108 | 20.4063 | 20.2666                   | 19.6713 | 18.6838 | 17.8300 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |
| adjusted MIT                                                                | 17.9345 | 18.3577 | 19.0571 | 19.7459 | 20.1726 | 20.3649 | 20.4108 | 20.4063 | 20.2666                   | 19.6713 | 18.6838 | 17.8300 (93) |

## 8. Space heating requirement

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|                                                                                | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov           | Dec       |       |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|---------------|-----------|-------|
| Utilisation                                                                    | 0.8535    | 0.8074    | 0.7204    | 0.5899   | 0.4451   | 0.2900   | 0.1868   | 0.2092   | 0.4184   | 0.6604   | 0.8073        | 0.8666    | (94)  |
| Useful gains                                                                   | 601.8141  | 671.9844  | 729.5519  | 721.8089 | 595.0014 | 400.9308 | 244.6995 | 252.1194 | 437.4460 | 555.1810 | 567.2563      | 571.7996  | (95)  |
| Ext temp.                                                                      | 5.1000    | 5.7000    | 7.4000    | 9.9000   | 12.9000  | 15.8000  | 17.7000  | 17.6000  | 15.0000  | 11.5000  | 8.0000        | 5.1000    | (96)  |
| Heat loss rate W                                                               | 1177.8730 | 1161.6512 | 1069.8237 | 903.6003 | 667.4390 | 418.9402 | 248.7855 | 257.5445 | 483.3339 | 749.9105 | 980.4948      | 1168.2879 | (97)  |
| Space heating kWh                                                              | 428.5879  | 329.0561  | 253.1622  | 130.8899 | 53.8935  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 144.8788 | 297.5317      | 443.7873  | (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |          |          |          |          |          |          |          |               | 2081.7873 |       |
| Solar heating kWh                                                              | -0.0000   | -0.0000   | -0.0000   | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000       | -0.0000   | (98b) |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |          |          |          |          |          |          |          |               | 0.0000    |       |
| Space heating kWh                                                              | 428.5879  | 329.0561  | 253.1622  | 130.8899 | 53.8935  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 144.8788 | 297.5317      | 443.7873  | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |          |               | 2081.7873 |       |
| Space heating per m2                                                           |           |           |           |          |          |          |          |          |          |          | (98c) / (4) = | 29.9538   | (99)  |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |          |           |        |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|--------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (201)  |
| Fraction of space heat from main system(s)                                                           |          |          |          |          |          |          |          |          |          |          |          |          | 1.0000    | (202)  |
| Fraction of main heating from main system 2                                                          |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (203)  |
| Fraction of total heating from main system 1                                                         |          |          |          |          |          |          |          |          |          |          |          |          | 1.0000    | (204)  |
| Fraction of total heating from main system 2                                                         |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (205)  |
| Efficiency of main space heating system 1 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          |          | 100.0000  | (206)  |
| Efficiency of main space heating system 2 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (207)  |
| Efficiency of secondary/supplementary heating system, %                                              |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (208)  |
| Space heating requirement                                                                            | 428.5879 | 329.0561 | 253.1622 | 130.8899 | 53.8935  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 144.8788 | 297.5317 | 443.7873 | (98)      |        |
| Space heating efficiency (main heating system 1)                                                     | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 100.0000 | 100.0000 | 100.0000 | (210)     |        |
| Space heating fuel (main heating system)                                                             | 428.5879 | 329.0561 | 253.1622 | 130.8899 | 53.8935  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 144.8788 | 297.5317 | 443.7873 | (211)     |        |
| Space heating efficiency (main heating system 2)                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (212)     |        |
| Space heating fuel (main heating system 2)                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (213)     |        |
| Space heating fuel (secondary)                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (215)     |        |
| Space heating fuel used, main system 2                                                               |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (213)  |
| Water heating requirement                                                                            | 256.8531 | 208.0433 | 177.7904 | 121.2323 | 90.0483  | 70.2935  | 68.1481  | 85.5312  | 116.3824 | 170.0328 | 219.8827 | 254.5432 | (64)      |        |
| Efficiency of water heater (217)m                                                                    | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | 313.4050 | (216)     |        |
| Fuel for water heating, kWh/month                                                                    | 81.9557  | 66.3816  | 56.7286  | 38.6823  | 28.7323  | 22.4290  | 21.7444  | 27.2909  | 37.1348  | 54.2534  | 70.1593  | 81.2186  | (219)     |        |
| Space cooling fuel requirement (221)m                                                                | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (221)     |        |
| Pumps and Fa                                                                                         | 19.5979  | 17.7013  | 19.5979  | 18.9657  | 19.5979  | 18.9657  | 19.5979  | 19.5979  | 18.9657  | 19.5979  | 18.9657  | 19.5979  | (231)     |        |
| Lighting                                                                                             | 24.8278  | 19.9178  | 17.9337  | 13.1390  | 10.1490  | 8.2918   | 9.2582   | 12.0342  | 15.6312  | 20.5090  | 23.1649  | 25.5178  | (232)     |        |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (233a)m                                                                                              | -45.4341 | -60.3486 | -88.6148 | -98.8948 | -98.9204 | -86.5910 | -85.1554 | -81.8918 | -73.8177 | -70.4065 | -49.8272 | -39.1621 | (233a)    |        |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (234a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (234a)    |        |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (235a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (235a)    |        |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (235c)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (235c)    |        |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (233b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (233b)    |        |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (234b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (234b)    |        |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (235b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (235b)    |        |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (235d)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (235d)    |        |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |          |           |        |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          |          | 2081.7873 | (211)  |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (213)  |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (215)  |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          |          | 313.4050  |        |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          |          | 586.7109  | (219)  |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (221)  |
| Electricity for pumps and fans:                                                                      |          |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (MEV)Centralised, Database: in-use factor = 1.3000, SFP = 0.6630)                                    |          |          |          |          |          |          |          |          |          |          |          |          |           |        |
| mechanical ventilation fans (SFP = 0.6630)                                                           |          |          |          |          |          |          |          |          |          |          |          |          | 150.7497  | (230a) |
| pump for solar water heating                                                                         |          |          |          |          |          |          |          |          |          |          |          |          | 80.0000   | (230g) |
| Total electricity for the above, kWh/year                                                            |          |          |          |          |          |          |          |          |          |          |          |          | 230.7497  | (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |          |          |          |          |          |          |          |          |          | 200.3743  | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |          |          |          |          |          |          |          |          |          |           |        |
| PV generation                                                                                        |          |          |          |          |          |          |          |          |          |          |          |          | -879.0645 | (233)  |
| Wind generation                                                                                      |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (234)  |
| Hydro-electric generation (Appendix N)                                                               |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (235a) |
| Electricity generated - Micro CHP (Appendix N)                                                       |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (235)  |
| Appendix Q - special features                                                                        |          |          |          |          |          |          |          |          |          |          |          |          |           |        |
| Energy saved or generated                                                                            |          |          |          |          |          |          |          |          |          |          |          |          | -0.0000   | (236)  |
| Energy used                                                                                          |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (237)  |
| Total delivered energy for all uses                                                                  |          |          |          |          |          |          |          |          |          |          |          |          | 2220.5576 | (238)  |

## 10a. Fuel costs - using BEDF prices (585)

|                                             | Fuel<br>kWh/year | Fuel price<br>p/kWh | Fuel cost<br>£/year |        |
|---------------------------------------------|------------------|---------------------|---------------------|--------|
| Space heating - main system 1               | 2081.7873        | 28.4300             | 591.8521            | (240)  |
| Space heating - main system 2               | 0.0000           | 28.4300             | 0.0000              | (241)  |
| Total CO2 associated with community systems |                  |                     | 0.0000              | (473)  |
| Water heating (other fuel)                  | 586.7109         | 28.4300             | 166.8019            | (247)  |
| Energy for instantaneous electric shower(s) | 0.0000           | 28.4300             | 0.0000              | (247a) |

# Full SAP Calculation Printout



|                                       |           |         |                 |
|---------------------------------------|-----------|---------|-----------------|
| Pumps, fans and electric keep-hot     | 150.7497  | 28.4300 | 42.8581 (249)   |
| Pump for solar water heating          | 80.0000   | 28.4300 | 22.7440 (249)   |
| Energy for lighting                   | 200.3743  | 28.4300 | 56.9664 (250)   |
| Additional standing charges           |           |         | 0.0000 (251)    |
| Energy saving/generation technologies |           |         |                 |
| PV Unit electricity used in dwelling  | -879.0645 | 28.4300 | -249.9180       |
| PV Unit electricity exported          | 0.0000    | 5.8100  | 0.0000          |
| Total                                 |           |         | -249.9180 (252) |
| Total energy cost                     |           |         | 631.3045 (255)  |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|---------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1               | 2081.7873          | 0.1557                        | 324.0419 (261)           |
| Space heating - main system 2               | 0.0000             | 0.0000                        | 0.0000 (262)             |
| Total CO2 associated with community systems |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                  | 586.7109           | 0.1464                        | 85.8868 (264)            |
| Space and water heating                     |                    |                               | 409.9288 (265)           |
| Pumps, fans and electric keep-hot           | 230.7497           | 0.1387                        | 32.0078 (267)            |
| Energy for lighting                         | 200.3743           | 0.1443                        | 28.9202 (268)            |
| Energy saving/generation technologies       |                    |                               |                          |
| PV Unit electricity used in dwelling        | -879.0645          | 0.1357                        | -119.3225                |
| PV Unit electricity exported                | 0.0000             | 0.0000                        | 0.0000                   |
| Total                                       |                    |                               | -119.3225 (269)          |
| Total CO2, kg/year                          |                    |                               | 351.5343 (272)           |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 2081.7873          | 1.5763                              | 3281.4304 (275)            |
| Space heating - main system 2               | 0.0000             | 0.0000                              | 0.0000 (276)               |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 586.7109           | 1.5415                              | 904.4283 (278)             |
| Space and water heating                     |                    |                                     | 4185.8587 (279)            |
| Pumps, fans and electric keep-hot           | 230.7497           | 1.5128                              | 349.0781 (281)             |
| Energy for lighting                         | 200.3743           | 1.5338                              | 307.3407 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -879.0645          | 1.5017                              | -1320.1324                 |
| PV Unit electricity exported                | 0.0000             | 0.0000                              | 0.0000                     |
| Total                                       |                    |                                     | -1320.1324 (283)           |
| Total Primary energy kWh/year               |                    |                                     | 3522.1451 (286)            |

# Predicted Energy Assessment



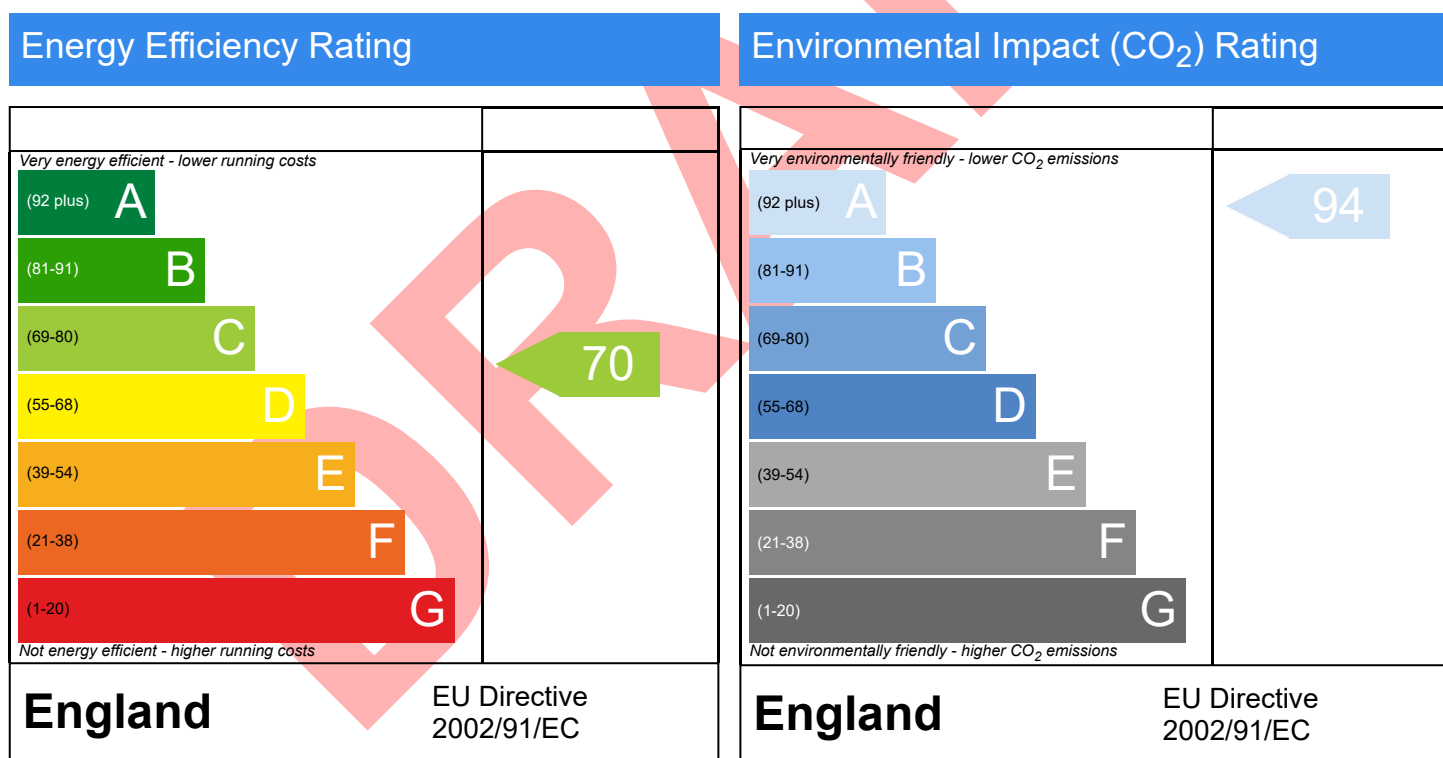
House, 85, Pell Street, Reading, RG1 2NP

Dwelling type:  
Date of assessment:  
SAP Version:  
Produced by:  
Total floor area:  
DRRN:

House, End-Terrace  
28/11/2025  
10.2  
Peter Yearsley  
69.5 m<sup>2</sup>

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO<sub>2</sub>) emissions.



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO<sub>2</sub>) emissions. The higher the rating the less impact it has on the environment.

# Summary for Input Data



|                      |                                          |               |                |            |
|----------------------|------------------------------------------|---------------|----------------|------------|
| Plot Reference       | House, 85 Pell Street                    |               | Issued on Date | 28/11/2025 |
| Assessment Reference | Electric Panel Heaters                   | Plot Type Ref |                |            |
| Plot Address         | House, 85, Pell Street, Reading, RG1 2NP |               | SAP Version    | 10.2       |

|                                    |          |               |       |      |       |
|------------------------------------|----------|---------------|-------|------|-------|
| SAP Rating                         | 70 C     | DER           | 7.95  | TER  | 13.83 |
| Environmental                      | 94 A     | % DER < TER   |       |      | 42.52 |
| CO <sub>2</sub> Emissions (t/year) | 0.49     | DFEE          | 46.01 | TFEE | 46.94 |
| Compliance Check                   | See BREL | % DFEE < TFEE |       |      | 1.98  |
| % DPER < TPER                      | -13.11   | DPER          | 82.12 | TPER | 72.60 |

|                  |                    |             |           |
|------------------|--------------------|-------------|-----------|
| Assessor Details | Mr. Peter Yearsley | Assessor ID | R301-0001 |
| Client           |                    |             |           |

## SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

|                                |                     |        |
|--------------------------------|---------------------|--------|
| Orientation                    | North               |        |
| Property Tenture               | ND                  |        |
| Transaction Type               | 6                   |        |
| Terrain Type                   | Suburban            |        |
| 1.0 Property Type              | House, End-Terrace  |        |
| 2.0 Number of Storeys          | 2                   |        |
| 3.0 Date Built                 | 2025                |        |
| 4.0 Sheltered Sides            | 1                   |        |
| 5.0 Sunlight/Shade             | Average or unknown  |        |
| 6.0 Thermal Mass Parameter     | Precise calculation |        |
| Thermal Mass                   | 96.20               | kJ/m²K |
|                                |                     |        |
| 7.0 Electricity Tariff         | Standard            |        |
| Smart electricity meter fitted | No                  |        |
| Smart gas meter fitted         | No                  |        |

| 7.0 Measurements | Ground floor: | Heat Loss Perimeter | Internal Floor Area  | Average Storey Height |
|------------------|---------------|---------------------|----------------------|-----------------------|
|                  | 1st Storey:   | 21.40 m             | 39.80 m <sup>2</sup> | 2.75 m                |
|                  |               | 27.10 m             | 29.70 m <sup>2</sup> | 2.59 m                |

|                 |       |                |
|-----------------|-------|----------------|
| 8.0 Living Area | 35.50 | m <sup>2</sup> |
|-----------------|-------|----------------|

| 9.0 External Walls | Description   | Type         | Construction                                   | U-Value (W/m <sup>2</sup> K) | Kappa (kJ/m <sup>2</sup> K) | Gross Area(m <sup>2</sup> ) | Nett Area (m <sup>2</sup> ) | Shelter Res | Shelter | Openings | Area Calculation Type |
|--------------------|---------------|--------------|------------------------------------------------|------------------------------|-----------------------------|-----------------------------|-----------------------------|-------------|---------|----------|-----------------------|
|                    | External Wall | Timber Frame | Timber framed wall (one layer of plasterboard) | 0.15                         | 9.00                        | 66.40                       | 51.46                       | 0.00        | None    | 14.94    | Enter Gross Area      |
|                    | RIR Stud Wall | Timber Frame | Timber framed wall (one layer of plasterboard) | 0.15                         | 9.00                        | 41.50                       | 41.50                       | 0.00        | None    | 0.00     | Enter Gross Area      |
|                    | Dormer Walls  | Timber Frame | Timber framed wall (one layer of plasterboard) | 0.15                         | 9.00                        | 8.00                        | 8.00                        | 0.00        | None    | 0.00     | Enter Gross Area      |

| 9.1 Party Walls | Description  | Type                            | Construction | U-Value (W/m <sup>2</sup> K) | Kappa (kJ/m <sup>2</sup> K) | Area (m <sup>2</sup> ) | Shelter Res | Shelter |
|-----------------|--------------|---------------------------------|--------------|------------------------------|-----------------------------|------------------------|-------------|---------|
|                 | Party Wall 1 | Filled Cavity with Edge Sealing | Other        | 0.00                         | 45.00                       | 20.75                  |             | None    |

| 9.2 Internal Walls | Description     | Construction                 | Kappa (kJ/m <sup>2</sup> K) | Area (m <sup>2</sup> ) |
|--------------------|-----------------|------------------------------|-----------------------------|------------------------|
|                    | Internal Wall 1 | Plasterboard on timber frame | 9.00                        | 73.53                  |

| 10.0 External Roofs | Description             | Type                | Construction                             | U-Value (W/m <sup>2</sup> K) | Kappa (kJ/m <sup>2</sup> K) | Gross Area(m <sup>2</sup> ) | Nett Area (m <sup>2</sup> ) | Shelter Code | Shelter Factor | Calculation Type | Openings |
|---------------------|-------------------------|---------------------|------------------------------------------|------------------------------|-----------------------------|-----------------------------|-----------------------------|--------------|----------------|------------------|----------|
|                     | Adj To RIR Ins At Slope | External Plane Roof | Plasterboard, insulated at ceiling level | 0.14                         | 9.00                        | 5.10                        | 5.10                        | None         | 0.00           | Enter Gross Area | 0.00     |
|                     | Slope Roof              | External Slope Roof | Plasterboard, insulated slope            | 0.14                         | 9.00                        | 38.77                       | 38.77                       | None         | 0.00           | Enter Gross Area | 0.00     |

| 10.2 Internal Ceilings | Description        | Storey          | Construction                                   | Kappa | Area (m <sup>2</sup> ) |
|------------------------|--------------------|-----------------|------------------------------------------------|-------|------------------------|
|                        | Internal Ceiling 1 | Lowest occupied | Plasterboard ceiling, carpeted chipboard floor | 9.00  | 29.70                  |

# Summary for Input Data



## 11.0 Heat Loss Floors

| Description      | Type                 | Storey Index    | Construction | U-Value (W/m²K) | Shelter Code | Shelter Factor | Kappa (kJ/m²K) | Area (m²) |
|------------------|----------------------|-----------------|--------------|-----------------|--------------|----------------|----------------|-----------|
| Heatloss Floor 1 | Ground Floor - Solid | Lowest occupied | Other        | 0.12            | None         | 0.00           | 75.00          | 39.80     |

## 11.2 Internal Floors

| Description      | Storey Index | Construction                                   | Kappa (kJ/m²K) | Area (m²) |
|------------------|--------------|------------------------------------------------|----------------|-----------|
| Internal Floor 1 | +1           | Plasterboard ceiling, carpeted chipboard floor | 18.00          | 29.70     |

## 12.0 Opening Types

| Description            | Data Source               | Type       | Glazing       | Glazing Gap | Filling Type | G-value | Frame Type | Frame Factor | U Value (W/m²K) |
|------------------------|---------------------------|------------|---------------|-------------|--------------|---------|------------|--------------|-----------------|
| Solid Door             | Manufacturer              | Solid Door |               |             |              | 0.00    |            |              | 1.20            |
| Windows / Glazed Doors | BFRC, BSI or CERTASS data | Window     | Double glazed |             |              | 0.76    |            |              | 1.20            |

## 13.0 Openings

| Name     | Opening Type           | Location      | Orientation | Area (m²) | Pitch |
|----------|------------------------|---------------|-------------|-----------|-------|
| Opening1 | Solid Door             | External Wall | North       | 1.78      |       |
| Opening2 | Windows / Glazed Doors | External Wall | East        | 7.20      |       |
| Opening3 | Windows / Glazed Doors | External Wall | West        | 5.96      |       |

## 14.0 Conservatory

## 15.0 Draught Proofing

 %

## 16.0 Draught Lobby

## 17.0 Thermal Bridging

## 17.1 List of Bridges

| Bridge Type                                                      | Source Type            | Length | Psi  | Adjusted Reference:       | Imported |
|------------------------------------------------------------------|------------------------|--------|------|---------------------------|----------|
| E2 Other lintels (including other steel lintels)                 | Independently assessed | 10.42  | 0.08 | 0.08 R.O.I. Psi Value     | No       |
| E3 Sill                                                          | Independently assessed | 9.57   | 0.03 | 0.03 R.O.I. Psi Value     | No       |
| E4 Jamb                                                          | Independently assessed | 34.30  | 0.04 | 0.04 R.O.I. Psi Value     | No       |
| E16 Corner (normal)                                              | Independently assessed | 27.90  | 0.03 | 0.03 R.O.I. Psi Value     | No       |
| E18 Party wall between dwellings                                 | Independently assessed | 2.75   | 0.04 | 0.04 R.O.I. Psi Value     | No       |
| E11 Eaves (insulation at rafter level)                           | Independently assessed | 10.60  | 0.01 | 0.01 R.O.I. Psi Value     | No       |
| E17 Corner (inverted – internal area greater than external area) | Independently assessed | 16.00  | 0.01 | 0.01 R.O.I. Psi Value     | No       |
| E13 Gable (insulation at rafter level)                           | Independently assessed | 10.80  | 0.02 | 0.02 R.O.I. Psi Value     | No       |
| E6 Intermediate floor within a dwelling                          | Independently assessed | 27.10  | 0.08 | 0.08 R.O.I. Psi Value     | No       |
| P5 Party wall - Roof (insulation at rafter level)                | Independently assessed | 6.40   | 0.24 | 0.24 Default Value Halved | No       |
| P2 Party wall - Intermediate floor within a dwelling             | Table K1 - Default     | 2.90   | 0.00 | 0.00                      | No       |
| R4 Ridge (vaulted ceiling)                                       | Table K1 - Default     | 17.70  | 0.12 | 0.12                      | No       |
| E5 Ground floor (normal)                                         | Table K1 - Default     | 21.40  | 0.32 | 0.32                      | No       |
| E25 Staggered party wall between dwellings                       | Independently assessed | 6.75   | 0.12 | 0.12 Default Value Halved | No       |

Y-value  W/m²K

## 19.0 Mechanical Ventilation

### Mechanical Ventilation

|                                       |                                                                           |
|---------------------------------------|---------------------------------------------------------------------------|
| Mechanical Ventilation System Present | <input type="text" value="Yes"/>                                          |
| Approved Installation                 | <input type="text" value="Yes"/>                                          |
| Mechanical Ventilation data Type      | <input type="text" value="Database"/>                                     |
| Type                                  | <input type="text" value="Mechanical extract ventilation - centralised"/> |
| MV Reference Number                   | <input type="text" value="500735"/>                                       |
| Configuration                         | <input type="text" value="1"/>                                            |
| Manufacturer SFP                      | <input type="text" value="0.51"/>                                         |
| Duct Type                             | <input type="text" value="Rigid"/>                                        |
| Wet Rooms                             | <input type="text" value="1"/>                                            |

## 20.0 Fans, Open Fireplaces, Flues

|                                                  |                                |
|--------------------------------------------------|--------------------------------|
| Number of open chimneys                          | <input type="text" value="0"/> |
| Number of open flues                             | <input type="text" value="0"/> |
| Number of chimneys/flues attached to closed fire | <input type="text" value="0"/> |
| Number of flues attached to solid fuel boiler    | <input type="text" value="0"/> |
| Number of flues attached to other heater         | <input type="text" value="0"/> |
| Number of blocked chimneys                       | <input type="text" value="0"/> |
| Number of intermittent extract fans              | <input type="text" value="0"/> |
| Number of passive vents                          | <input type="text" value="0"/> |

# Summary for Input Data

|                              |                                |  |  |  |  |
|------------------------------|--------------------------------|--|--|--|--|
| Number of flueless gas fires | <input type="text" value="0"/> |  |  |  |  |
|------------------------------|--------------------------------|--|--|--|--|

---

|                                  |                                 |  |  |  |  |
|----------------------------------|---------------------------------|--|--|--|--|
| <b>21.0 Fixed Cooling System</b> | <input type="text" value="No"/> |  |  |  |  |
|----------------------------------|---------------------------------|--|--|--|--|

---

|                              |                                          |                                             |  |  |  |
|------------------------------|------------------------------------------|---------------------------------------------|--|--|--|
| <b>22.0 Pressure Testing</b> | <input type="text" value="Yes"/>         |                                             |  |  |  |
| Designed AP <sub>50</sub>    | <input type="text" value="3.00"/>        | m <sup>3</sup> /(h.m <sup>2</sup> ) @ 50 Pa |  |  |  |
| Test Method                  | <input type="text" value="Blower Door"/> |                                             |  |  |  |

---

|                      |                                 |                          |                      |                           |                   |
|----------------------|---------------------------------|--------------------------|----------------------|---------------------------|-------------------|
| <b>22.0 Lighting</b> | <input type="text" value="No"/> |                          |                      |                           |                   |
| No Fixed Lighting    | <input type="text" value="No"/> |                          |                      |                           |                   |
|                      | <b>Name</b><br>Lighting 1       | <b>Efficacy</b><br>90.00 | <b>Power</b><br>5.00 | <b>Capacity</b><br>450.00 | <b>Count</b><br>8 |

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|                            |                                                                   |   |  |  |  |
|----------------------------|-------------------------------------------------------------------|---|--|--|--|
| <b>24.0 Main Heating 1</b> | <input type="text" value="SAP table"/>                            |   |  |  |  |
| Percentage of Heat         | <input type="text" value="100.00"/>                               | % |  |  |  |
| Fuel Type                  | <input type="text" value="Electricity"/>                          |   |  |  |  |
| SAP Code                   | <input type="text" value="691"/>                                  |   |  |  |  |
| In Winter                  | <input type="text" value="100.00"/>                               |   |  |  |  |
| In Summer                  | <input type="text" value="313.40"/>                               |   |  |  |  |
| Controls SAP Code          | <input type="text" value="2603"/>                                 |   |  |  |  |
| Controls description       | <input type="text" value="Programmer and appliance thermostats"/> |   |  |  |  |

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|                            |                                                                         |   |  |  |  |
|----------------------------|-------------------------------------------------------------------------|---|--|--|--|
| <b>25.0 Main Heating 2</b> | <input type="text" value="Database"/>                                   |   |  |  |  |
| Percentage of Heat         | <input type="text" value="0.00"/>                                       | % |  |  |  |
| Database Ref. No.          | <input type="text" value="105943"/>                                     |   |  |  |  |
| Fuel Type                  | <input type="text" value="Electricity"/>                                |   |  |  |  |
| In Winter                  | <input type="text" value="0.00"/>                                       |   |  |  |  |
| In Summer                  | <input type="text" value="313.40"/>                                     |   |  |  |  |
| Model Name                 | <input type="text" value="KERS MEV-W200SL"/>                            |   |  |  |  |
| Manufacturer               | <input type="text" value="KERS Innovations UK Ltd"/>                    |   |  |  |  |
| Controls                   | <input type="text" value="2100"/>                                       |   |  |  |  |
| Controls description       | <input type="text" value="Not applicable (heating provides DHW only)"/> |   |  |  |  |

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|                           |                                   |  |  |  |  |
|---------------------------|-----------------------------------|--|--|--|--|
| <b>26.0 Heat Networks</b> | <input type="text" value="None"/> |  |  |  |  |
|---------------------------|-----------------------------------|--|--|--|--|

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|                               |                                   |  |  |  |  |
|-------------------------------|-----------------------------------|--|--|--|--|
| <b>27.0 Secondary Heating</b> | <input type="text" value="None"/> |  |  |  |  |
|-------------------------------|-----------------------------------|--|--|--|--|

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|                                                  |                                             |  |  |  |  |
|--------------------------------------------------|---------------------------------------------|--|--|--|--|
| <b>28.0 Water Heating</b>                        | <input type="text" value="Main Heating 2"/> |  |  |  |  |
| Water Heating                                    | <input type="text" value="Main Heating 2"/> |  |  |  |  |
| SAP Code                                         | <input type="text" value="914"/>            |  |  |  |  |
| Flue Gas Heat Recovery System                    | <input type="text" value="No"/>             |  |  |  |  |
| Waste Water Heat Recovery Instantaneous System 1 | <input type="text" value="No"/>             |  |  |  |  |
| Waste Water Heat Recovery Instantaneous System 2 | <input type="text" value="No"/>             |  |  |  |  |
| Waste Water Heat Recovery Storage System         | <input type="text" value="No"/>             |  |  |  |  |
| Solar Panel                                      | <input type="text" value="No"/>             |  |  |  |  |
| Water use <= 125 litres/person/day               | <input type="text" value="Yes"/>            |  |  |  |  |
| Cold Water Source                                | <input type="text" value="From mains"/>     |  |  |  |  |
| Bath Count                                       | <input type="text" value="1"/>              |  |  |  |  |
| Immersion Only Heating Hot Water                 | <input type="text" value="No"/>             |  |  |  |  |

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|                     |                                           |                             |                            |                  |                     |
|---------------------|-------------------------------------------|-----------------------------|----------------------------|------------------|---------------------|
| <b>28.1 Showers</b> |                                           |                             |                            |                  |                     |
| <b>Description</b>  | <b>Shower Type</b>                        | <b>Flow Rate</b><br>[l/min] | <b>Rated Power</b><br>[kW] | <b>Connected</b> | <b>Connected To</b> |
| Shower              | Combi boiler or unvented hot water system | 11.00                       |                            | No               |                     |

---

|                                              |  |  |  |  |  |
|----------------------------------------------|--|--|--|--|--|
| <b>28.3 Waste Water Heat Recovery System</b> |  |  |  |  |  |
|----------------------------------------------|--|--|--|--|--|

---

|                                |                                             |  |  |  |  |
|--------------------------------|---------------------------------------------|--|--|--|--|
| <b>29.0 Hot Water Cylinder</b> | <input type="text" value="Internal Store"/> |  |  |  |  |
|--------------------------------|---------------------------------------------|--|--|--|--|

# Summary for Input Data



|                 |               |         |
|-----------------|---------------|---------|
| Insulation Type | Measured Loss |         |
| Cylinder Volume | 196.00        | L       |
| Loss            | 1.31          | kWh/day |

## 34.0 Small-scale Hydro

None

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

## Recommendations

### Lower cost measures

None

### Further measures to achieve even higher standards

|                     | Typical Cost     | Typical savings per year | Ratings after improvement |                      |
|---------------------|------------------|--------------------------|---------------------------|----------------------|
|                     |                  |                          | SAP rating                | Environmental Impact |
| Solar water heating | £4,000 - £7,000  | £40                      | C 71                      | A 94                 |
| Photovoltaic        | £8,000 - £10,000 | £250                     | C 78                      | A 95                 |
| Wind turbine        |                  |                          | 0                         | 0                    |

# Thermal Bridging

|                      |                                          |               |                   |            |
|----------------------|------------------------------------------|---------------|-------------------|------------|
| Plot Reference       | House, 85 Pell Street                    |               | Issued on Date    | 28/11/2025 |
| Assessment Reference | Electric Panel Heaters                   | Plot Type Ref | End-Terrace House |            |
| Plot Address         | House, 85, Pell Street, Reading, RG1 2NP |               | SAP Version       | 10.2       |

|                                    |          |               |       |      |       |
|------------------------------------|----------|---------------|-------|------|-------|
| SAP Rating                         | 70 C     | DER           | 7.95  | TER  | 13.83 |
| Environmental                      | 94 A     | % DER < TER   |       |      | 42.52 |
| CO <sub>2</sub> Emissions (t/year) | 0.49     | DFEE          | 46.01 | TFEE | 46.94 |
| Compliance Check                   | See BREL | % DFEE < TFEE |       |      | 1.98  |
| % DPER < TPER                      | -13.11   | DPER          | 82.12 | TPER | 72.60 |

|                  |                    |             |           |
|------------------|--------------------|-------------|-----------|
| Assessor Details | Mr. Peter Yearsley | Assessor ID | R301-0001 |
| Client           |                    |             |           |

|               | Junction details                                                 | Source Type            | Psi (W/mK) | Length (m) | Result | Reference            |
|---------------|------------------------------------------------------------------|------------------------|------------|------------|--------|----------------------|
| External wall | E2 Other lintels (including other steel lintels)                 | Independently assessed | 0.084      | 10.42      | 0.88   | R.O.I. Psi Value     |
| External wall | E3 Sill                                                          | Independently assessed | 0.034      | 9.57       | 0.33   | R.O.I. Psi Value     |
| External wall | E4 Jamb                                                          | Independently assessed | 0.043      | 34.30      | 1.47   | R.O.I. Psi Value     |
| External wall | E16 Corner (normal)                                              | Independently assessed | 0.030      | 27.90      | 0.84   | R.O.I. Psi Value     |
| External wall | E18 Party wall between dwellings                                 | Independently assessed | 0.040      | 2.75       | 0.11   | R.O.I. Psi Value     |
| External wall | E11 Eaves (insulation at rafter level)                           | Independently assessed | 0.013      | 10.60      | 0.14   | R.O.I. Psi Value     |
| External wall | E17 Corner (inverted – internal area greater than external area) | Independently assessed | 0.015      | 16.00      | 0.24   | R.O.I. Psi Value     |
| External wall | E13 Gable (insulation at rafter level)                           | Independently assessed | 0.024      | 10.80      | 0.26   | R.O.I. Psi Value     |
| External wall | E6 Intermediate floor within a dwelling                          | Independently assessed | 0.080      | 27.10      | 2.17   | R.O.I. Psi Value     |
| Party wall    | P5 Party wall - Roof (insulation at rafter level)                | Independently assessed | 0.240      | 6.40       | 1.54   | Default Value Halved |
| Party wall    | P2 Party wall - Intermediate floor within a dwelling             | Table K1 - Default     | 0.000      | 2.90       | 0.00   |                      |
| External roof | R4 Ridge (vaulted ceiling)                                       | Table K1 - Default     | 0.120      | 17.70      | 2.12   |                      |
| External wall | E5 Ground floor (normal)                                         | Table K1 - Default     | 0.320      | 21.40      | 6.85   |                      |
| External wall | E25 Staggered party wall between dwellings                       | Independently assessed | 0.120      | 6.75       | 0.81   | Default Value Halved |

Total: 204.59 W/mK:  
Y-Value: 0.09 W/m²K:

# Energy Report



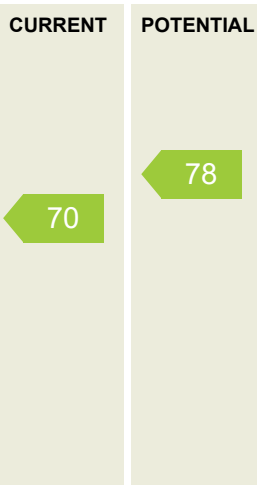
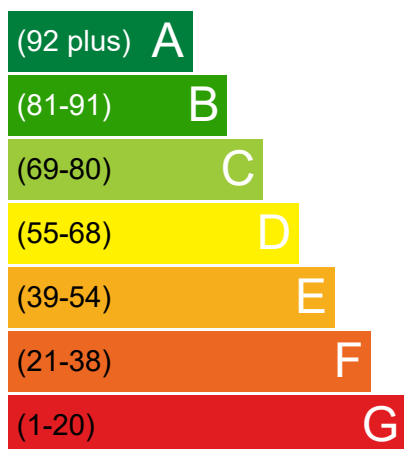
|                  |                                              |
|------------------|----------------------------------------------|
| Dwelling Address | House, 85, Pell Street, Reading, RG1 2NP     |
| Reference        | House, 85 Pell Street-Electric Panel Heaters |
| SAP Version      | 10.2                                         |
| Assessment Date  | 28/11/2025                                   |
| Submission Date  |                                              |
| Property Type    | House, End-Terrace                           |
| Total Floor Area | 70                                           |

This Energy Report has been generated using the UK's National Calculation Methodology for dwellings, Standard Assessment Procedure (SAP). This methodology is used to assess the energy efficiency of dwellings which is calculated based on a dwelling's heating, hot water, ventilation and lighting usage.

This document is not an Energy Performance Certificate (EPC) as required by the Energy Performance of Buildings Regulations

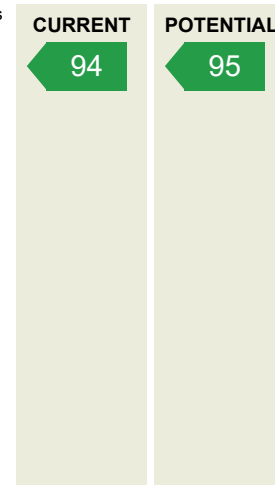
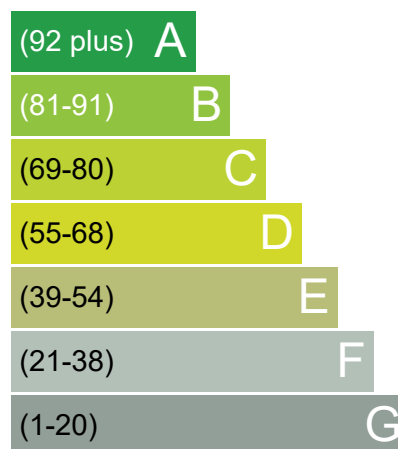
## Energy Efficiency Rating

Most energy efficient - lower running costs



## Carbon Dioxide (CO2) Emissions Rating

Very environmentally friendly - lower CO2 emissions



## Additional ratings for your home

|           | Primary Energy | Energy      | Carbon    | Cost        | HTC       |
|-----------|----------------|-------------|-----------|-------------|-----------|
| CURRENT   | 72.63<br>kWh   | 3241<br>kWh | 488<br>kg | 921.54<br>£ | 92<br>W/K |
| POTENTIAL | 50.68<br>kWh   | 2221<br>kWh | 352<br>kg | 631.30<br>£ | 92<br>W/K |

## Breakdown of property's energy performance

Each feature is assessed as one of the following:

|           |      |         |      |           |
|-----------|------|---------|------|-----------|
| Very Poor | Poor | Average | Good | Very Good |
|-----------|------|---------|------|-----------|

| Feature               | Description                                                              | Energy Performance |
|-----------------------|--------------------------------------------------------------------------|--------------------|
| Walls                 | Average thermal transmittance 0.15 W/m <sup>2</sup> K                    | Very Good          |
| Roof                  | Average thermal transmittance 0.14 W/m <sup>2</sup> K                    | Very Good          |
| Floor                 | Average thermal transmittance 0.12 W/m <sup>2</sup> K                    | Very Good          |
| Windows               | High performance glazing                                                 | Very Good          |
| Main heating          | Room heaters, electric                                                   | Very Poor          |
| Main heating controls | Programmer and appliance thermostats                                     | Good               |
| Secondary heating     | None                                                                     |                    |
| Hot water             | From main system                                                         | Very Good          |
| Lighting              | Good lighting efficiency                                                 | Good               |
| Air tightness         | Air permeability [AP50] = 3.0 m <sup>3</sup> /h.m <sup>2</sup> (assumed) | Good               |

## Recommendations

The recommended measures provided below will help to improve the energy efficiency of the dwelling. To reach the dwelling's potential energy rating all of the recommended measures shown below would need to be installed. Having these measures installed individually or in any other order may give a different result when compared with the cumulative potential rating.

| Recommended measures | Cumulative savings (per year) | Cumulative rating | Typical costs    | Incremental savings (per year) | Cumulative CO2 rating |
|----------------------|-------------------------------|-------------------|------------------|--------------------------------|-----------------------|
| Solar water heating  | £40                           | C 71              | £4,000 - £7,000  | £40                            | A 94                  |
| Photovoltaic         | £290                          | C 78              | £8,000 - £10,000 | £250                           | A 95                  |

The typical cost is based on average installation prices across the country so may not be representative of the actual costs in your area.

## Estimated energy costs of the dwelling

The table below shows the estimated running costs of the space and water heating and lighting within the dwelling. It does not include the energy used from household appliances. The estimated annual costs after potential improvements indicates the total energy cost if all recommended measures named above were installed.

|                                                                                             | Estimated annual costs | Estimated annual costs after potential improvements | Potential future savings                                                             |
|---------------------------------------------------------------------------------------------|------------------------|-----------------------------------------------------|--------------------------------------------------------------------------------------|
| Lighting   | £57                    | £57                                                 |  |
| Heating    | £635                   | £657                                                |                                                                                      |
| Hot Water  | £230                   | £167                                                |                                                                                      |
| New Technologies e.g. Impact of PV                                                          | £0                     | -(£250)                                             |                                                                                      |
| TOTAL                                                                                       | £922                   | £631                                                |                                                                                      |

## Estimated energy use and potential savings



Space Heating

**2082**

kWh per year



Water Heating

**809**

kWh per year

## About this document

Created by:  
Company/Trading name:  
Phone number:  
Email address:

### Disclaimer

This Energy Report should not under any circumstances be treated as a Condition Survey and cannot be used to indicate that any element of the dwelling (e.g. heating system) is working correctly.  
This Energy Report must not be used in situations where an Energy Performance Certificate (EPC) is required.  
This Energy Report is generated from a set of data inputs which may not reflect the actual dimensions, services or construction of the dwelling.  
The calculation used to generate this report reflects the SAP Methodology current at the time of report generation.

## Glossary terms for additional metrics

|                           |                                                                                                                                                                                                                                                                       |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Primary Energy            | The measure of the energy required for lighting, heating and hot water in a property. This includes the efficiency of the property's heating system, power station efficiency for electricity and the energy used to produce the fuel and deliver it to the property. |
| Energy Used               | The estimated amount of fuel energy for lighting, heating and hot water for the property. The estimate is based on typical usage which is likely to be different to actual consumption.                                                                               |
| Carbon (CO <sub>2</sub> ) | The current emissions based on the energy estimates.                                                                                                                                                                                                                  |
| Cost                      | The estimated cost of energy. The cost of each unit of fuel is based on an industry standard which is likely to be different to those the occupier actually pays.                                                                                                     |
| Heat Transfer Coefficient | Heat flow through the property envelope where internal and external temperatures are different.                                                                                                                                                                       |