

# Building Regulations England Part L (BREL) Compliance Report

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

Date: Mon 29 Apr 2024 08:28:57

| Project Information |               |                 |                 |
|---------------------|---------------|-----------------|-----------------|
| Assessed By         | Andrew Sadler | Building Type   | House, Detached |
| OCDEA Registration  | EES/008464    | Assessment Date | 2024-04-29      |

| Dwelling Details |                                     |                  |                    |
|------------------|-------------------------------------|------------------|--------------------|
| Assessment Type  | As built                            | Total Floor Area | 145 m <sup>2</sup> |
| Site Reference   | Plot 1 Whitely                      | Plot Reference   | As Built           |
| Address          | 20, Byworth Close, Reading, RG2 8SH |                  |                    |

| Client Details |               |
|----------------|---------------|
| Name           | Alex Omirou   |
| Company        | SHG LTD       |
| Address        | tbc, tbc, tbc |

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                                             | Mains gas                               |  |    |
| Target carbon dioxide emission rate                                      | 9.04 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                                                    | 47.34 kWh <sub>PE</sub> /m <sup>2</sup> |  |    |
| Dwelling primary energy                                                  | 47.34 kWh <sub>PE</sub> /m <sup>2</sup> |  | OK |
| 1c Target fabric energy efficiency and dwelling fabric energy efficiency |                                         |  |    |
| Target fabric energy efficiency                                          | 38.9 kWh/m <sup>2</sup>                 |  |    |
| Dwelling fabric energy efficiency                                        | 28.6 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                                                    | N/A                                           | N/A                                     | N/A |
| Curtain walls                    | 1.6                                                    | N/A                                           | N/A                                     | N/A |
| Floors                           | 0.18                                                   | 0.1                                           | Heatloss Floor 1 (0.1)                  | OK  |
| Roofs                            | 0.16                                                   | 0.09                                          | Roof (1) (0.1)                          | OK  |
| Windows, doors, and roof windows | 1.6                                                    | 1.14                                          | South Windows (1.17)                    | OK  |
| Rooflights                       | 2.2                                                    | 1.17                                          | East Roof Light, East (1.17)            | OK  |

| 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)                                                                        | 127.17                     | 0.15                         |  |
| Exposed wall: Walls (2)                                                                        | 9.93                       | 0.15                         |  |
| Ground floor: Heatloss Floor 1, Heatloss Floor 1                                               | 79.9                       | 0.1 (!)                      |  |
| Exposed roof: Roof (1)                                                                         | 26.8                       | 0.1 (!)                      |  |
| Exposed roof: Roof (2)                                                                         | 50.76                      | 0.09 (!)                     |  |

| 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] |
| Front Door, Door                                                                      | 2.2                    | North       | N/A          | 0.8 (!)                      |
| South Windows, Windows                                                                | 13.65                  | South       | 1.0          | 1.17 (!)                     |
| East Windows, Windows                                                                 | 1.5                    | East        | 1.0          | 1.17 (!)                     |
| East Windows, Windows                                                                 | 1.5                    | East        | 1.0          | 1.17 (!)                     |
| East Dormer, Windows                                                                  | 1.28                   | East        | 1.0          | 1.17 (!)                     |
| East Roof Light, Roof Light                                                           | 1                      | East        | 1.0          | 1.17                         |
| East Roof Light, Roof Light                                                           | 1                      | East        | 1.0          | 1.17                         |
| West Window, Windows                                                                  | 1.35                   | West        | 1.0          | 1.17 (!)                     |
| West Window, Windows                                                                  | 1.35                   | West        | 1.0          | 1.17 (!)                     |
| West Dormer, Windows                                                                  | 2.08                   | West        | 1.0          | 1.17 (!)                     |
| West Dormer, Windows                                                                  | 2.08                   | West        | 1.0          | 1.17 (!)                     |
| West Roof Light, Roof Light                                                           | 0.64                   | West        | 1.0          | 1.17                         |

| Name                        | Area [m <sup>2</sup> ] | Orientation | Frame factor | U-Value [W/m <sup>2</sup> K] |
|-----------------------------|------------------------|-------------|--------------|------------------------------|
| West Roof Light, Roof Light | 0.64                   | West        | 1.0          | 1.17                         |

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

Building part 1 - Main Dwelling: 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) | Government-approved scheme | 0.05             |                     |
| External wall | E3: Sill                                          | Government-approved scheme | 0.04             |                     |
| External wall | E4: Jamb                                          | Government-approved scheme | 0.05             |                     |
| External wall | E5: Ground floor (normal)                         | Government-approved scheme | 0.08             |                     |
| External wall | E6: Intermediate floor within a dwelling          | Government-approved scheme | 0.01 (!)         |                     |
| Roof          | R11: Upstands or kerbs of rooflights              | Government-approved scheme | 0.08             |                     |
| External wall | E10: Eaves (insulation at ceiling level)          | Government-approved scheme | 0.05             |                     |
| External wall | E11: Eaves (insulation at rafter level)           | Government-approved scheme | 0.04             |                     |
| External wall | E13: Gable (insulation at rafter level)           | Government-approved scheme | 0.04             |                     |
| External wall | E16: Corner (normal)                              | Government-approved scheme | 0.09             |                     |

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           | 2.92 m <sup>3</sup> /hm <sup>2</sup> , Measured value (!) OK |
| Air permeability test certificate reference |                                                              |

4 Space heating

Main heating system 1: Boiler with radiators or underfloor heating - Mains gas

|                  |                  |
|------------------|------------------|
| Efficiency       | 83.4%            |
| Emitter type     | Radiators        |
| Flow temperature |                  |
| System type      | Combi boiler     |
| Manufacturer     | Ideal Boilers    |
| Model            | LOGIC CODE COMBI |
| 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: Time and temperature zone control by device in PCDB

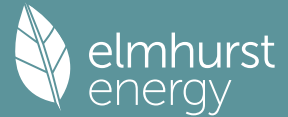
|                 |  |
|-----------------|--|
| Function        |  |
| Ecodesign class |  |
| Manufacturer    |  |
| Model           |  |

Water heating - type: Cylinder thermostat and HW separately timed

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

| 7 Lighting                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----|
| Minimum permitted light source efficacy                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 75 lm/W         |    |
| Lowest light source efficacy                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 75 lm/W         | OK |
| External lights control                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | N/A             |    |
| 8 Mechanical ventilation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |    |
| <b>System type:</b> Balanced whole-house mechanical ventilation with heat recovery                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |    |
| Maximum permitted specific fan power                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1.5 W/(l/s)     |    |
| Specific fan power                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.84 W/(l/s)    | OK |
| Minimum permitted heat recovery efficiency                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 73%             |    |
| Heat recovery efficiency                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 89%             | OK |
| Manufacturer/Model                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | VL-350CZPVU-R-E |    |
| Commissioning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 |    |
| 9 Local generation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |    |
| N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |    |
| 10 Heat networks                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                 |    |
| N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |    |
| 11 Supporting documentary evidence                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |    |
| <p>Documentary evidence identified in 11.1 and 11.2 is needed to confirm the data values used for any calculations undertaken, manufacturer declarations made, and tests performed as reflected in this "As built" BREL Compliance Report are correct.</p> <p>11.1 SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required.</p> <p>11.2 Indicative photographic evidence of key stages during construction (guidance within Approved Document L, Volume 1 – Appendix B) that confirms the products identified in this BREL Compliance Report are used in this dwelling, and workmanship is of sufficient quality to support the calculated values claimed in 2a to 2d.</p> |                 |    |
| 12 Declarations                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |    |
| a. Assessor Declaration                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                 |    |
| <p>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 and construction information submitted for this dwelling for the purpose of carrying out the assessment, and that the supporting documentary evidence (identified in 11.1 and 11.2) pursuant to Part L of the Building Regulations 2010 (as amended) has been reviewed in the course of preparing this BREL Compliance Report.</p>                                                                                                                                                                                                                          |                 |    |
| Signed:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Assessor ID:    |    |
| Name:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Date:           |    |
| b. Client Declaration                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |    |
| <p>This declaration by the client is confirmation that the dwelling has been constructed and completed according to the specifications set out in this BREL Compliance Report, and that photographic evidence of key stages, as described in 11.2, has been provided to the Assessor for this dwelling.</p>                                                                                                                                                                                                                                                                                                                                                                                                               |                 |    |
| Signed:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Organisation:   |    |
| Name:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Date:           |    |

# Full SAP Calculation Printout



|                                    |                                     |               |               |      |                |            |
|------------------------------------|-------------------------------------|---------------|---------------|------|----------------|------------|
| Property Reference                 | Plot 1 Whitely                      |               |               |      | Issued on Date | 29/04/2024 |
| Assessment Reference               | As Built                            |               | Prop Type Ref |      |                |            |
| Property                           | 20, Byworth Close, Reading, RG2 8SH |               |               |      |                |            |
|                                    |                                     |               |               |      |                |            |
| SAP Rating                         | 87 B                                | DER           | 7.95          | TER  | 9.04           |            |
| Environmental                      | 92 A                                | % DER < TER   |               |      |                | 12.06      |
| CO <sub>2</sub> Emissions (t/year) | 1.01                                | DFEE          | 28.63         | TFEE | 38.88          |            |
| Compliance Check                   | See BREL                            | % DFEE < TFEE |               |      |                | 26.36      |
| % DPER < TPER                      | 0.01                                | DPER          | 47.34         | TPER | 47.34          |            |
|                                    |                                     |               |               |      |                |            |
| Assessor Details                   | Mr. Andrew Sadler                   |               |               |      | Assessor ID    | P628-0001  |
| Client                             | shglttd, Alex Omirou                |               |               |      |                |            |

SAP 10 WORKSHEET FOR New Build (As Built) (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> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Ground floor                                           | 79.1000 (1b)              | x 2.3500 (2b)                   | = 185.8850 (1b) - (3b)      |
| First floor                                            | 66.1200 (1c)              | x 2.4000 (2c)                   | = 158.6880 (1c) - (3c)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 145.2200                  |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 344.5730 (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)  |
|                                                                                                         |        |        |        |        |        |        |        |        |        |        | 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                                                                                    |        |        |        |        |        |        |        |        |        |        | 2.9200 (17)                 |              |
| Infiltration rate                                                                                       |        |        |        |        |        |        |        |        |        |        | 0.1460 (18)                 |              |
| Number of sides sheltered                                                                               |        |        |        |        |        |        |        |        |        |        | 0 (19)                      |              |
| Shelter factor                                                                                          |        |        |        |        |        |        |        |        |        |        | (20) = 1 - [0.075 x (19)] = | 1.0000 (20)  |
| Infiltration rate adjusted to include shelter factor                                                    |        |        |        |        |        |        |        |        |        |        | (21) = (18) x (20) =        | 0.1460 (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                                                                                         |        |        |        |        |        |        |        |        |        |        |                             |              |
|                                                                                                         | 0.1861 | 0.1825 | 0.1789 | 0.1606 | 0.1569 | 0.1387 | 0.1387 | 0.1351 | 0.1460 | 0.1569 | 0.1642                      | 0.1716 (22b) |
| Balanced mechanical ventilation with heat recovery                                                      |        |        |        |        |        |        |        |        |        |        |                             |              |
| 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)                |              |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =            |        |        |        |        |        |        |        |        |        |        | 80.1000 (23c)               |              |
| Effective ac                                                                                            | 0.2856 | 0.2820 | 0.2783 | 0.2601 | 0.2564 | 0.2382 | 0.2382 | 0.2345 | 0.2455 | 0.2564 | 0.2637                      | 0.2711 (25)  |

# Full SAP Calculation Printout



Heat capacity Cm = Sum(A x k)  
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K  
List of Thermal Bridges

|                                                  | Length  | Psi-value | Total  |
|--------------------------------------------------|---------|-----------|--------|
| K1 Element                                       | 19.8000 | 0.0500    | 0.9900 |
| E2 Other lintels (including other steel lintels) | 18.8000 | 0.0400    | 0.7520 |
| E3 Sill                                          | 20.8000 | 0.0500    | 1.0400 |
| E4 Jamb                                          | 35.6000 | 0.0800    | 2.8480 |
| E5 Ground floor (normal)                         | 38.1000 | 0.0100    | 0.3810 |
| E6 Intermediate floor within a dwelling          | 14.4000 | 0.0800    | 1.1520 |
| R11 Upstands or kerbs of rooflights              | 10.8000 | 0.0500    | 0.5400 |
| E10 Eaves (insulation at ceiling level)          | 18.8000 | 0.0400    | 0.7520 |
| E11 Eaves (insulation at rafter level)           | 8.0000  | 0.0400    | 0.3200 |
| E13 Gable (insulation at rafter level)           | 19.0000 | 0.0900    | 1.7100 |
| E16 Corner (normal)                              |         |           |        |

Thermal bridges (Sum(L x Psi) calculated using Appendix K)  
Point Thermal bridges (36a) = 0.0000  
Total fabric heat loss (33) + (36) + (36a) = 79.4220 (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                                                               | 32.4810  | 32.0660  | 31.6509  | 29.5757  | 29.1607  | 27.0855  | 27.0855  | 26.6705  | 27.9156  | 29.1607  | 29.9908  | 30.8208  | (38) |
| Heat transfer coeff                                                 | 111.9030 | 111.4880 | 111.0729 | 108.9977 | 108.5827 | 106.5075 | 106.5075 | 106.0925 | 107.3376 | 108.5827 | 109.4128 | 110.2429 | (39) |
| Average = Sum(39)m / 12 =                                           |          |          |          |          |          |          |          |          |          |          |          | 108.8940 |      |
| HLP                                                                 | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |      |
| HLP (average)                                                       | 0.7706   | 0.7677   | 0.7649   | 0.7506   | 0.7477   | 0.7334   | 0.7334   | 0.7306   | 0.7391   | 0.7477   | 0.7534   | 0.7591   | (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                                               |          |          |          |          |          |          |          |          |          |          |          |          | 2.9264 (42)    |
| Hot water usage for mixer showers                               | 73.2865  | 72.1852  | 70.5803  | 67.5096  | 65.2435  | 62.7164  | 61.2800  | 62.8728  | 64.6187  | 67.3320  | 70.4687  | 73.0057  | (42a)          |
| Hot water usage for baths                                       | 31.6388  | 31.1689  | 30.5072  | 29.2872  | 28.3737  | 27.3607  | 26.8135  | 27.4706  | 28.1860  | 29.2699  | 30.5151  | 31.5319  | (42b)          |
| Hot water usage for other uses                                  | 44.5996  | 42.9778  | 41.3560  | 39.7342  | 38.1124  | 36.4906  | 36.4906  | 38.1124  | 39.7342  | 41.3560  | 42.9778  | 44.5996  | (42c)          |
| Average daily hot water use (litres/day)                        |          |          |          |          |          |          |          |          |          |          |          |          | 137.4470 (43)  |
| Daily hot water use                                             | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |                |
| Energy conte                                                    | 149.5249 | 146.3319 | 142.4435 | 136.5310 | 131.7296 | 126.5677 | 124.5841 | 128.4557 | 132.5389 | 137.9580 | 143.9615 | 149.1372 | (44)           |
| Energy content (annual)                                         | 236.8109 | 208.3747 | 218.9304 | 186.9041 | 177.3333 | 155.6297 | 150.6737 | 159.0550 | 163.4337 | 187.2076 | 205.0996 | 233.5128 | (45)           |
| Distribution loss (46)m = 0.15 x (45)m                          | 35.5216  | 31.2562  | 32.8396  | 28.0356  | 26.6000  | 23.3445  | 22.6011  | 23.8583  | 24.5151  | 28.0811  | 30.7649  | 35.0269  | (46)           |
| Water storage 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                                                      | 19.1013  | 17.2456  | 19.0780  | 18.4302  | 19.0240  | 18.3895  | 18.9893  | 19.0002  | 18.3997  | 19.0368  | 18.4538  | 19.0970  | (61)           |
| Total heat required for water heating calculated for each month | 255.9122 | 225.6203 | 238.0084 | 205.3343 | 196.3573 | 174.0192 | 169.6630 | 178.0552 | 181.8334 | 206.2445 | 223.5534 | 252.6098 | (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                                                 | 255.9122 | 225.6203 | 238.0084 | 205.3343 | 196.3573 | 174.0192 | 169.6630 | 178.0552 | 181.8334 | 206.2445 | 223.5534 | 252.6098 | (64)           |
| 12Total per year (kWh/year)                                     |          |          |          |          |          |          |          |          |          |          |          |          | 2507.2110 (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                        | 83.5150  | 73.5960  | 77.5639  | 66.7532  | 63.7193  | 56.3443  | 54.8463  | 57.6358  | 58.9416  | 67.0057  | 72.8091  | 82.4172  | (65)           |

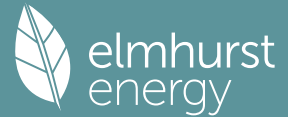
## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |           |           |           |           |           |           |           |           |           |           |           |           |      |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------|
| Metabolic gains (Table 5), Watts                                                    | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec       |      |
| (66)m                                                                               | 146.3217  | 146.3217  | 146.3217  | 146.3217  | 146.3217  | 146.3217  | 146.3217  | 146.3217  | 146.3217  | 146.3217  | 146.3217  | 146.3217  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 159.0190  | 176.0568  | 159.0190  | 164.3197  | 159.0190  | 164.3197  | 159.0190  | 159.0190  | 164.3197  | 159.0190  | 164.3197  | 159.0190  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 315.2730  | 318.5445  | 310.3003  | 292.7494  | 270.5946  | 249.7721  | 235.8614  | 232.5899  | 240.8341  | 258.3850  | 280.5399  | 301.3623  | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 37.6322   | 37.6322   | 37.6322   | 37.6322   | 37.6322   | 37.6322   | 37.6322   | 37.6322   | 37.6322   | 37.6322   | 37.6322   | 37.6322   | (69) |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | (71) |
| Water heating gains (Table 5)                                                       | 112.2513  | 109.5178  | 104.2525  | 92.7127   | 85.6443   | 78.2559   | 73.7182   | 77.4675   | 81.8634   | 90.0615   | 101.1237  | 110.7759  | (72) |
| Total internal gains                                                                | 656.4398  | 674.0156  | 643.4684  | 619.6783  | 585.1543  | 559.2442  | 535.4951  | 535.9729  | 553.9136  | 577.3620  | 615.8797  | 641.0537  | (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  | 4.2800     | 19.6403                        | 0.7600                            | 1.0000                             | 0.7700                       | 44.2729 (76)  |
| South | 13.6500    | 46.7521                        | 0.7600                            | 1.0000                             | 0.7700                       | 336.1091 (78) |
| West  | 6.8600     | 19.6403                        | 0.7600                            | 1.0000                             | 0.7700                       | 70.9608 (80)  |
| East  | 2.0000     | 26.0000                        | 0.7600                            | 1.0000                             | 1.0000                       | 35.5680 (82)  |

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|             |           |           |           |           |           |           |           |           |           |           |              |                |
|-------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|--------------|----------------|
| West        | 1.2800    |           | 26.0000   |           | 0.7600    |           | 1.0000    |           | 1.0000    |           | 22.7635 (82) |                |
| Solar gains | 509.6743  | 897.0317  | 1287.8035 | 1670.4504 | 1920.1242 | 1922.7026 | 1847.2167 | 1661.8221 | 1422.2431 | 1009.2768 | 616.1229     | 432.3057 (83)  |
| Total gains | 1166.1141 | 1571.0473 | 1931.2719 | 2290.1287 | 2505.2785 | 2481.9468 | 2382.7119 | 2197.7950 | 1976.1566 | 1586.6387 | 1232.0026    | 1073.3594 (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                                                                         | 43.2239                   | 43.3848 | 43.5469 | 44.3760 | 44.5456 | 45.4135 | 45.4135 | 45.5912 | 45.0623 | 44.5456 | 44.2077 | 43.8748      |             |
| alpha                                                                       | 3.8816                    | 3.8923  | 3.9031  | 3.9584  | 3.9697  | 4.0276  | 4.0276  | 4.0394  | 4.0042  | 3.9697  | 3.9472  | 3.9250       |             |
| util living area                                                            | 0.9330                    | 0.8449  | 0.7183  | 0.5465  | 0.3965  | 0.2735  | 0.1965  | 0.2217  | 0.3701  | 0.6465  | 0.8722  | 0.9470 (86)  |             |
| MIT                                                                         | 19.8906                   | 20.3350 | 20.6820 | 20.9037 | 20.9763 | 20.9961 | 20.9992 | 20.9987 | 20.9868 | 20.8518 | 20.3621 | 19.8079 (87) |             |
| Th 2                                                                        | 20.2789                   | 20.2814 | 20.2839 | 20.2964 | 20.2989 | 20.3114 | 20.3114 | 20.3139 | 20.3064 | 20.2989 | 20.2939 | 20.2889 (88) |             |
| util rest of house                                                          | 0.9244                    | 0.8289  | 0.6951  | 0.5193  | 0.3680  | 0.2445  | 0.1658  | 0.1888  | 0.3342  | 0.6133  | 0.8557  | 0.9400 (89)  |             |
| MIT 2                                                                       | 18.9842                   | 19.5283 | 19.9394 | 20.1990 | 20.2773 | 20.3085 | 20.3110 | 20.3132 | 20.2959 | 20.1518 | 19.5797 | 18.8889 (90) |             |
| Living area fraction                                                        | fLA = Living area / (4) = |         |         |         |         |         |         |         |         |         |         |              | 0.5447 (91) |
| MIT                                                                         | 19.4779                   | 19.9677 | 20.3439 | 20.5828 | 20.6581 | 20.6830 | 20.6859 | 20.6866 | 20.6722 | 20.5331 | 20.0059 | 19.3895 (92) |             |
| Temperature adjustment                                                      |                           |         |         |         |         |         |         |         |         |         |         |              | -0.1500     |
| adjusted MIT                                                                | 19.3279                   | 19.8177 | 20.1939 | 20.4328 | 20.5081 | 20.5330 | 20.5359 | 20.5366 | 20.5222 | 20.3831 | 19.8559 | 19.2395 (93) |             |

## 8. Space heating requirement

|                                                                                |           |           |           |           |          |          |          |          |          |           |           |                            |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|-----------|-----------|----------------------------|
|                                                                                | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct       | Nov       | Dec                        |
| Utilisation                                                                    | 0.9111    | 0.8176    | 0.6921    | 0.5246    | 0.3766   | 0.2538   | 0.1758   | 0.1994   | 0.3455   | 0.6174    | 0.8443    | 0.9275 (94)                |
| Useful gains                                                                   | 1062.4372 | 1284.5124 | 1336.6190 | 1201.4361 | 943.3633 | 630.0014 | 418.8825 | 438.3376 | 682.6953 | 979.6155  | 1040.2397 | 995.5308 (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                                                               | 1681.6704 | 1663.1473 | 1521.0246 | 1257.0536 | 956.4025 | 631.9093 | 419.1980 | 438.8618 | 689.3471 | 1062.2704 | 1395.6566 | 1657.9925 (97)             |
| Space heating kWh                                                              | 460.7095  | 254.4427  | 137.1977  | 40.0447   | 9.7011   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 61.4953   | 255.9001  | 492.8715 (98a)             |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |          |          |          |          |          |           |           | 1712.3625                  |
| 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                                                              | 460.7095  | 254.4427  | 137.1977  | 40.0447   | 9.7011   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 61.4953   | 255.9001  | 492.8715 (98c)             |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |          |          |          |          |          |           |           | 1712.3625                  |
| Space heating per m2                                                           |           |           |           |           |          |          |          |          |          |           |           | (98c) / (4) = 11.7915 (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 %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 83.4000 (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                                                                            | 460.7095 | 254.4427 | 137.1977 | 40.0447  | 9.7011   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 61.4953  | 255.9001 | 492.8715 (98)   |
| Space heating efficiency (main heating system 1)                                                     | 83.4000  | 83.4000  | 83.4000  | 83.4000  | 83.4000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 83.4000  | 83.4000  | 83.4000 (210)   |
| Space heating fuel (main heating system)                                                             | 552.4095 | 305.0871 | 164.5057 | 48.0152  | 11.6321  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 73.7353  | 306.8347 | 590.9730 (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                                                                            | 255.9122 | 225.6203 | 238.0084 | 205.3343 | 196.3573 | 174.0192 | 169.6630 | 178.0552 | 181.8334 | 206.2445 | 223.5534 | 252.6098 (64)   |
| Efficiency of water heater (217)m                                                                    | 88.0040  | 87.8796  | 87.6990  | 87.4776  | 87.3512  | 87.3000  | 87.3000  | 87.3000  | 87.3000  | 87.5502  | 87.8837  | 88.0242 (217)   |
| Fuel for water heating, kWh/month                                                                    | 290.7961 | 256.7380 | 271.3923 | 234.7277 | 224.7907 | 199.3348 | 194.3448 | 203.9579 | 208.2856 | 235.5727 | 254.3743 | 286.9778 (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                                                                                         | 44.7927  | 40.4579  | 44.7927  | 43.3478  | 44.7927  | 43.3478  | 44.7927  | 44.7927  | 43.3478  | 44.7927  | 43.3478  | 44.7927 (231)   |
| Lighting                                                                                             | 42.2412  | 33.8875  | 30.5119  | 22.3543  | 17.2671  | 14.1074  | 15.7517  | 20.4746  | 26.5945  | 34.8934  | 39.4120  | 43.4152 (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                                                                   |          |          |          |          |          |          |          |          |          |          |          | 2053.1925 (211) |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 87.3000         |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          | 2861.2926 (219) |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (221)    |

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|                                                                            |                 |
|----------------------------------------------------------------------------|-----------------|
| Electricity for pumps and fans:                                            |                 |
| (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.0500) |                 |
| mechanical ventilation fans (SFP = 1.0500)                                 | 441.3980 (230a) |
| central heating pump                                                       | 41.0000 (230c)  |
| main heating flue fan                                                      | 45.0000 (230e)  |
| Total electricity for the above, kWh/year                                  | 527.3980 (231)  |
| Electricity for lighting (calculated in Appendix L)                        | 340.9110 (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                                        | 5782.7940 (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                   | 2053.1925          | 0.2100                        | 431.1704 (261)           |
| Total CO2 associated with community systems     |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                      | 2861.2926          | 0.2100                        | 600.8714 (264)           |
| Space and water heating                         |                    |                               | 1032.0419 (265)          |
| Pumps, fans and electric keep-hot               | 527.3980           | 0.1387                        | 73.1566 (267)            |
| Energy for lighting                             | 340.9110           | 0.1443                        | 49.2040 (268)            |
| Total CO2, kg/year                              |                    |                               | 1154.4025 (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               | 2053.1925          | 1.1300                              | 2320.1075 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2861.2926          | 1.1300                              | 3233.2606 (278)            |
| Space and water heating                     |                    |                                     | 5553.3681 (279)            |
| Pumps, fans and electric keep-hot           | 527.3980           | 1.5128                              | 797.8477 (281)             |
| Energy for lighting                         | 340.9110           | 1.5338                              | 522.9006 (282)             |
| Total Primary energy kWh/year               |                    |                                     | 6874.1165 (286)            |
| Dwelling Primary energy Rate (DPER)         |                    |                                     | 47.3400 (287)              |

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

### 1. Overall dwelling characteristics

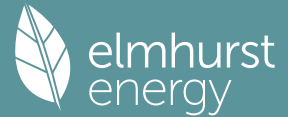
|                                                        | Area<br>(m2) | Storey height<br>(m)            | Volume<br>(m3)         |
|--------------------------------------------------------|--------------|---------------------------------|------------------------|
| Ground floor                                           | 79.1000 (1b) | x 2.3500 (2b)                   | = 185.8850 (1b) - (3b) |
| First floor                                            | 66.1200 (1c) | x 2.4000 (2c)                   | = 158.6880 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 145.2200     |                                 | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 344.5730 (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                                                                | 4 * 10 = 40.0000 (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) = | 40.0000 / (5) = 0.1161 (8)              |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 5.0000 (17)                             |
| Infiltration rate                                                                                  | 0.3661 (18)                             |
| Number of sides sheltered                                                                          | 0 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 1.0000 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.3661 (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 | 0.4668 | 0.4576 | 0.4485 | 0.4027 | 0.3935 | 0.3478 | 0.3478 | 0.3386 | 0.3661 | 0.3935 | 0.4118 | 0.4302 (22b) |
| Effective ac    | 0.6089 | 0.6047 | 0.6006 | 0.5811 | 0.5774 | 0.5605 | 0.5605 | 0.5573 | 0.5670 | 0.5774 | 0.5848 | 0.5925 (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 |       |
|------------------------------------------------|-------------|----------------|---------------|----------------------|--------------|-------------------|---------------|-------|
| TER Opaque door                                |             |                | 2.2000        | 1.0000               | 2.2000       |                   |               | (26)  |
| TER Opening Type (Uw = 1.20)                   |             |                | 24.7900       | 1.1450               | 28.3855      |                   |               | (27)  |
| East Roof Light                                |             |                | 2.0000        | 2.0221               | 4.0441       |                   |               | (27a) |
| West Roof Light                                |             |                | 1.2800        | 2.0221               | 2.5882       |                   |               | (27a) |
| Heatloss Floor 1                               |             |                | 79.9000       | 0.1300               | 10.3870      |                   |               | (28a) |
| External Wall 1                                | 148.7200    | 21.5500        | 127.1700      | 0.1800               | 22.8906      |                   |               | (29a) |
| Dormer Wall                                    | 15.3700     | 5.4400         | 9.9300        | 0.1800               | 1.7874       |                   |               | (29a) |
| Pitched Roof                                   | 30.0800     | 3.2800         | 26.8000       | 0.1100               | 2.9480       |                   |               | (30)  |
| Plan Roof                                      | 50.7600     |                | 50.7600       | 0.1100               | 5.5836       |                   |               | (30)  |
| Total net area of external elements Aum(A, m2) |             |                | 324.8300      |                      |              |                   |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)            |             |                |               | (26)...(30) + (32) = | 80.8144      |                   |               | (33)  |

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

119.9062 (35)

List of Thermal Bridges

|                                                  | Length  | Psi-value | Total  |  |
|--------------------------------------------------|---------|-----------|--------|--|
| K1 Element                                       | 19.8000 | 0.0500    | 0.9900 |  |
| E2 Other lintels (including other steel lintels) | 18.8000 | 0.0500    | 0.9400 |  |
| E3 Sill                                          | 20.8000 | 0.0500    | 1.0400 |  |
| E4 Jamb                                          | 35.6000 | 0.1600    | 5.6960 |  |
| E5 Ground floor (normal)                         | 38.1000 | 0.0000    | 0.0000 |  |
| E6 Intermediate floor within a dwelling          | 14.4000 | 0.0800    | 1.1520 |  |
| R11 Upstands or kerbs of rooflights              | 10.8000 | 0.0600    | 0.6480 |  |
| E10 Eaves (insulation at ceiling level)          | 18.8000 | 0.0400    | 0.7520 |  |
| E11 Eaves (insulation at rafter level)           | 8.0000  | 0.0800    | 0.6400 |  |
| E13 Gable (insulation at rafter level)           | 19.0000 | 0.0900    | 1.7100 |  |
| E16 Corner (normal)                              |         |           |        |  |

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

13.5680 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 94.3824 (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                     | 69.2411  | 68.7601  | 68.2887  | 66.0742  | 65.6599  | 63.7312  | 63.7312  | 63.3740  | 64.4741  | 65.6599  | 66.4981  | 67.3743  | (38) |
| Heat transfer coeff       | 163.6236 | 163.1426 | 162.6711 | 160.4567 | 160.0424 | 158.1137 | 158.1137 | 157.7565 | 158.8566 | 160.0424 | 160.8805 | 161.7568 | (39) |
| Average = Sum(39)m / 12 = |          |          |          |          |          |          |          |          |          |          |          | 160.4547 |      |

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |      |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| HLP           | 1.1267 | 1.1234 | 1.1202 | 1.1049 | 1.1021 | 1.0888 | 1.0888 | 1.0863 | 1.0939 | 1.1021 | 1.1078 | 1.1139 | (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 1.1049 |      |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |      |

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

|                                          |         |         |         |         |         |         |         |         |         |         |         |          |             |
|------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------|-------------|
| Assumed occupancy                        |         |         |         |         |         |         |         |         |         |         |         |          | 2.9264 (42) |
| Hot water usage for mixer showers        | 73.2865 | 72.1852 | 70.5803 | 67.5096 | 65.2435 | 62.7164 | 61.2800 | 62.8728 | 64.6187 | 67.3320 | 70.4687 | 73.0057  | (42a)       |
| Hot water usage for baths                | 31.6388 | 31.1689 | 30.5072 | 29.2872 | 28.3737 | 27.3607 | 26.8135 | 27.4706 | 28.1860 | 29.2699 | 30.5151 | 31.5319  | (42b)       |
| Hot water usage for other uses           | 44.5996 | 42.9778 | 41.3560 | 39.7342 | 38.1124 | 36.4906 | 36.4906 | 38.1124 | 39.7342 | 41.3560 | 42.9778 | 44.5996  | (42c)       |
| Average daily hot water use (litres/day) |         |         |         |         |         |         |         |         |         |         |         | 137.4470 | (43)        |

|                                        | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct                | Nov      | Dec       |      |
|----------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------------|----------|-----------|------|
| Daily hot water use                    | 149.5249 | 146.3319 | 142.4435 | 136.5310 | 131.7296 | 126.5677 | 124.5841 | 128.4557 | 132.5389 | 137.9580           | 143.9615 | 149.1372  | (44) |
| Energy conte                           | 236.8109 | 208.3747 | 218.9304 | 186.9041 | 177.3333 | 155.6297 | 150.6737 | 159.0550 | 163.4337 | 187.2076           | 205.0996 | 233.5128  | (45) |
| Energy content (annual)                |          |          |          |          |          |          |          |          |          | Total = Sum(45)m = |          | 2282.9656 |      |
| Distribution loss (46)m = 0.15 x (45)m | 35.5216  | 31.2562  | 32.8396  | 28.0356  | 26.6000  | 23.3445  | 22.6011  | 23.8583  | 24.5151  | 28.0811            | 30.7649  | 35.0269   | (46) |

Water storage 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 | 50.9589 | 46.0274 | 50.9589 | 49.3151 | 50.9589 | 49.3151 | 50.9589 | 50.9589 | 49.3151 | 50.9589 | 49.3151 | 50.9589 | (61) |
|------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|

Total heat required for water heating calculated for each month

|             |          |          |          |          |          |          |          |          |          |          |          |          |       |
|-------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-------|
| WWHRS       | 287.7698 | 254.4021 | 269.8893 | 236.2192 | 228.2922 | 204.9448 | 201.6326 | 210.0139 | 212.7488 | 238.1666 | 254.4147 | 284.4717 | (62)  |
| PV diverter | -33.5035 | -29.6308 | -31.0277 | -25.6921 | -23.9441 | -20.4892 | -19.2053 | -20.4229 | -21.1989 | -24.9912 | -28.3119 | -32.8831 | (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 | 254.2663 | 224.7713 | 238.8616 | 210.5271 | 204.3481 | 184.4556 | 182.4273 | 189.5910 | 191.5499 | 213.1754 | 226.1027 | 251.5886 | (64) |
|-----------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|

Total per year (kWh/year) = Sum(64)m = 2571.6648 (64)

|                             |  |  |  |  |  |  |  |  |  |  |  |      |      |
|-----------------------------|--|--|--|--|--|--|--|--|--|--|--|------|------|
| 12Total per year (kWh/year) |  |  |  |  |  |  |  |  |  |  |  | 2572 | (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) |
|--------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|

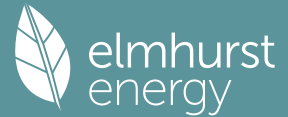
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

|                                          |         |         |         |         |         |         |         |         |         |         |         |         |      |
|------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| Heat gains from water heating, kWh/month | 91.4794 | 80.7914 | 85.5341 | 74.4744 | 71.7031 | 64.0757 | 62.8387 | 65.6255 | 66.6705 | 74.9863 | 80.5244 | 90.3827 | (65) |
|------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|

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

|                                                                                     |           |           |           |           |           |           |           |           |           |           |           |           |      |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------|
| Metabolic gains (Table 5), Watts                                                    |           |           |           |           |           |           |           |           |           |           |           |           |      |
| (66)m                                                                               | 146.3217  | 146.3217  | 146.3217  | 146.3217  | 146.3217  | 146.3217  | 146.3217  | 146.3217  | 146.3217  | 146.3217  | 146.3217  | 146.3217  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 160.3195  | 177.4966  | 160.3195  | 165.6635  | 160.3195  | 165.6635  | 160.3195  | 160.3195  | 165.6635  | 160.3195  | 165.6635  | 160.3195  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 315.2730  | 318.5445  | 310.3003  | 292.7494  | 270.5946  | 249.7721  | 235.8614  | 232.5899  | 240.8341  | 258.3850  | 280.5399  | 301.3623  | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 37.6322   | 37.6322   | 37.6322   | 37.6322   | 37.6322   | 37.6322   | 37.6322   | 37.6322   | 37.6322   | 37.6322   | 37.6322   | 37.6322   | (69) |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | (71) |
| Water heating gains (Table 5)                                                       | 122.9561  | 120.2253  | 114.9651  | 103.4366  | 96.3751   | 88.9940   | 84.4607   | 88.2063   | 92.5979   | 100.7880  | 111.8394  | 121.4822  | (72) |

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Total internal gains  
668.4452 686.1630 655.4815 631.7461 597.1857 571.3261 547.5381 548.0123 565.9920 589.3890 627.9393 653.0605 (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        |          |           |           |           | 4.2800     | 19.6403                        | 0.6300                            | 0.7000                             |           |           | 0.7700                       |               |  | 25.6899 (76)  |
| South       |          |           |           |           | 13.6500    | 46.7521                        | 0.6300                            | 0.7000                             |           |           | 0.7700                       |               |  | 195.0317 (78) |
| West        |          |           |           |           | 6.8600     | 19.6403                        | 0.6300                            | 0.7000                             |           |           | 0.7700                       |               |  | 41.1759 (80)  |
| East        |          |           |           |           | 2.0000     | 26.0000                        | 0.6300                            | 0.7000                             |           |           | 1.0000                       |               |  | 20.6388 (82)  |
| West        |          |           |           |           | 1.2800     | 26.0000                        | 0.6300                            | 0.7000                             |           |           | 1.0000                       |               |  | 13.2088 (82)  |
|             |          |           |           |           |            |                                |                                   |                                    |           |           |                              |               |  |               |
| Solar gains | 295.7452 | 520.5144  | 747.2649  | 969.3008  | 1114.1773  | 1115.6735                      | 1071.8718                         | 964.2941                           | 825.2752  | 585.6461  | 357.5134                     | 250.8511 (83) |  |               |
| Total gains | 964.1904 | 1206.6774 | 1402.7465 | 1601.0469 | 1711.3630  | 1686.9996                      | 1619.4099                         | 1512.3064                          | 1391.2672 | 1175.0351 | 985.4527                     | 903.9116 (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                                                                         | 29.5610 | 29.6482 | 29.7341 | 30.1445 | 30.2225 | 30.5912 | 30.5912 | 30.6604 | 30.4481 | 30.2225 | 30.0651 | 29.9022      |
| alpha                                                                       | 2.9707  | 2.9765  | 2.9823  | 3.0096  | 3.0148  | 3.0394  | 3.0394  | 3.0440  | 3.0299  | 3.0148  | 3.0043  | 2.9935       |
| util living area                                                            | 0.9702  | 0.9441  | 0.9015  | 0.8177  | 0.6963  | 0.5417  | 0.4102  | 0.4517  | 0.6564  | 0.8633  | 0.9504  | 0.9750 (86)  |
| MIT                                                                         | 18.7300 | 19.1192 | 19.6151 | 20.1958 | 20.6223 | 20.8746 | 20.9598 | 20.9456 | 20.7666 | 20.1725 | 19.3486 | 18.6712 (87) |
| Th 2                                                                        | 19.9791 | 19.9818 | 19.9844 | 19.9968 | 19.9991 | 20.0100 | 20.0100 | 20.0120 | 20.0058 | 19.9991 | 19.9944 | 19.9895 (88) |
| util rest of house                                                          | 0.9652  | 0.9351  | 0.8857  | 0.7890  | 0.6494  | 0.4731  | 0.3250  | 0.3645  | 0.5907  | 0.8348  | 0.9409  | 0.9707 (89)  |
| MIT 2                                                                       | 17.3292 | 17.8203 | 18.4396 | 19.1524 | 19.6449 | 19.9162 | 19.9889 | 19.9816 | 19.8152 | 19.1443 | 18.1239 | 17.2610 (90) |
| Living area fraction                                                        | 18.0922 | 18.5278 | 19.0799 | 19.7207 | 20.1773 | 20.4382 | 20.5177 | 20.5066 | 20.3335 | 19.7044 | 18.7910 | 18.0291 (92) |
| Temperature adjustment                                                      | 18.0922 | 18.5278 | 19.0799 | 19.7207 | 20.1773 | 20.4382 | 20.5177 | 20.5066 | 20.3335 | 19.7044 | 18.7910 | 0.0000       |
| adjusted MIT                                                                | 18.0922 | 18.5278 | 19.0799 | 19.7207 | 20.1773 | 20.4382 | 20.5177 | 20.5066 | 20.3335 | 19.7044 | 18.7910 | 18.0291 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |           |           |          |          |          |          |               |           |                 |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|---------------|-----------|-----------------|
|                                                                                | Jan       | Feb       | Mar       | Apr       | May       | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec             |
| Utilisation                                                                    | 0.9526    | 0.9187    | 0.8689    | 0.7802    | 0.6582    | 0.5037   | 0.3695   | 0.4092   | 0.6136   | 0.8251        | 0.9262    | 0.9594 (94)     |
| Useful gains                                                                   | 918.4733  | 1108.5516 | 1218.8031 | 1249.0631 | 1126.4937 | 849.8134 | 598.4004 | 618.8621 | 853.6568 | 969.4650      | 912.7000  | 867.1756 (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                                                               | 2256.7343 | 2223.2762 | 2046.3887 | 1736.2589 | 1356.7203 | 923.1029 | 619.4463 | 647.8483 | 990.2248 | 1457.0825     | 1880.8552 | 2236.9540 (97)  |
| Space heating kWh                                                              | 995.6662  | 749.0949  | 615.7237  | 350.7810  | 171.2886  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 362.7875      | 697.0717  | 1019.1152 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |           |          |          |          |          |               |           | 4961.5287       |
| 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                                                              | 995.6662  | 749.0949  | 615.7237  | 350.7810  | 171.2886  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 362.7875      | 697.0717  | 1019.1152 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |           |          |          |          |          |               |           | 4961.5287       |
| Space heating per m2                                                           |           |           |           |           |           |          |          |          |          | (98c) / (4) = |           | 34.1656 (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 %)                                                     |           |          |           |           |           |           |           |           |           |           |          | 92.4000 (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                                                                            | 995.6662  | 749.0949 | 615.7237  | 350.7810  | 171.2886  | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 362.7875  | 697.0717 | 1019.1152 (98)  |
| Space heating efficiency (main heating system 1)                                                     | 92.4000   | 92.4000  | 92.4000   | 92.4000   | 92.4000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 92.4000   | 92.4000  | 92.4000 (210)   |
| Space heating fuel (main heating system)                                                             | 1077.5608 | 810.7088 | 666.3677  | 379.6331  | 185.3772  | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 392.6271  | 754.4066 | 1102.9385 (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                                                                            | 254.2663  | 224.7713 | 238.8616  | 210.5271  | 204.3481  | 184.4556  | 182.4273  | 189.5910  | 191.5499  | 213.1754  | 226.1027 | 251.5886 (64)   |
| Efficiency of water heater (217)m                                                                    | 87.0045   | 86.7555  | 86.3162   | 85.4669   | 84.0057   | 80.3000   | 80.3000   | 80.3000   | 80.3000   | 85.5104   | 86.6277  | 80.3000 (216)   |
| Fuel for water heating, kWh/month                                                                    | 292.2451  | 259.0858 | 276.7287  | 246.3259  | 243.2551  | 229.7081  | 227.1821  | 236.1033  | 238.5428  | 249.2975  | 261.0051 | 289.0027 (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                                                                                             | 33.3112   | 26.7235  | 24.0616   | 17.6285   | 13.6168   | 11.1250   | 12.4217   | 16.1462   | 20.9723   | 27.5168   | 31.0801  | 34.2371 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -67.5730  | -92.1591 | -128.1666 | -139.2100 | -146.0173 | -134.7214 | -132.8902 | -127.3116 | -117.0694 | -102.8464 | -73.1045 | -58.7776 (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) |           |          |           |           |           |           |           |           |           |           |          |                 |

# Full SAP Calculation Printout



|                                                                                                      |          |           |           |           |           |           |           |           |           |           |          |            |        |
|------------------------------------------------------------------------------------------------------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|------------|--------|
| (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                                                                                              | -48.2449 | -100.1365 | -196.6489 | -292.0456 | -383.1099 | -383.9635 | -379.5899 | -322.9082 | -238.6104 | -142.2589 | -64.0830 | -38.2686   | (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                                                                   |          |           |           |           |           |           |           |           |           |           |          | 5369.6198  | (211)  |
| Space heating fuel - main system 2                                                                   |          |           |           |           |           |           |           |           |           |           |          | 0.0000     | (213)  |
| Space heating fuel - secondary                                                                       |          |           |           |           |           |           |           |           |           |           |          | 0.0000     | (215)  |
| Efficiency of water heater                                                                           |          |           |           |           |           |           |           |           |           |           |          | 80.3000    |        |
| Water heating fuel used                                                                              |          |           |           |           |           |           |           |           |           |           |          | 3048.4823  | (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)                                                  |          |           |           |           |           |           |           |           |           |           |          | 268.8407   | (232)  |
| Energy saving/generation technologies (Appendices M, N and Q)                                        |          |           |           |           |           |           |           |           |           |           |          |            |        |
| PV generation                                                                                        |          |           |           |           |           |           |           |           |           |           |          | -3909.7157 | (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                                                                  |          |           |           |           |           |           |           |           |           |           |          | 4863.2272  | (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                 | 5369.6198          | 0.2100                        | 1127.6202 (261)          |
| Total CO2 associated with community systems   |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                    | 3048.4823          | 0.2100                        | 640.1813 (264)           |
| Space and water heating                       |                    |                               | 1767.8014 (265)          |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293 (267)            |
| Energy for lighting                           | 268.8407           | 0.1443                        | 38.8020 (268)            |
| Energy saving/generation technologies         |                    |                               |                          |
| PV Unit electricity used in dwelling          | -1319.8472         | 0.1353                        | -178.6161                |
| PV Unit electricity exported                  | -2589.8685         | 0.1262                        | -326.9003                |
| Total                                         |                    |                               | -505.5164 (269)          |
| Total CO2, kg/year                            |                    |                               | 1313.0163 (272)          |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 9.0400 (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               | 5369.6198          | 1.1300                              | 6067.6704 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 3048.4823          | 1.1300                              | 3444.7850 (278)            |
| Space and water heating                     |                    |                                     | 9512.4554 (279)            |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008 (281)             |
| Energy for lighting                         | 268.8407           | 1.5338                              | 412.3569 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -1319.8472         | 1.5002                              | -1980.0365                 |
| PV Unit electricity exported                | -2589.8685         | 0.4633                              | -1199.9855                 |
| Total                                       |                    |                                     | -3180.0220 (283)           |
| Total Primary energy kWh/year               |                    |                                     | 6874.8911 (286)            |
| Target Primary Energy Rate (TPER)           |                    |                                     | 47.3400 (287)              |

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

### CALCULATION OF FABRIC ENERGY EFFICIENCY

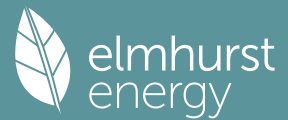
#### 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)                        | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------------------|-----------------------------|
| Ground floor                                           | 79.1000 (1b)              | x 2.3500 (2b)                               | = 185.8850 (1b) - (3b)      |
| First floor                                            | 66.1200 (1c)              | x 2.4000 (2c)                               | = 158.6880 (1c) - (3c)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 145.2200                  |                                             | (4)                         |
| Dwelling volume                                        |                           | (3a) + (3b) + (3c) + (3d) + (3e) ... (3n) = | 344.5730 (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                | 4 * 10 = 40.0000 (7a)   |

# Full SAP Calculation Printout



Number of passive vents  
Number of flueless gas fires

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) =  
Pressure test  
Pressure Test Method  
Measured/design AP50  
Infiltration rate  
Number of sides sheltered

Air changes per hour  
40.0000 / (5) = 0.1161 (8)  
Yes  
Blower Door  
2.9200 (17)  
0.2621 (18)  
0 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 1.0000 (20)  
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.2621 (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                                                                                         | 0.3342 | 0.3276 | 0.3211 | 0.2883 | 0.2817 | 0.2490 | 0.2490 | 0.2424 | 0.2621 | 0.2817 | 0.2948 | 0.3080 | (22b) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        |        | (23b) |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =            |        |        |        |        |        |        |        |        |        |        |        |        | (23c) |
| Effective ac                                                                                            | 0.5558 | 0.5537 | 0.5515 | 0.5416 | 0.5397 | 0.5310 | 0.5310 | 0.5294 | 0.5343 | 0.5397 | 0.5435 | 0.5474 | (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 |       |
|------------------------------------------------|-------------|----------------|---------------|----------------------|--------------|-------------------|---------------|-------|
| Door                                           |             |                | 2.2000        | 0.8000               | 1.7600       |                   |               | (26)  |
| Windows (Uw = 1.17)                            |             |                | 24.7900       | 1.1177               | 27.7076      |                   |               | (27)  |
| East Roof Light                                |             |                | 2.0000        | 1.1177               | 2.2354       |                   |               | (27a) |
| West Roof Light                                |             |                | 1.2800        | 1.1177               | 1.4306       |                   |               | (27a) |
| Heatloss Floor 1                               |             |                | 79.9000       | 0.1000               | 7.9900       | 75.0000           | 5992.5000     | (28a) |
| External Wall 1                                | 148.7200    | 21.5500        | 127.1700      | 0.1500               | 19.0755      | 60.0000           | 7630.2000     | (29a) |
| Dormer Wall                                    | 15.3700     | 5.4400         | 9.9300        | 0.1500               | 1.4895       | 18.0000           | 178.7400      | (29a) |
| Pitched Roof                                   | 30.0800     | 3.2800         | 26.8000       | 0.1000               | 2.6800       | 9.0000            | 241.2000      | (30)  |
| Plan Roof                                      | 50.7600     |                | 50.7600       | 0.0900               | 4.5684       | 9.0000            | 456.8400      | (30)  |
| Total net area of external elements Aum(A, m2) |             |                | 324.8300      |                      |              |                   |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)            |             |                |               | (26)...(30) + (32) = | 68.9370      |                   |               | (33)  |
| Internal Wall 1                                |             |                | 84.0000       |                      |              | 9.0000            | 756.0000      | (32c) |
| Internal Floor 1                               |             |                | 79.9000       |                      |              | 18.0000           | 1438.2000     | (32d) |
| Internal Ceiling 1                             |             |                | 79.9000       |                      |              | 9.0000            | 719.1000      | (32e) |

Heat capacity Cm = Sum(A x k)  
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K (28)...(30) + (32) + (32a)...(32e) = 17412.7800 (34)  
List of Thermal Bridges 119.9062 (35)

| K1 Element                                       | Length  | Psi-value | Total  |  |
|--------------------------------------------------|---------|-----------|--------|--|
| E2 Other lintels (including other steel lintels) | 19.8000 | 0.0500    | 0.9900 |  |
| E3 Sill                                          | 18.8000 | 0.0400    | 0.7520 |  |
| E4 Jamb                                          | 20.8000 | 0.0500    | 1.0400 |  |
| E5 Ground floor (normal)                         | 35.6000 | 0.0800    | 2.8480 |  |
| E6 Intermediate floor within a dwelling          | 38.1000 | 0.0100    | 0.3810 |  |
| R11 Upstands or kerbs of rooflights              | 14.4000 | 0.0800    | 1.1520 |  |
| E10 Eaves (insulation at ceiling level)          | 10.8000 | 0.0500    | 0.5400 |  |
| E11 Eaves (insulation at rafter level)           | 18.8000 | 0.0400    | 0.7520 |  |
| E13 Gable (insulation at rafter level)           | 8.0000  | 0.0400    | 0.3200 |  |
| E16 Corner (normal)                              | 19.0000 | 0.0900    | 1.7100 |  |

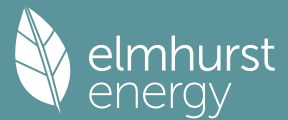
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.4850 (36)  
Point Thermal bridges (36a) = 0.0000  
Total fabric heat loss (33) + (36) + (36a) = 79.4220 (37)

|                                                                     |          |          |          |          |          |          |          |          |          |          |          |          |      |
|---------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| 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                                                 | 63.2031  | 62.9565  | 62.7149  | 61.5799  | 61.3676  | 60.3791  | 60.3791  | 60.1960  | 60.7598  | 61.3676  | 61.7972  | 62.2463  | (38) |
| Average = Sum(39)m / 12 =                                           | 142.6251 | 142.3786 | 142.1369 | 141.0019 | 140.7896 | 139.8011 | 139.8011 | 139.6180 | 140.1818 | 140.7896 | 141.2192 | 141.6683 | (39) |
|                                                                     |          |          |          |          |          |          |          |          |          |          |          | 141.0009 |      |
| HLP                                                                 | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |      |
| HLP (average)                                                       | 0.9821   | 0.9804   | 0.9788   | 0.9710   | 0.9695   | 0.9627   | 0.9627   | 0.9614   | 0.9653   | 0.9695   | 0.9724   | 0.9755   | (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                                               |          |          |          |         |         |         |         |         |         |         |          |          | 2.9264 (42) |
| Hot water usage for mixer showers                               |          |          |          |         |         |         |         |         |         |         |          |          | (42a)       |
| Hot water usage for baths                                       |          |          |          |         |         |         |         |         |         |         |          |          | (42b)       |
| Hot water usage for other uses                                  |          |          |          |         |         |         |         |         |         |         |          |          | (42c)       |
| Average daily hot water use (litres/day)                        |          |          |          |         |         |         |         |         |         |         |          |          | (43)        |
| Daily hot water use                                             | Jan      | Feb      | Mar      | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov      | Dec      |             |
| Energy conte                                                    | 76.2384  | 74.1467  | 71.8632  | 69.0214 | 66.4860 | 63.8513 | 63.3041 | 65.5830 | 67.9202 | 70.6259 | 73.4929  | 76.1315  | (44)        |
| Energy content (annual)                                         | 120.7430 | 105.5840 | 110.4511 | 94.4868 | 89.5030 | 78.5126 | 76.5608 | 81.2054 | 83.7524 | 95.8387 | 104.7041 | 119.2035 | (45)        |
| Distribution loss (46)m = 0.15 x (45)m                          |          |          |          |         |         |         |         |         |         |         |          |          | (46)        |
| Water storage 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 |          |          |          |         |         |         |         |         |         |         |          |          |             |
| WWHRS                                                           | 102.6316 | 89.7464  | 93.8835  | 80.3138 | 76.0775 | 66.7357 | 65.0767 | 69.0246 | 71.1895 | 81.4629 | 88.9985  | 101.3229 | (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)       |

# Full SAP Calculation Printout



|                                          |                                        |         |         |         |         |         |         |         |         |         |         |                |
|------------------------------------------|----------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------------|
| Output from w/h                          | 102.6316                               | 89.7464 | 93.8835 | 80.3138 | 76.0775 | 66.7357 | 65.0767 | 69.0246 | 71.1895 | 81.4629 | 88.9985 | 101.3229 (64)  |
| 12Total per year (kWh/year)              | Total per year (kWh/year) = Sum(64)m = |         |         |         |         |         |         |         |         |         |         | 986.4636 (64)  |
| Electric shower(s)                       | 58.6903                                | 52.2935 | 57.1025 | 54.4922 | 55.5148 | 52.9557 | 54.7209 | 55.5148 | 54.4922 | 57.1025 | 56.0288 | 58.6903 (64a)  |
| Heat gains from water heating, kWh/month | 40.3305                                | 35.5100 | 37.7465 | 33.7015 | 32.8981 | 29.9228 | 29.9494 | 31.1348 | 31.4204 | 34.6414 | 36.2568 | 667.5985 (64a) |

## 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                                                                               | 146.3217  | 146.3217  | 146.3217  | 146.3217  | 146.3217  | 146.3217  | 146.3217  | 146.3217  | 146.3217  | 146.3217  | 146.3217  | 146.3217 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 159.0190  | 176.0568  | 159.0190  | 164.3197  | 159.0190  | 164.3197  | 159.0190  | 159.0190  | 164.3197  | 159.0190  | 164.3197  | 159.0190 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 315.2730  | 318.5445  | 310.3003  | 292.7494  | 270.5946  | 249.7721  | 235.8614  | 232.5899  | 240.8341  | 258.3850  | 280.5399  | 301.3623 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 37.6322   | 37.6322   | 37.6322   | 37.6322   | 37.6322   | 37.6322   | 37.6322   | 37.6322   | 37.6322   | 37.6322   | 37.6322   | 37.6322 (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)                                 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 (71) |
| Water heating gains (Table 5)                                                       | 54.2076   | 52.8422   | 50.7345   | 46.8077   | 44.2178   | 41.5595   | 40.2546   | 41.8479   | 43.6395   | 46.5610   | 50.3567   | 53.7679 (72)   |
| Total internal gains                                                                | 595.3961  | 614.3400  | 586.9504  | 570.7732  | 540.7279  | 522.5478  | 502.0315  | 500.3533  | 515.6897  | 530.8615  | 562.1127  | 581.0457 (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        |           |           |           | 4.2800     | 19.6403                        |           | 0.7600                            |           | 1.0000                             |           | 0.7700                       |  | 44.2729 (76)   |
| South       |           |           |           | 13.6500    | 46.7521                        |           | 0.7600                            |           | 1.0000                             |           | 0.7700                       |  | 336.1091 (78)  |
| West        |           |           |           | 6.8600     | 19.6403                        |           | 0.7600                            |           | 1.0000                             |           | 0.7700                       |  | 70.9608 (80)   |
| East        |           |           |           | 2.0000     | 26.0000                        |           | 0.7600                            |           | 1.0000                             |           | 1.0000                       |  | 35.5680 (82)   |
| West        |           |           |           | 1.2800     | 26.0000                        |           | 0.7600                            |           | 1.0000                             |           | 1.0000                       |  | 22.7635 (82)   |
|             |           |           |           |            |                                |           |                                   |           |                                    |           |                              |  |                |
| Solar gains | 509.6743  | 897.0317  | 1287.8035 | 1670.4504  | 1920.1242                      | 1922.7026 | 1847.2167                         | 1661.8221 | 1422.2431                          | 1009.2768 | 616.1229                     |  | 432.3057 (83)  |
| Total gains | 1105.0704 | 1511.3717 | 1874.7539 | 2241.2236  | 2460.8521                      | 2445.2504 | 2349.2482                         | 2162.1753 | 1937.9328                          | 1540.1382 | 1178.2356                    |  | 1013.3514 (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                                                                         | 33.9133 | 33.9720 | 34.0297 | 34.3037 | 34.3554 | 34.5983 | 34.5983 | 34.6437 | 34.5044 | 34.3554 | 34.2509 | 34.1423      |
| alpha                                                                       | 3.2609  | 3.2648  | 3.2686  | 3.2869  | 3.2904  | 3.3066  | 3.3066  | 3.3096  | 3.3003  | 3.2904  | 3.2834  | 3.2762       |
| util living area                                                            | 0.9545  | 0.8947  | 0.8006  | 0.6537  | 0.4986  | 0.3574  | 0.2595  | 0.2933  | 0.4725  | 0.7472  | 0.9157  | 0.9641 (86)  |
| MIT                                                                         | 19.2446 | 19.7559 | 20.2584 | 20.6800 | 20.8906 | 20.9725 | 20.9928 | 20.9891 | 20.9315 | 20.5836 | 19.8270 | 19.1400 (87) |
| Th 2                                                                        | 20.0983 | 20.0997 | 20.1011 | 20.1076 | 20.1088 | 20.1145 | 20.1145 | 20.1156 | 20.1123 | 20.1088 | 20.1064 | 20.1038 (88) |
| util rest of house                                                          | 0.9476  | 0.8808  | 0.7774  | 0.6202  | 0.4576  | 0.3105  | 0.2082  | 0.2383  | 0.4187  | 0.7106  | 0.9019  | 0.9585 (89)  |
| MIT 2                                                                       | 18.5029 | 18.9973 | 19.4709 | 19.8549 | 20.0320 | 20.0990 | 20.1116 | 20.1109 | 20.0706 | 19.7844 | 19.0792 | 18.4046 (90) |
| Living area fraction                                                        | 18.9069 | 19.4105 | 19.8998 | 20.3043 | 20.4997 | 20.5748 | 20.5916 | 20.5893 | 20.5395 | 20.2197 | 19.4865 | 18.8052 (91) |
| MIT                                                                         | 18.9069 | 19.4105 | 19.8998 | 20.3043 | 20.4997 | 20.5748 | 20.5916 | 20.5893 | 20.5395 | 20.2197 | 19.4865 | 18.8052 (92) |
| Temperature adjustment                                                      | 18.9069 | 19.4105 | 19.8998 | 20.3043 | 20.4997 | 20.5748 | 20.5916 | 20.5893 | 20.5395 | 20.2197 | 19.4865 | 18.8052 (93) |
| adjusted MIT                                                                | 18.9069 | 19.4105 | 19.8998 | 20.3043 | 20.4997 | 20.5748 | 20.5916 | 20.5893 | 20.5395 | 20.2197 | 19.4865 | 18.8052 (93) |

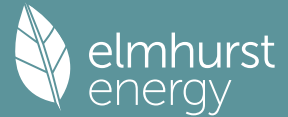
## 8. Space heating requirement

|                                                                                |           |           |           |           |           |          |          |          |          |           |           |                            |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|-----------|-----------|----------------------------|
| Utilisation                                                                    | Jan       | Feb       | Mar       | Apr       | May       | Jun      | Jul      | Aug      | Sep      | Oct       | Nov       | Dec                        |
| Useful gains                                                                   | 1034.7116 | 1312.7921 | 1446.8356 | 1407.0715 | 1171.0181 | 819.3502 | 554.3492 | 579.2429 | 862.4526 | 1101.8903 | 1049.4462 | 961.0056 (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                                                               | 2083.3034 | 2065.9847 | 1904.6118 | 1608.0347 | 1238.9084 | 835.2766 | 558.0268 | 584.8980 | 902.7056 | 1354.3564 | 1749.2082 | 2069.0910 (97)             |
| Space heating kWh                                                              | 780.1523  | 506.1455  | 340.5855  | 144.6935  | 50.5104   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 187.8348  | 503.8286  | 824.4156 (98a)             |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |           |          |          |          |          |           |           | 3338.1661                  |
| 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                                                              | 780.1523  | 506.1455  | 340.5855  | 144.6935  | 50.5104   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 187.8348  | 503.8286  | 824.4156 (98c)             |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |           |          |          |          |          |           |           | 3338.1661                  |
| Space heating per m2                                                           |           |           |           |           |           |          |          |          |          |           |           | (98c) / (4) = 22.9870 (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  | 1314.1301 | 1034.5279 | 1061.0969 | 0.0000  | 0.0000  | 0.0000 | 0.0000 (100) |
| Utilisation                                         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.9510    | 0.9711    | 0.9616    | 0.0000  | 0.0000  | 0.0000 | 0.0000 (101) |
| Useful loss                                         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 1249.6749 | 1004.6539 | 1020.3913 | 0.0000  | 0.0000  | 0.0000 | 0.0000 (102) |
| Total gains                                         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 2713.8405 | 2608.8301 | 2405.4741 | 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 | 1054.1992 | 1193.5071 | 1030.5016 | 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 | 263.5498  | 298.3768  | 257.6254  | 0.0000 | 0.0000 | 0.0000 | 0.0000 (107)   |
| Space cooling requirement        |        |        |        |        |        |           |           |           |        |        |        | 819.5520 (107) |
| Energy for space heating         |        |        |        |        |        |           |           |           |        |        |        | 22.9870 (99)   |
| Energy for space cooling         |        |        |        |        |        |           |           |           |        |        |        | 5.6435 (108)   |
| Total                            |        |        |        |        |        |           |           |           |        |        |        | 28.6305 (109)  |
| Fabric Energy Efficiency (DFEE)  |        |        |        |        |        |           |           |           |        |        |        | 28.6 (109)     |

SAP 10 WORKSHEET FOR New Build (As Built) (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> ) |
|--------------------------------------------------------|---------------------------|-----------------------------------|-----------------------------|
| Ground floor                                           | 79.1000 (1b)              | x 2.3500 (2b)                     | = 185.8850 (1b) - (3b)      |
| First floor                                            | 66.1200 (1c)              | x 2.4000 (2c)                     | = 158.6880 (1c) - (3c)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 145.2200                  |                                   | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 344.5730 (5)                |

## 2. Ventilation rate

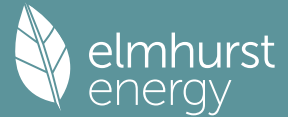
|                                                                                                    | m <sup>3</sup> per hour                 |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of 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                                                                | 4 * 10 = 40.0000 (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) = | 40.0000 / (5) = 0.1161 (8)              |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 5.0000 (17)                             |
| Infiltration rate                                                                                  | 0.3661 (18)                             |
| Number of sides sheltered                                                                          | 0 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 1.0000 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.3661 (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                                                                                         | 0.4668 | 0.4576 | 0.4485 | 0.4027 | 0.3935 | 0.3478 | 0.3478 | 0.3386 | 0.3661 | 0.3935 | 0.4118 | 0.4302 (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                                                                                            | 0.6089 | 0.6047 | 0.6006 | 0.5811 | 0.5774 | 0.5605 | 0.5605 | 0.5573 | 0.5670 | 0.5774 | 0.5848 | 0.5925 (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 |
|----------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|---------------|
| TER Opaque door                                                |                         |                            | 2.2000                    | 1.0000                        | 2.2000       |                                | (26)          |
| TER Opening Type (Uw = 1.20)                                   |                         |                            | 24.7900                   | 1.1450                        | 28.3855      |                                | (27)          |
| East Roof Light                                                |                         |                            | 2.0000                    | 2.0221                        | 4.0441       |                                | (27a)         |
| West Roof Light                                                |                         |                            | 1.2800                    | 2.0221                        | 2.5882       |                                | (27a)         |
| Heatloss Floor 1                                               |                         |                            | 79.9000                   | 0.1300                        | 10.3870      |                                | (28a)         |
| External Wall 1                                                | 148.7200                | 21.5500                    | 127.1700                  | 0.1800                        | 22.8906      |                                | (29a)         |
| Dormer Wall                                                    | 15.3700                 | 5.4400                     | 9.9300                    | 0.1800                        | 1.7874       |                                | (29a)         |
| Pitched Roof                                                   | 30.0800                 | 3.2800                     | 26.8000                   | 0.1100                        | 2.9480       |                                | (30)          |
| Plan Roof                                                      | 50.7600                 |                            | 50.7600                   | 0.1100                        | 5.5836       |                                | (30)          |
| Total net area of external elements Aum(A, m <sup>2</sup> )    |                         |                            | 324.8300                  |                               |              |                                | (31)          |
| Fabric heat loss, W/K = Sum (A x U)                            |                         |                            |                           | (26)...(30) + (32) =          | 80.8144      |                                | (33)          |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K |                         |                            |                           |                               |              |                                | 119.9062 (35) |
| List of Thermal Bridges                                        |                         |                            |                           |                               |              |                                |               |
| K1 Element                                                     |                         |                            |                           | Length                        | Psi-value    | Total                          |               |
| E2 Other lintels (including other steel lintels)               |                         |                            |                           | 19.8000                       | 0.0500       | 0.9900                         |               |
| E3 Sill                                                        |                         |                            |                           | 18.8000                       | 0.0500       | 0.9400                         |               |
| E4 Jamb                                                        |                         |                            |                           | 20.8000                       | 0.0500       | 1.0400                         |               |
| E5 Ground floor (normal)                                       |                         |                            |                           | 35.6000                       | 0.1600       | 5.6960                         |               |
| E6 Intermediate floor within a dwelling                        |                         |                            |                           | 38.1000                       | 0.0000       | 0.0000                         |               |
| R11 Upstands or kerbs of rooflights                            |                         |                            |                           | 14.4000                       | 0.0800       | 1.1520                         |               |
| E10 Eaves (insulation at ceiling level)                        |                         |                            |                           | 10.8000                       | 0.0600       | 0.6480                         |               |
| E11 Eaves (insulation at rafter level)                         |                         |                            |                           | 18.8000                       | 0.0400       | 0.7520                         |               |
| E13 Gable (insulation at rafter level)                         |                         |                            |                           | 8.0000                        | 0.0800       | 0.6400                         |               |
| E16 Corner (normal)                                            |                         |                            |                           | 19.0000                       | 0.0900       | 1.7100                         |               |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)     |                         |                            |                           |                               |              |                                | 13.5680 (36)  |
| Point Thermal bridges                                          |                         |                            |                           |                               |              | (36a) =                        | 0.0000        |
| Total fabric heat loss                                         |                         |                            |                           |                               |              | (33) + (36) + (36a) =          | 94.3824 (37)  |

# Full SAP Calculation Printout



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                     | 69.2411  | 68.7601  | 68.2887  | 66.0742  | 65.6599  | 63.7312  | 63.7312  | 63.3740  | 64.4741  | 65.6599  | 66.4981  | 67.3743  | (38) |
| Heat transfer coeff       | 163.6236 | 163.1426 | 162.6711 | 160.4567 | 160.0424 | 158.1137 | 158.1137 | 157.7565 | 158.8566 | 160.0424 | 160.8805 | 161.7568 | (39) |
| Average = Sum(39)m / 12 = |          |          |          |          |          |          |          |          |          |          |          | 160.4547 |      |
| HLP                       | 1.1267   | 1.1234   | 1.1202   | 1.1049   | 1.1021   | 1.0888   | 1.0888   | 1.0863   | 1.0939   | 1.1021   | 1.1078   | 1.1139   | (40) |
| HLP (average)             |          |          |          |          |          |          |          |          |          |          |          | 1.1049   |      |
| Days in mont              | 31       | 28       | 31       | 30       | 31       | 30       | 31       | 31       | 30       | 31       | 30       | 31       |      |

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

|                                                                 |          |          |          |         |         |         |         |         |         |                                        |          |           |             |
|-----------------------------------------------------------------|----------|----------|----------|---------|---------|---------|---------|---------|---------|----------------------------------------|----------|-----------|-------------|
| Assumed occupancy                                               |          |          |          |         |         |         |         |         |         |                                        |          |           | 2.9264 (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                                       | 31.6388  | 31.1689  | 30.5072  | 29.2872 | 28.3737 | 27.3607 | 26.8135 | 27.4706 | 28.1860 | 29.2699                                | 30.5151  | 31.5319   | (42b)       |
| Hot water usage for other uses                                  | 44.5996  | 42.9778  | 41.3560  | 39.7342 | 38.1124 | 36.4906 | 36.4906 | 38.1124 | 39.7342 | 41.3560                                | 42.9778  | 44.5996   | (42c)       |
| Average daily hot water use (litres/day)                        |          |          |          |         |         |         |         |         |         |                                        |          | 69.8793   | (43)        |
| Daily hot water use                                             | 76.2384  | 74.1467  | 71.8632  | 69.0214 | 66.4860 | 63.8513 | 63.3041 | 65.5830 | 67.9202 | 70.6259                                | 73.4929  | 76.1315   | (44)        |
| Energy conte                                                    | 120.7430 | 105.5840 | 110.4511 | 94.4868 | 89.5030 | 78.5126 | 76.5608 | 81.2054 | 83.7524 | 95.8387                                | 104.7041 | 119.2035  | (45)        |
| Energy content (annual)                                         |          |          |          |         |         |         |         |         |         | Total = Sum(45)m =                     |          | 1160.5454 |             |
| 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:                                             |          |          |          |         |         |         |         |         |         |                                        |          |           |             |
| 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 | 102.6316 | 89.7464  | 93.8835  | 80.3138 | 76.0775 | 66.7357 | 65.0767 | 69.0246 | 71.1895 | 81.4629                                | 88.9985  | 101.3229  | (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                                                 | 102.6316 | 89.7464  | 93.8835  | 80.3138 | 76.0775 | 66.7357 | 65.0767 | 69.0246 | 71.1895 | 81.4629                                | 88.9985  | 101.3229  | (64)        |
| 12Total per year (kWh/year)                                     |          |          |          |         |         |         |         |         |         | Total per year (kWh/year) = Sum(64)m = |          | 986.4636  | (64)        |
| Electric shower(s)                                              | 58.6903  | 52.2935  | 57.1025  | 54.4922 | 55.5148 | 52.9557 | 54.7209 | 55.5148 | 54.4922 | 57.1025                                | 56.0288  | 58.6903   | (64a)       |
|                                                                 |          |          |          |         |         |         |         |         |         |                                        |          | 667.5985  | (64a)       |
| Heat gains from water heating, kWh/month                        | 40.3305  | 35.5100  | 37.7465  | 33.7015 | 32.8981 | 29.9228 | 29.9494 | 31.1348 | 31.4204 | 34.6414                                | 36.2568  | 40.0033   | (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                                                                               | 146.3217  | 146.3217  | 146.3217  | 146.3217  | 146.3217  | 146.3217  | 146.3217  | 146.3217  | 146.3217  | 146.3217  | 146.3217  | 146.3217  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 160.3195  | 177.4966  | 160.3195  | 165.6635  | 160.3195  | 165.6635  | 160.3195  | 160.3195  | 165.6635  | 160.3195  | 165.6635  | 160.3195  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 315.2730  | 318.5445  | 310.3003  | 292.7494  | 270.5946  | 249.7721  | 235.8614  | 232.5899  | 240.8341  | 258.3850  | 280.5399  | 301.3623  | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 37.6322   | 37.6322   | 37.6322   | 37.6322   | 37.6322   | 37.6322   | 37.6322   | 37.6322   | 37.6322   | 37.6322   | 37.6322   | 37.6322   | (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)                                 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | (71) |
| Water heating gains (Table 5)                                                       | 54.2076   | 52.8422   | 50.7345   | 46.8077   | 44.2178   | 41.5595   | 40.2546   | 41.8479   | 43.6395   | 46.5610   | 50.3567   | 53.7679   | (72) |
| Total internal gains                                                                | 596.6966  | 615.7799  | 588.2509  | 572.1171  | 542.0284  | 523.8916  | 503.3320  | 501.6538  | 517.0336  | 532.1620  | 563.4566  | 582.3462  | (73) |

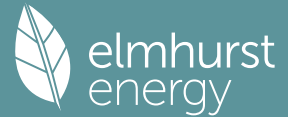
## 6. Solar gains

| [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        |          |           |           |           | 4.2800     | 19.6403                        |           | 0.6300                            | 0.7000                             | 0.7700                       |          | 25.6899 (76)  |  |
| South       |          |           |           |           | 13.6500    | 46.7521                        |           | 0.6300                            | 0.7000                             | 0.7700                       |          | 195.0317 (78) |  |
| West        |          |           |           |           | 6.8600     | 19.6403                        |           | 0.6300                            | 0.7000                             | 0.7700                       |          | 41.1759 (80)  |  |
| East        |          |           |           |           | 2.0000     | 26.0000                        |           | 0.6300                            | 0.7000                             | 1.0000                       |          | 20.6388 (82)  |  |
| West        |          |           |           |           | 1.2800     | 26.0000                        |           | 0.6300                            | 0.7000                             | 1.0000                       |          | 13.2088 (82)  |  |
| Solar gains | 295.7452 | 520.5144  | 747.2649  | 969.3008  | 1114.1773  | 1115.6735                      | 1071.8718 | 964.2941                          | 825.2752                           | 585.6461                     | 357.5134 | 250.8511 (83) |  |
| Total gains | 892.4418 | 1136.2943 | 1335.5158 | 1541.4179 | 1656.2058  | 1639.5651                      | 1575.2038 | 1465.9479                         | 1342.3088                          | 1117.8081                    | 920.9700 | 833.1973 (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                                                                         | 29.5610 | 29.6482 | 29.7341 | 30.1445 | 30.2225 | 30.5912 | 30.5912 | 30.6604 | 30.4481 | 30.2225 | 30.0651 | 29.9022 |              |
| alpha                                                                       | 2.9707  | 2.9765  | 2.9823  | 3.0096  | 3.0148  | 3.0394  | 3.0394  | 3.0440  | 3.0299  | 3.0148  | 3.0043  | 2.9935  |              |
| util living area                                                            | 0.9755  | 0.9514  | 0.9112  | 0.8295  | 0.7095  | 0.5536  | 0.4203  | 0.4638  | 0.6713  | 0.8760  | 0.9579  | 0.9797  | (86)         |

# Full SAP Calculation Printout



|                        |         |         |         |         |         |         |         |         |                     |         |         |              |
|------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------|---------|---------|--------------|
| MIT                    | 18.6480 | 19.0458 | 19.5548 | 20.1569 | 20.6012 | 20.8668 | 20.9570 | 20.9415 | 20.7512             | 20.1278 | 19.2795 | 18.5888 (87) |
| Th 2                   | 19.9791 | 19.9818 | 19.9844 | 19.9968 | 19.9991 | 20.0100 | 20.0100 | 20.0120 | 20.0058             | 19.9991 | 19.9944 | 19.9895 (88) |
| util rest of house     |         |         |         |         |         |         |         |         |                     |         |         |              |
|                        | 0.9713  | 0.9434  | 0.8966  | 0.8019  | 0.6630  | 0.4845  | 0.3335  | 0.3750  | 0.6059              | 0.8493  | 0.9496  | 0.9762 (89)  |
| MIT 2                  | 17.8334 | 18.2261 | 18.7236 | 19.3042 | 19.7063 | 19.9320 | 19.9923 | 19.9863 | 19.8464             | 19.2928 | 18.4697 | 17.7819 (90) |
| Living area fraction   |         |         |         |         |         |         |         |         | fLA = Living area / | (4) =   |         | 0.5447 (91)  |
| MIT                    | 18.2771 | 18.6725 | 19.1764 | 19.7687 | 20.1937 | 20.4412 | 20.5178 | 20.5066 | 20.3392             | 19.7476 | 18.9108 | 18.2214 (92) |
| Temperature adjustment |         |         |         |         |         |         |         |         |                     |         |         | 0.0000       |
| adjusted MIT           | 18.2771 | 18.6725 | 19.1764 | 19.7687 | 20.1937 | 20.4412 | 20.5178 | 20.5066 | 20.3392             | 19.7476 | 18.9108 | 18.2214 (93) |

## 8. Space heating requirement

|                                                                                | Jan       | Feb       | Mar       | Apr       | May       | Jun      | Jul      | Aug      | Sep      | Oct       | Nov       | Dec           |              |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|-----------|-----------|---------------|--------------|
| Utilisation                                                                    | 0.9618    | 0.9304    | 0.8828    | 0.7949    | 0.6726    | 0.5156   | 0.3789   | 0.4206   | 0.6291   | 0.8415    | 0.9381    | 0.9678        | (94)         |
| Useful gains                                                                   | 858.3904  | 1057.2254 | 1178.9298 | 1225.2004 | 1114.0284 | 845.3976 | 596.9023 | 616.5892 | 844.4982 | 940.6522  | 863.9646  | 806.4020      | (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                                                               |           |           |           |           |           |          |          |          |          |           |           |               |              |
|                                                                                | 2286.9854 | 2246.8878 | 2062.0789 | 1743.9558 | 1359.3522 | 923.5698 | 619.4545 | 647.8410 | 991.1414 | 1464.0035 | 1900.1258 | 2268.0523     | (97)         |
| Space heating kWh                                                              |           |           |           |           |           |          |          |          |          |           |           |               |              |
|                                                                                | 1062.8746 | 799.4532  | 657.0629  | 373.5039  | 182.5209  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 389.3734  | 746.0360  | 1087.4678     | (98a)        |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |           |          |          |          |          |           |           | 5298.2927     |              |
| 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                                                              |           |           |           |           |           |          |          |          |          |           |           |               |              |
|                                                                                | 1062.8746 | 799.4532  | 657.0629  | 373.5039  | 182.5209  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 389.3734  | 746.0360  | 1087.4678     | (98c)        |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |           |          |          |          |          |           |           | 5298.2927     |              |
| Space heating per m2                                                           |           |           |           |           |           |          |          |          |          |           |           | (98c) / (4) = | 36.4846 (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  | 1486.2684 | 1170.0411 | 1198.9493 | 0.0000             | 0.0000  | 0.0000 | 0.0000   | (100) |
| Utilisation                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.8196    | 0.8762    | 0.8515    | 0.0000             | 0.0000  | 0.0000 | 0.0000   | (101) |
| Useful loss                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 1218.2194 | 1025.1986 | 1020.8833 | 0.0000             | 0.0000  | 0.0000 | 0.0000   | (102) |
| Total gains                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 1802.4707 | 1732.7542 | 1615.3024 | 0.0000             | 0.0000  | 0.0000 | 0.0000   | (103) |
| Space cooling kWh                |        |        |        |        |         |           |           |           |                    |         |        |          |       |
|                                  | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 420.6610  | 526.4214  | 442.2477  | 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  | 105.1652  | 131.6053  | 110.5619  | 0.0000             | 0.0000  | 0.0000 | 0.0000   | (107) |
| Space cooling requirement        |        |        |        |        |         |           |           |           |                    |         |        | 347.3325 | (107) |
| Energy for space heating         |        |        |        |        |         |           |           |           |                    |         |        | 36.4846  | (99)  |
| Energy for space cooling         |        |        |        |        |         |           |           |           |                    |         |        | 2.3918   | (108) |
| Total                            |        |        |        |        |         |           |           |           |                    |         |        | 38.8764  | (109) |
| Fabric Energy Efficiency (TFEE)  |        |        |        |        |         |           |           |           |                    |         |        | 38.9     | (109) |

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

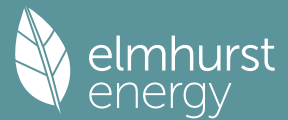
## 1. Overall dwelling characteristics

|                                                        | Area (m2)    | Storey height (m)                 | Volume (m3)            |  |
|--------------------------------------------------------|--------------|-----------------------------------|------------------------|--|
| Ground floor                                           | 79.1000 (1b) | x 2.3500 (2b)                     | = 185.8850 (1b) - (3b) |  |
| First floor                                            | 66.1200 (1c) | x 2.4000 (2c)                     | = 158.6880 (1c) - (3c) |  |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 145.2200     |                                   |                        |  |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 344.5730 (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) |
|                                                                                                    | 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                                                                               | 2.9200                      | (17)        |
| Infiltration rate                                                                                  | 0.1460                      | (18)        |
| Number of sides sheltered                                                                          | 0                           | (19)        |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = | 1.0000 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) =        | 0.1460 (21) |

# Full SAP Calculation Printout



|                                                                                                         |        |        |        |        |        |        |        |        |        |        |        |        |               |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------------|
| 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)         |
| Balanced mechanical ventilation with heat recovery                                                      | 0.1861 | 0.1825 | 0.1789 | 0.1606 | 0.1569 | 0.1387 | 0.1387 | 0.1351 | 0.1460 | 0.1569 | 0.1642 | 0.1716 | (22b)         |
| 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)  |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =            |        |        |        |        |        |        |        |        |        |        |        |        | 80.1000 (23c) |
| Effective ac                                                                                            | 0.2856 | 0.2820 | 0.2783 | 0.2601 | 0.2564 | 0.2382 | 0.2382 | 0.2345 | 0.2455 | 0.2564 | 0.2637 | 0.2711 | (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 |       |
|------------------------------------------------|-------------|----------------|---------------|----------------------|--------------|-------------------|---------------|-------|
| Door                                           |             |                | 2.2000        | 0.8000               | 1.7600       |                   |               | (26)  |
| Windows (Uw = 1.17)                            |             |                | 24.7900       | 1.1177               | 27.7076      |                   |               | (27)  |
| East Roof Light                                |             |                | 2.0000        | 1.1177               | 2.2354       |                   |               | (27a) |
| West Roof Light                                |             |                | 1.2800        | 1.1177               | 1.4306       |                   |               | (27a) |
| Heatloss Floor 1                               |             |                | 79.9000       | 0.1000               | 7.9900       | 75.0000           | 5992.5000     | (28a) |
| External Wall 1                                | 148.7200    | 21.5500        | 127.1700      | 0.1500               | 19.0755      | 60.0000           | 7630.2000     | (29a) |
| Dormer Wall                                    | 15.3700     | 5.4400         | 9.9300        | 0.1500               | 1.4895       | 18.0000           | 178.7400      | (29a) |
| Pitched Roof                                   | 30.0800     | 3.2800         | 26.8000       | 0.1000               | 2.6800       | 9.0000            | 241.2000      | (30)  |
| Plan Roof                                      | 50.7600     |                | 50.7600       | 0.0900               | 4.5684       | 9.0000            | 456.8400      | (30)  |
| Total net area of external elements Aum(A, m2) |             |                | 324.8300      |                      |              |                   |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)            |             |                |               | (26)...(30) + (32) = | 68.9370      |                   |               | (33)  |
| Internal Wall 1                                |             |                | 84.0000       |                      |              | 9.0000            | 756.0000      | (32c) |
| Internal Floor 1                               |             |                | 79.9000       |                      |              | 18.0000           | 1438.2000     | (32d) |
| Internal Ceiling 1                             |             |                | 79.9000       |                      |              | 9.0000            | 719.1000      | (32e) |

Heat capacity Cm = Sum(A x k)  
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K  
(28)...(30) + (32) + (32a)...(32e) = 17412.7800 (34)  
List of Thermal Bridges  
119.9062 (35)

| K1 Element                                       | Length  | Psi-value | Total  |
|--------------------------------------------------|---------|-----------|--------|
| E2 Other lintels (including other steel lintels) | 19.8000 | 0.0500    | 0.9900 |
| E3 Sill                                          | 18.8000 | 0.0400    | 0.7520 |
| E4 Jamb                                          | 20.8000 | 0.0500    | 1.0400 |
| E5 Ground floor (normal)                         | 35.6000 | 0.0800    | 2.8480 |
| E6 Intermediate floor within a dwelling          | 38.1000 | 0.0100    | 0.3810 |
| R11 Upstands or kerbs of rooflights              | 14.4000 | 0.0800    | 1.1520 |
| E10 Eaves (insulation at ceiling level)          | 10.8000 | 0.0500    | 0.5400 |
| E11 Eaves (insulation at rafter level)           | 18.8000 | 0.0400    | 0.7520 |
| E13 Gable (insulation at rafter level)           | 8.0000  | 0.0400    | 0.3200 |
| E16 Corner (normal)                              | 19.0000 | 0.0900    | 1.7100 |

Thermal bridges (Sum(L x Psi) calculated using Appendix K)  
Point Thermal bridges  
Total fabric heat loss  
(33) + (36) + (36a) = 79.4220 (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                                                 | 32.4810  | 32.0660  | 31.6509  | 29.5757  | 29.1607  | 27.0855  | 27.0855  | 26.6705  | 27.9156  | 29.1607  | 29.9908  | 30.8208  | (38) |
| Average = Sum(39)m / 12 =                                           | 111.9030 | 111.4880 | 111.0729 | 108.9977 | 108.5827 | 106.5075 | 106.5075 | 106.0925 | 107.3376 | 108.5827 | 109.4128 | 110.2429 | (39) |
|                                                                     |          |          |          |          |          |          |          |          |          |          |          | 108.8940 |      |

|               |        |        |        |        |        |        |        |        |        |        |        |        |      |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| HLP           | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |      |
| HLP (average) | 0.7706 | 0.7677 | 0.7649 | 0.7506 | 0.7477 | 0.7334 | 0.7334 | 0.7306 | 0.7391 | 0.7477 | 0.7534 | 0.7591 | (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                        |         |         |         |         |         |         |         |         |         |         |         |         | 2.9264 (42)   |
| Hot water usage for mixer showers        |         |         |         |         |         |         |         |         |         |         |         |         |               |
|                                          | 73.2865 | 72.1852 | 70.5803 | 67.5096 | 65.2435 | 62.7164 | 61.2800 | 62.8728 | 64.6187 | 67.3320 | 70.4687 | 73.0057 | (42a)         |
| Hot water usage for baths                |         |         |         |         |         |         |         |         |         |         |         |         |               |
|                                          | 31.6388 | 31.1689 | 30.5072 | 29.2872 | 28.3737 | 27.3607 | 26.8135 | 27.4706 | 28.1860 | 29.2699 | 30.5151 | 31.5319 | (42b)         |
| Hot water usage for other uses           |         |         |         |         |         |         |         |         |         |         |         |         |               |
|                                          | 44.5996 | 42.9778 | 41.3560 | 39.7342 | 38.1124 | 36.4906 | 36.4906 | 38.1124 | 39.7342 | 41.3560 | 42.9778 | 44.5996 | (42c)         |
| Average daily hot water use (litres/day) |         |         |         |         |         |         |         |         |         |         |         |         | 137.4470 (43) |

|                                                                 |          |          |          |          |          |          |          |                                        |          |                    |          |          |                |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------------------------------------|----------|--------------------|----------|----------|----------------|
| Daily hot water use                                             | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug                                    | Sep      | Oct                | Nov      | Dec      |                |
|                                                                 | 149.5249 | 146.3319 | 142.4435 | 136.5310 | 131.7296 | 126.5677 | 124.5841 | 128.4557                               | 132.5389 | 137.9580           | 143.9615 | 149.1372 | (44)           |
| Energy conte                                                    | 236.8109 | 208.3747 | 218.9304 | 186.9041 | 177.3333 | 155.6297 | 150.6737 | 159.0550                               | 163.4337 | 187.2076           | 205.0996 | 233.5128 | (45)           |
| Energy content (annual)                                         |          |          |          |          |          |          |          |                                        |          | Total = Sum(45)m = |          |          | 2282.9656      |
| Distribution loss (46)m = 0.15 x (45)m                          |          |          |          |          |          |          |          |                                        |          |                    |          |          |                |
|                                                                 | 35.5216  | 31.2562  | 32.8396  | 28.0356  | 26.6000  | 23.3445  | 22.6011  | 23.8583                                | 24.5151  | 28.0811            | 30.7649  | 35.0269  | (46)           |
| Water storage 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                                                      | 19.1013  | 17.2456  | 19.0780  | 18.4302  | 19.0240  | 18.3895  | 18.9893  | 19.0002                                | 18.3997  | 19.0368            | 18.4538  | 19.0970  | (61)           |
| Total heat required for water heating calculated for each month | 255.9122 | 225.6203 | 238.0084 | 205.3343 | 196.3573 | 174.0192 | 169.6630 | 178.0552                               | 181.8334 | 206.2445           | 223.5534 | 252.6098 | (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                                                 | 255.9122 | 225.6203 | 238.0084 | 205.3343 | 196.3573 | 174.0192 | 169.6630 | 178.0552                               | 181.8334 | 206.2445           | 223.5534 | 252.6098 | (64)           |
|                                                                 |          |          |          |          |          |          |          | Total per year (kWh/year) = Sum(64)m = |          |                    |          |          | 2507.2110 (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 | 83.5150 | 73.5960 | 77.5639 | 66.7532 | 63.7193 | 56.3443 | 54.8463 | 57.6358                                                                        | 58.9416 | 67.0057 | 72.8091 | 82.4172 | (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                                                                               | 175.5860  | 175.5860  | 175.5860  | 175.5860  | 175.5860  | 175.5860  | 175.5860  | 175.5860  | 175.5860  | 175.5860  | 175.5860  | 175.5860 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 48.2595   | 42.8636   | 34.8591   | 26.3905   | 19.7272   | 16.6546   | 17.9958   | 23.3917   | 31.3963   | 39.8648   | 46.5281   | 49.6008 (67)   |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 470.5567  | 475.4396  | 463.1348  | 436.9394  | 403.8725  | 372.7942  | 352.0320  | 347.1491  | 359.4538  | 385.6492  | 418.7162  | 449.7945 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 55.4850   | 55.4850   | 55.4850   | 55.4850   | 55.4850   | 55.4850   | 55.4850   | 55.4850   | 55.4850   | 55.4850   | 55.4850   | 55.4850 (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)                                 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 (71) |
| Water heating gains (Table 5)                                                       | 112.2513  | 109.5178  | 104.2525  | 92.7127   | 85.6443   | 78.2559   | 73.7182   | 77.4675   | 81.8634   | 90.0615   | 101.1237  | 110.7759 (72)  |
| Total internal gains                                                                | 748.0812  | 744.8348  | 719.2601  | 673.0564  | 626.2577  | 581.7184  | 557.7597  | 562.0220  | 586.7272  | 632.5892  | 683.3817  | 727.1848 (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        |           |           |           |           | 4.2800     | 19.6403                        |           | 0.7600                            | 1.0000                             | 0.7700                       |           | 44.2729 (76)   |
| South       |           |           |           |           | 13.6500    | 46.7521                        |           | 0.7600                            | 1.0000                             | 0.7700                       |           | 336.1091 (78)  |
| West        |           |           |           |           | 6.8600     | 19.6403                        |           | 0.7600                            | 1.0000                             | 0.7700                       |           | 70.9608 (80)   |
| East        |           |           |           |           | 2.0000     | 26.0000                        |           | 0.7600                            | 1.0000                             | 1.0000                       |           | 35.5680 (82)   |
| West        |           |           |           |           | 1.2800     | 26.0000                        |           | 0.7600                            | 1.0000                             | 1.0000                       |           | 22.7635 (82)   |
| Solar gains | 509.6743  | 897.0317  | 1287.8035 | 1670.4504 | 1920.1242  | 1922.7026                      | 1847.2167 | 1661.8221                         | 1422.2431                          | 1009.2768                    | 616.1229  | 432.3057 (83)  |
| Total gains | 1257.7554 | 1641.8664 | 2007.0636 | 2343.5068 | 2546.3818  | 2504.4210                      | 2404.9764 | 2223.8440                         | 2008.9702                          | 1641.8659                    | 1299.5046 | 1159.4905 (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                                                                         | 43.2239 | 43.3848 | 43.5469 | 44.3760 | 44.5456 | 45.4135 | 45.4135 | 45.5912 | 45.0623 | 44.5456 | 44.2077 | 43.8748      |
| alpha                                                                       | 3.8816  | 3.8923  | 3.9031  | 3.9584  | 3.9697  | 4.0276  | 4.0276  | 4.0394  | 4.0042  | 3.9697  | 3.9472  | 3.9250       |
| util living area                                                            | 0.9178  | 0.8295  | 0.7007  | 0.5359  | 0.3904  | 0.2711  | 0.1946  | 0.2191  | 0.3644  | 0.6302  | 0.8553  | 0.9339 (86)  |
| MIT                                                                         | 19.9849 | 20.3840 | 20.7093 | 20.9100 | 20.9776 | 20.9962 | 20.9993 | 20.9988 | 20.9876 | 20.8646 | 20.4149 | 19.9026 (87) |
| Th 2                                                                        | 20.2789 | 20.2814 | 20.2839 | 20.2964 | 20.2989 | 20.3114 | 20.3114 | 20.3139 | 20.3064 | 20.2989 | 20.2939 | 20.2889 (88) |
| util rest of house                                                          | 0.9077  | 0.8125  | 0.6772  | 0.5090  | 0.3623  | 0.2423  | 0.1643  | 0.1865  | 0.3289  | 0.5971  | 0.8375  | 0.9255 (89)  |
| MIT 2                                                                       | 19.1004 | 19.5864 | 19.9701 | 20.2056 | 20.2785 | 20.3086 | 20.3110 | 20.3132 | 20.2965 | 20.1651 | 19.6423 | 19.0065 (90) |
| Living area fraction                                                        | 19.5822 | 20.0209 | 20.3727 | 20.5893 | 20.6593 | 20.6831 | 20.6859 | 20.6866 | 20.6729 | 20.5461 | 20.0631 | 19.4946 (92) |
| MIT                                                                         | 19.5822 | 20.0209 | 20.3727 | 20.5893 | 20.6593 | 20.6831 | 20.6859 | 20.6866 | 20.6729 | 20.5461 | 20.0631 | 19.4946 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | -0.1500      |
| adjusted MIT                                                                | 19.4322 | 19.8709 | 20.2227 | 20.4393 | 20.5093 | 20.5331 | 20.5359 | 20.5366 | 20.5229 | 20.3961 | 19.9131 | 19.3446 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |           |          |          |          |          |          |               |           |                |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|---------------|-----------|----------------|
|                                                                                | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec            |
| Utilisation                                                                    | 0.8941    | 0.8021    | 0.6752    | 0.5145    | 0.3708   | 0.2516   | 0.1742   | 0.1971   | 0.3400   | 0.6018        | 0.8269    | 0.9124 (94)    |
| Useful gains                                                                   | 1124.5563 | 1316.9127 | 1355.0835 | 1205.7649 | 944.1899 | 630.0758 | 418.8958 | 438.3652 | 683.1364 | 988.0881      | 1074.6197 | 1057.9433 (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                                                               | 1693.3359 | 1669.0703 | 1524.2261 | 1257.7573 | 956.5346 | 631.9214 | 419.2003 | 438.8665 | 689.4185 | 1063.6888     | 1401.9166 | 1669.5855 (97) |
| Space heating kWh                                                              | 423.1720  | 236.6499  | 125.8421  | 37.4346   | 9.1845   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 56.2469       | 235.6538  | 455.0618 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |          |          |          |          |          |               |           | 1579.2456      |
| 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                                                              | 423.1720  | 236.6499  | 125.8421  | 37.4346   | 9.1845   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 56.2469       | 235.6538  | 455.0618 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |          |          |          |          |          |               |           | 1579.2456      |
| Space heating per m <sup>2</sup>                                               |           |           |           |           |          |          |          |          |          | (98c) / (4) = |           | 10.8748 (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 %)                      |          |          |          |         |         |        |        |        |        |         |          | 83.4000 (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                                             | 423.1720 | 236.6499 | 125.8421 | 37.4346 | 9.1845  | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 56.2469 | 235.6538 | 455.0618 (98)  |
| Space heating efficiency (main heating system 1)                      | 83.4000  | 83.4000  | 83.4000  | 83.4000 | 83.4000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 83.4000 | 83.4000  | 83.4000 (210)  |
| Space heating fuel (main heating system)                              | 507.4005 | 283.7529 | 150.8898 | 44.8856 | 11.0126 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 67.4423 | 282.5585 | 545.6376 (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

# Full SAP Calculation Printout



|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |           |        |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|--------|
| Water heating requirement                                                                            | 255.9122 | 225.6203 | 238.0084 | 205.3343 | 196.3573 | 174.0192 | 169.6630 | 178.0552 | 181.8334 | 206.2445 | 223.5534 | 252.6098  | (64)   |
| Efficiency of water heater                                                                           | (217)m   | 87.9822  | 87.8597  | 87.6773  | 87.4678  | 87.3486  | 87.3000  | 87.3000  | 87.3000  | 87.5334  | 87.8611  | 87.3000   | (216)  |
| Fuel for water heating, kWh/month                                                                    |          | 290.8681 | 256.7961 | 271.4594 | 234.7541 | 224.7974 | 199.3348 | 194.3448 | 203.9579 | 208.2856 | 235.6180 | 254.4398  | (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    | (219)  |
| Pumps and Fa                                                                                         |          | 44.7927  | 40.4579  | 44.7927  | 43.3478  | 44.7927  | 43.3478  | 44.7927  | 43.3478  | 44.7927  | 43.3478  | 44.7927   | (221)  |
| Lighting                                                                                             |          | 42.2412  | 33.8875  | 30.5119  | 22.3543  | 17.2671  | 14.1074  | 15.7517  | 20.4746  | 26.5945  | 34.8934  | 39.4120   | (231)  |
| 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    | (232)  |
| 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    | (233a) |
| 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    | (234a) |
| 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    | (235a) |
| 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    | (235c) |
| 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    | (233b) |
| 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    | (234b) |
| 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    | (235b) |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |           | (235d) |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 1893.5798 | (211)  |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (213)  |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (215)  |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 87.3000   |        |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          | 2861.6989 | (219)  |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (221)  |
| Electricity for pumps and fans:                                                                      |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.0500)                           |          |          |          |          |          |          |          |          |          |          |          |           |        |
| mechanical ventilation fans (SFP = 1.0500)                                                           |          |          |          |          |          |          |          |          |          |          |          | 441.3980  | (230a) |
| central heating pump                                                                                 |          |          |          |          |          |          |          |          |          |          |          | 41.0000   | (230c) |
| main heating flue fan                                                                                |          |          |          |          |          |          |          |          |          |          |          | 45.0000   | (230e) |
| Total electricity for the above, kWh/year                                                            |          |          |          |          |          |          |          |          |          |          |          | 527.3980  | (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |          |          |          |          |          |          |          |          | 340.9110  | (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                                                                  |          |          |          |          |          |          |          |          |          |          |          | 5623.5877 | (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               | 1893.5798        | 3.6400              | 68.9263             | (240)  |
| Total CO2 associated with community systems |                  |                     | 0.0000              | (473)  |
| Water heating (other fuel)                  | 2861.6989        | 3.6400              | 104.1658            | (247)  |
| Energy for instantaneous electric shower(s) | 0.0000           | 16.4900             | 0.0000              | (247a) |
| Pumps, fans and electric keep-hot           | 527.3980         | 16.4900             | 86.9679             | (249)  |
| Energy for lighting                         | 340.9110         | 16.4900             | 56.2162             | (250)  |
| Additional standing charges                 |                  |                     | 92.0000             | (251)  |
| Total energy cost                           |                  |                     | 408.2763            | (255)  |

## 11a. SAP rating - Individual heating systems

|                                  |  |         |       |
|----------------------------------|--|---------|-------|
| Energy cost deflator (Table 12): |  | 0.3600  | (256) |
| Energy cost factor (ECF)         |  | 0.7727  | (257) |
| SAP value                        |  | 87.4748 |       |
| SAP rating (Section 12)          |  | 87      | (258) |
| SAP band                         |  | B       |       |

## 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               | 1893.5798          | 0.2100                        | 397.6518                 | (261) |
| Total CO2 associated with community systems |                    |                               | 0.0000                   | (373) |
| Water heating (other fuel)                  | 2861.6989          | 0.2100                        | 600.9568                 | (264) |
| Space and water heating                     |                    |                               | 998.6085                 | (265) |
| Pumps, fans and electric keep-hot           | 527.3980           | 0.1387                        | 73.1566                  | (267) |
| Energy for lighting                         | 340.9110           | 0.1443                        | 49.2040                  | (268) |
| Total CO2, kg/year                          |                    |                               | 1120.9691                | (272) |
| CO2 emissions per m2                        |                    |                               | 7.7200                   | (273) |
| EI value                                    |                    |                               | 92.1034                  |       |
| EI rating                                   |                    |                               | 92                       | (274) |
| EI band                                     |                    |                               | A                        |       |

# Full SAP Calculation Printout



## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Ground floor                                           | 79.1000 (1b)              | x 2.3500 (2b)                   | = 185.8850 (1b) - (3b)      |
| First floor                                            | 66.1200 (1c)              | x 2.4000 (2c)                   | = 158.6880 (1c) - (3c)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 145.2200                  |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 344.5730 (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                                 |                                                       | 2.9200         | (17)       |
| Infiltration rate                                    |                                                       | 0.1460         | (18)       |
| Number of sides sheltered                            |                                                       | 0              | (19)       |
| Shelter factor                                       | (20) = 1 - [0.075 x (19)] =                           | 1.0000         | (20)       |
| Infiltration rate adjusted to include shelter factor | (21) = (18) x (20) =                                  | 0.1460         | (21)       |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec           |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------------|
| Wind speed                                                                                              | 4.2000 | 3.9000 | 4.0000 | 3.7000 | 3.7000 | 3.3000 | 3.3000 | 3.2000 | 3.2000 | 3.5000 | 3.5000 | 3.8000 (22)   |
| Wind factor                                                                                             | 1.0500 | 0.9750 | 1.0000 | 0.9250 | 0.9250 | 0.8250 | 0.8250 | 0.8000 | 0.8000 | 0.8750 | 0.8750 | 0.9500 (22a)  |
| Adj infilt rate                                                                                         | 0.1533 | 0.1423 | 0.1460 | 0.1351 | 0.1351 | 0.1204 | 0.1204 | 0.1168 | 0.1168 | 0.1278 | 0.1278 | 0.1387 (22b)  |
| Balanced mechanical ventilation with heat recovery                                                      |        |        |        |        |        |        |        |        |        |        |        |               |
| 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)  |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =            |        |        |        |        |        |        |        |        |        |        |        | 80.1000 (23c) |
| Effective ac                                                                                            | 0.2528 | 0.2418 | 0.2455 | 0.2345 | 0.2345 | 0.2199 | 0.2199 | 0.2163 | 0.2163 | 0.2272 | 0.2272 | 0.2382 (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   |
|--------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|-----------------|
| Door                                                         |                         |                            | 2.2000                    | 0.8000                        | 1.7600       |                                | (26)            |
| Windows (Uw = 1.17)                                          |                         |                            | 24.7900                   | 1.1177                        | 27.7076      |                                | (27)            |
| East Roof Light                                              |                         |                            | 2.0000                    | 1.1177                        | 2.2354       |                                | (27a)           |
| West Roof Light                                              |                         |                            | 1.2800                    | 1.1177                        | 1.4306       |                                | (27a)           |
| Heatloss Floor 1                                             |                         |                            | 79.9000                   | 0.1000                        | 7.9900       | 75.0000                        | 5992.5000 (28a) |
| External Wall 1                                              | 148.7200                | 21.5500                    | 127.1700                  | 0.1500                        | 19.0755      | 60.0000                        | 7630.2000 (29a) |
| Dormer Wall                                                  | 15.3700                 | 5.4400                     | 9.9300                    | 0.1500                        | 1.4895       | 18.0000                        | 178.7400 (29a)  |
| Pitched Roof                                                 | 30.0800                 | 3.2800                     | 26.8000                   | 0.1000                        | 2.6800       | 9.0000                         | 241.2000 (30)   |
| Plan Roof                                                    | 50.7600                 |                            | 50.7600                   | 0.0900                        | 4.5684       | 9.0000                         | 456.8400 (30)   |
| Total net area of external elements Aum (A, m <sup>2</sup> ) |                         |                            | 324.8300                  |                               |              |                                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                          |                         |                            |                           | (26)...(30) + (32) =          | 68.9370      |                                | (33)            |
| Internal Wall 1                                              |                         |                            | 84.0000                   |                               |              | 9.0000                         | 756.0000 (32c)  |
| Internal Floor 1                                             |                         |                            | 79.9000                   |                               |              | 18.0000                        | 1438.2000 (32d) |
| Internal Ceiling 1                                           |                         |                            | 79.9000                   |                               |              | 9.0000                         | 719.1000 (32e)  |

|                                                                |                                      |                 |
|----------------------------------------------------------------|--------------------------------------|-----------------|
| Heat capacity Cm = Sum(A x k)                                  | (28)...(30) + (32) + (32a)...(32e) = | 17412.7800 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K |                                      | 119.9062 (35)   |

### List of Thermal Bridges

| K1 Element                                       | Length  | Psi-value | Total  |
|--------------------------------------------------|---------|-----------|--------|
| E2 Other lintels (including other steel lintels) | 19.8000 | 0.0500    | 0.9900 |
| E3 Sill                                          | 18.8000 | 0.0400    | 0.7520 |
| E4 Jamb                                          | 20.8000 | 0.0500    | 1.0400 |
| E5 Ground floor (normal)                         | 35.6000 | 0.0800    | 2.8480 |
| E6 Intermediate floor within a dwelling          | 38.1000 | 0.0100    | 0.3810 |
| R11 Upstands or kerbs of rooflights              | 14.4000 | 0.0800    | 1.1520 |
| E10 Eaves (insulation at ceiling level)          | 10.8000 | 0.0500    | 0.5400 |
| E11 Eaves (insulation at rafter level)           | 18.8000 | 0.0400    | 0.7520 |
| E13 Gable (insulation at rafter level)           | 8.0000  | 0.0400    | 0.3200 |
| E16 Corner (normal)                              | 19.0000 | 0.0900    | 1.7100 |

|                                                            |                       |              |
|------------------------------------------------------------|-----------------------|--------------|
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |                       | 10.4850 (36) |
| Point Thermal bridges                                      | (36a) =               | 0.0000       |
| Total fabric heat loss                                     | (33) + (36) + (36a) = | 79.4220 (37) |

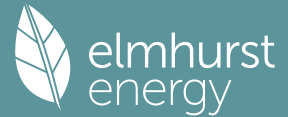
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

|                           | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
|---------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| (38)m                     | 28.7457  | 27.5005  | 27.9156  | 26.6705  | 26.6705  | 25.0103  | 25.0103  | 24.5953  | 24.5953  | 25.8404  | 25.8404  | 27.0855 (38)  |
| Heat transfer coeff       | 108.1677 | 106.9226 | 107.3376 | 106.0925 | 106.0925 | 104.4323 | 104.4323 | 104.0173 | 104.0173 | 105.2624 | 105.2624 | 106.5075 (39) |
| Average = Sum(39)m / 12 = |          |          |          |          |          |          |          |          |          |          |          | 105.7120      |

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec         |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
| HLP           | 0.7449 | 0.7363 | 0.7391 | 0.7306 | 0.7306 | 0.7191 | 0.7191 | 0.7163 | 0.7163 | 0.7248 | 0.7248 | 0.7334 (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 0.7279      |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31          |

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

# Full SAP Calculation Printout



|                                                                 |          |          |          |          |          |          |          |          |          |          |          |                                                                                             |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------------------------------------------------------------------------------------|
| Assumed occupancy                                               |          |          |          |          |          |          |          |          |          |          |          | 2.9264 (42)                                                                                 |
| Hot water usage for mixer showers                               |          |          |          |          |          |          |          |          |          |          |          |                                                                                             |
| 73.2865                                                         | 72.1852  | 70.5803  | 67.5096  | 65.2435  | 62.7164  | 61.2800  | 62.8728  | 64.6187  | 67.3320  | 70.4687  | 73.0057  | (42a)                                                                                       |
| Hot water usage for baths                                       |          |          |          |          |          |          |          |          |          |          |          |                                                                                             |
| 31.6388                                                         | 31.1689  | 30.5072  | 29.2872  | 28.3737  | 27.3607  | 26.8135  | 27.4706  | 28.1860  | 29.2699  | 30.5151  | 31.5319  | (42b)                                                                                       |
| Hot water usage for other uses                                  |          |          |          |          |          |          |          |          |          |          |          |                                                                                             |
| 44.5996                                                         | 42.9778  | 41.3560  | 39.7342  | 38.1124  | 36.4906  | 36.4906  | 38.1124  | 39.7342  | 41.3560  | 42.9778  | 44.5996  | (42c)                                                                                       |
| Average daily hot water use (litres/day)                        |          |          |          |          |          |          |          |          |          |          |          | 137.4470 (43)                                                                               |
|                                                                 | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec                                                                                         |
| Daily hot water use                                             | 149.5249 | 146.3319 | 142.4435 | 136.5310 | 131.7296 | 126.5677 | 124.5841 | 128.4557 | 132.5389 | 137.9580 | 143.9615 | 149.1372 (44)                                                                               |
| Energy conte                                                    | 236.8109 | 208.3747 | 218.9304 | 186.9041 | 177.3333 | 155.6297 | 150.6737 | 159.0550 | 163.4337 | 187.2076 | 205.0996 | 233.5128 (45)                                                                               |
| Energy content (annual)                                         |          |          |          |          |          |          |          |          |          |          |          | Total = Sum(45)m = 2282.9656                                                                |
| Distribution loss (46)m = 0.15 x (45)m                          |          |          |          |          |          |          |          |          |          |          |          |                                                                                             |
| 35.5216                                                         | 31.2562  | 32.8396  | 28.0356  | 26.6000  | 23.3445  | 22.6011  | 23.8583  | 24.5151  | 28.0811  | 30.7649  | 35.0269  | (46)                                                                                        |
| Water storage 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   | 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                                                      | 19.1013  | 17.2456  | 19.0780  | 18.4302  | 19.0240  | 18.3895  | 18.9893  | 19.0002  | 18.3997  | 19.0368  | 18.4538  | (61)                                                                                        |
| Total heat required for water heating calculated for each month |          |          |          |          |          |          |          |          |          |          |          |                                                                                             |
| 255.9122                                                        | 225.6203 | 238.0084 | 205.3343 | 196.3573 | 174.0192 | 169.6630 | 178.0552 | 181.8334 | 206.2445 | 223.5534 | 252.6098 | (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                                                 | 255.9122 | 225.6203 | 238.0084 | 205.3343 | 196.3573 | 174.0192 | 169.6630 | 178.0552 | 181.8334 | 206.2445 | 223.5534 | (64)                                                                                        |
|                                                                 |          |          |          |          |          |          |          |          |          |          |          | Total per year (kWh/year) = Sum(64)m = 2507.2110 (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   | (64a)                                                                                       |
|                                                                 |          |          |          |          |          |          |          |          |          |          |          | Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a) |
| Heat gains from water heating, kWh/month                        | 83.5150  | 73.5960  | 77.5639  | 66.7532  | 63.7193  | 56.3443  | 54.8463  | 57.6358  | 58.9416  | 67.0057  | 72.8091  | 82.4172 (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                                                                               | 175.5860  | 175.5860  | 175.5860  | 175.5860  | 175.5860  | 175.5860  | 175.5860  | 175.5860  | 175.5860  | 175.5860  | 175.5860  | 175.5860 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 48.2595   | 42.8636   | 34.8591   | 26.3905   | 19.7272   | 16.6546   | 17.9958   | 23.3917   | 31.3963   | 39.8648   | 46.5281   | 49.6008 (67)   |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 470.5567  | 475.4396  | 463.1348  | 436.9394  | 403.8725  | 372.7942  | 352.0320  | 347.1491  | 359.4538  | 385.6492  | 418.7162  | 449.7945 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 55.4850   | 55.4850   | 55.4850   | 55.4850   | 55.4850   | 55.4850   | 55.4850   | 55.4850   | 55.4850   | 55.4850   | 55.4850   | 55.4850 (69)   |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000 (70)    |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 (71) |
| Water heating gains (Table 5)                                                       | 112.2513  | 109.5178  | 104.2525  | 92.7127   | 85.6443   | 78.2559   | 73.7182   | 77.4675   | 81.8634   | 90.0615   | 101.1237  | 110.7759 (72)  |
| Total internal gains                                                                | 748.0812  | 744.8348  | 719.2601  | 673.0564  | 626.2577  | 581.7184  | 557.7597  | 562.0220  | 586.7272  | 632.5892  | 683.3817  | 727.1848 (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        |           |           |           | 4.2800     | 23.7835                        |           | 0.7600                            |           | 1.0000                             |           | 0.7700                       |           | 53.6125 (76)  |
| South       |           |           |           | 13.6500    | 54.0600                        |           | 0.7600                            |           | 1.0000                             |           | 0.7700                       |           | 388.6472 (78) |
| West        |           |           |           | 6.8600     | 23.7835                        |           | 0.7600                            |           | 1.0000                             |           | 0.7700                       |           | 85.9303 (80)  |
| East        |           |           |           | 2.0000     | 32.0000                        |           | 0.7600                            |           | 1.0000                             |           | 1.0000                       |           | 43.7760 (82)  |
| West        |           |           |           | 1.2800     | 32.0000                        |           | 0.7600                            |           | 1.0000                             |           | 1.0000                       |           | 28.0166 (82)  |
|             |           |           |           |            |                                |           |                                   |           |                                    |           |                              |           |               |
| Solar gains | 599.9827  | 923.1434  | 1318.3005 | 1743.2063  | 1960.0921                      | 2080.1493 | 1986.7061                         | 1817.4762 | 1554.2529                          | 1115.3776 | 714.5323                     | 511.8448  | (83)          |
| Total gains | 1348.0639 | 1667.9782 | 2037.5606 | 2416.2627  | 2586.3498                      | 2661.8677 | 2544.4658                         | 2379.4982 | 2140.9801                          | 1747.9668 | 1397.9140                    | 1239.0296 | (84)          |

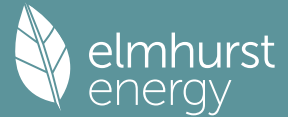
## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| 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                                                                         | 44.7165 | 45.2373 | 45.0623 | 45.5912 | 45.5912 | 46.3160 | 46.3160 | 46.5008 | 46.5008 | 45.9507 | 45.9507 | 45.4135      |
| alpha                                                                       | 3.9811  | 4.0158  | 4.0042  | 4.0394  | 4.0394  | 4.0877  | 4.0877  | 4.1001  | 4.1001  | 4.0634  | 4.0634  | 4.0276       |
| util living area                                                            | 0.8851  | 0.7981  | 0.6541  | 0.4771  | 0.3376  | 0.2077  | 0.1395  | 0.1529  | 0.2997  | 0.5500  | 0.7970  | 0.9053 (86)  |
| MIT                                                                         | 20.2294 | 20.5309 | 20.8020 | 20.9491 | 20.9892 | 20.9990 | 20.9999 | 20.9998 | 20.9952 | 20.9292 | 20.6176 | 20.1616 (87) |
| Th 2                                                                        | 20.3014 | 20.3089 | 20.3064 | 20.3139 | 20.3139 | 20.3240 | 20.3240 | 20.3265 | 20.3265 | 20.3189 | 20.3189 | 20.3114 (88) |
| util rest of house                                                          | 0.8720  | 0.7793  | 0.6293  | 0.4505  | 0.3104  | 0.1813  | 0.1118  | 0.1235  | 0.2676  | 0.5163  | 0.7747  | 0.8939 (89)  |
| MIT 2                                                                       | 19.4189 | 19.7855 | 20.0964 | 20.2640 | 20.3046 | 20.3233 | 20.3239 | 20.3264 | 20.3229 | 20.2516 | 19.9034 | 19.3448 (90) |
| Living area fraction                                                        | 19.8604 | 20.1915 | 20.4807 | 20.6371 | 20.6775 | 20.6913 | 20.6921 | 20.6932 | 20.6891 | 20.6207 | 20.2924 | 19.7897 (92) |
| MIT                                                                         | 19.7104 | 20.0415 | 20.3307 | 20.4871 | 20.5275 | 20.5413 | 20.5421 | 20.5432 | 20.5391 | 20.4707 | 20.1424 | -0.1500      |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 19.6397 (93) |

## 8. Space heating requirement

|              |           |           |           |           |          |          |          |          |          |          |           |                |
|--------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|-----------|----------------|
|              | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov       | Dec            |
| Utilisation  | 0.8595    | 0.7716    | 0.6302    | 0.4573    | 0.3189   | 0.1898   | 0.1207   | 0.1330   | 0.2778   | 0.5240   | 0.7686    | 0.8812 (94)    |
| Useful gains | 1158.7133 | 1286.9510 | 1284.0088 | 1104.8663 | 824.6858 | 505.1295 | 307.2016 | 316.4740 | 594.6738 | 915.8574 | 1074.4004 | 1091.8878 (95) |

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|                                                                                |           |           |           |           |          |          |          |          |          |               |           |                |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|---------------|-----------|----------------|
| Ext temp.                                                                      | 5.0000    | 5.5000    | 7.3000    | 9.8000    | 12.7000  | 15.7000  | 17.6000  | 17.5000  | 14.8000  | 11.4000       | 7.9000    | 5.0000 (96)    |
| Heat loss rate W                                                               | 1591.1875 | 1554.8187 | 1398.6884 | 1133.8260 | 830.4345 | 505.5903 | 307.2493 | 316.5442 | 596.9672 | 954.8008      | 1288.6652 | 1559.2388 (97) |
| Space heating kWh                                                              | 321.7608  | 180.0070  | 85.3217   | 20.8510   | 4.2770   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 28.9738       | 154.2707  | 347.7092 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |          |          |          |          |          |               |           | 1143.1712      |
| 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                                                              | 321.7608  | 180.0070  | 85.3217   | 20.8510   | 4.2770   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 28.9738       | 154.2707  | 347.7092 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |          |          |          |          |          |               |           | 1143.1712      |
| Space heating per m2                                                           |           |           |           |           |          |          |          |          |          | (98c) / (4) = |           | 7.8720 (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 %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 83.4000 (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                                                                            | 321.7608 | 180.0070 | 85.3217  | 20.8510  | 4.2770   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 28.9738  | 154.2707 | 347.7092 (98)   |
| Space heating efficiency (main heating system 1)                                                     | 83.4000  | 83.4000  | 83.4000  | 83.4000  | 83.4000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 83.4000  | 83.4000  | 83.4000 (210)   |
| Space heating fuel (main heating system)                                                             | 385.8043 | 215.8358 | 102.3041 | 25.0012  | 5.1283   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 34.7408  | 184.9768 | 416.9175 (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                                                                            | 255.9122 | 225.6203 | 238.0084 | 205.3343 | 196.3573 | 174.0192 | 169.6630 | 178.0552 | 181.8334 | 206.2445 | 223.5534 | 252.6098 (64)   |
| Efficiency of water heater                                                                           | 87.9093  | 87.7848  | 87.5876  | 87.4003  | 87.3232  | 87.3000  | 87.3000  | 87.3000  | 87.3000  | 87.4340  | 87.7458  | 87.9338 (216)   |
| Fuel for water heating, kWh/month                                                                    | 291.1094 | 257.0153 | 271.7376 | 234.9356 | 224.8628 | 199.3348 | 194.3448 | 203.9579 | 208.2856 | 235.8858 | 254.7739 | 287.2728 (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                                                                                         | 44.7927  | 40.4579  | 44.7927  | 43.3478  | 44.7927  | 43.3478  | 44.7927  | 44.7927  | 43.3478  | 44.7927  | 43.3478  | 44.7927 (231)   |
| Lighting                                                                                             | 42.2412  | 33.8875  | 30.5119  | 22.3543  | 17.2671  | 14.1074  | 15.7517  | 20.4746  | 26.5945  | 34.8934  | 39.4120  | 43.4152 (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                                                                   |          |          |          |          |          |          |          |          |          |          |          | 1370.7089 (211) |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 87.3000         |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          | 2863.5162 (219) |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (221)    |
| Electricity for pumps and fans:                                                                      |          |          |          |          |          |          |          |          |          |          |          |                 |
| (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.0500)                           |          |          |          |          |          |          |          |          |          |          |          |                 |
| mechanical ventilation fans (SFP = 1.0500)                                                           |          |          |          |          |          |          |          |          |          |          |          | 441.3980 (230a) |
| central heating pump                                                                                 |          |          |          |          |          |          |          |          |          |          |          | 41.0000 (230c)  |
| main heating flue fan                                                                                |          |          |          |          |          |          |          |          |          |          |          | 45.0000 (230e)  |
| Total electricity for the above, kWh/year                                                            |          |          |          |          |          |          |          |          |          |          |          | 527.3980 (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |          |          |          |          |          |          |          |          | 340.9110 (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                                                                  |          |          |          |          |          |          |          |          |          |          |          | 5102.5341 (238) |

## 10a. Fuel costs - using BEDF prices (540)

|                                             | Fuel kWh/year | Fuel price p/kWh | Fuel cost £/year |  |
|---------------------------------------------|---------------|------------------|------------------|--|
| Space heating - main system 1               | 1370.7089     | 6.1900           | 84.8469 (240)    |  |
| Total CO2 associated with community systems |               |                  | 0.0000 (473)     |  |
| Water heating (other fuel)                  | 2863.5162     | 6.1900           | 177.2517 (247)   |  |
| Energy for instantaneous electric shower(s) | 0.0000        | 25.1600          | 0.0000 (247a)    |  |
| Pumps, fans and electric keep-hot           | 527.3980      | 25.1600          | 132.6933 (249)   |  |
| Energy for lighting                         | 340.9110      | 25.1600          | 85.7732 (250)    |  |
| Additional standing charges                 |               |                  | 102.0000 (251)   |  |
| Total energy cost                           |               |                  | 582.5651 (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               | 1370.7089          | 0.2100                        | 287.8489 (261)           |
| Total CO2 associated with community systems |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                  | 2863.5162          | 0.2100                        | 601.3384 (264)           |
| Space and water heating                     |                    |                               | 889.1873 (265)           |
| Pumps, fans and electric keep-hot           | 527.3980           | 0.1387                        | 73.1566 (267)            |
| Energy for lighting                         | 340.9110           | 0.1443                        | 49.2040 (268)            |
| Total CO2, kg/year                          |                    |                               | 1011.5479 (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               | 1370.7089          | 1.1300                              | 1548.9011 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2863.5162          | 1.1300                              | 3235.7733 (278)            |
| Space and water heating                     |                    |                                     | 4784.6744 (279)            |
| Pumps, fans and electric keep-hot           | 527.3980           | 1.5128                              | 797.8477 (281)             |
| Energy for lighting                         | 340.9110           | 1.5338                              | 522.9006 (282)             |
| Total Primary energy kWh/year               |                    |                                     | 6105.4227 (286)            |

## SAP 10 EPC IMPROVEMENTS

As Built

Current energy efficiency rating: B 87  
Current environmental impact rating: A 92

|                                                         |            |             |                        |
|---------------------------------------------------------|------------|-------------|------------------------|
| N Solar water heating                                   |            |             | SAP increase too small |
| U Solar photovoltaic panels                             |            |             | Recommended            |
| V2 Wind turbine                                         |            |             | Not applicable         |
| Recommended measures:                                   | SAP change | Cost change | CO2 change             |
| U Solar photovoltaic panels                             | + 5.9      | -£ 287      | -242 kg (23.9%)        |
| Measures omitted - SAP change or cost saving too small: |            |             |                        |
| N Solar water heating                                   | + 0.4      | -£ 29       | -155 kg (15.3%)        |

|                                        | Typical annual savings | Energy efficiency | Environmental impact |
|----------------------------------------|------------------------|-------------------|----------------------|
| Recommended measures                   |                        |                   |                      |
| Solar photovoltaic panels              | £287 1.67 kg/m²        | A 93              | A 94                 |
| Total Savings                          | £287 1.67 kg/m²        |                   |                      |
| Potential energy efficiency rating:    |                        | A 93              |                      |
| Potential environmental impact rating: |                        |                   | A 94                 |

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)  
Recommendation texts revision number 6.1 (11 Jun 2019)

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

|                          | Current    | Potential  | Saving     |
|--------------------------|------------|------------|------------|
| Electricity              | £218       | £218       | £0         |
| Mains gas                | £364       | £364       | £0         |
| Space heating            | £320       | £320       | £0         |
| Water heating            | £177       | £177       | £0         |
| Lighting                 | £86        | £86        | £0         |
| Generated (PV)           | -£0        | -£287      | £287       |
| Total cost of fuels      | £582       | £295       | £287       |
| Total cost of uses       | £583       | £296       | £287       |
| Delivered energy         | 35 kWh/m²  | 22 kWh/m²  | 13 kWh/m²  |
| Carbon dioxide emissions | 1.0 tonnes | 0.8 tonnes | 0.2 tonnes |
| CO2 emissions per m²     | 7 kg/m²    | 5 kg/m²    | 2 kg/m²    |
| Primary energy           | 42 kWh/m²  | 30 kWh/m²  | 12 kWh/m²  |

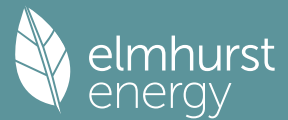
## SAP 10 WORKSHEET FOR New Build (As Built) (Version 10.2, February 2022) CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

### 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m)            | Volume<br>(m3)         |
|--------------------------------------------------------|--------------|---------------------------------|------------------------|
| Ground floor                                           | 79.1000 (1b) | x 2.3500 (2b)                   | = 185.8850 (1b) - (3b) |
| First floor                                            | 66.1200 (1c) | x 2.4000 (2c)                   | = 158.6880 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 145.2200     |                                 | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 344.5730 (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) |

|                                                      |                                                       |                |            |
|------------------------------------------------------|-------------------------------------------------------|----------------|------------|
| 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                                 |                                                       | 2.9200         | (17)       |
| Infiltration rate                                    |                                                       | 0.1460         | (18)       |
| Number of sides sheltered                            |                                                       | 0              | (19)       |
| Shelter factor                                       | (20) = 1 - [0.075 x (19)] =                           | 1.0000         | (20)       |
| Infiltration rate adjusted to include shelter factor | (21) = (18) x (20) =                                  | 0.1460         | (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                                                                                         | 0.1861 | 0.1825 | 0.1789 | 0.1606 | 0.1569 | 0.1387 | 0.1387 | 0.1351 | 0.1460 | 0.1569 | 0.1642 | 0.1716 | (22b)         |
| Balanced mechanical ventilation with heat recovery                                                      |        |        |        |        |        |        |        |        |        |        |        |        |               |
| 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)  |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =            |        |        |        |        |        |        |        |        |        |        |        |        | 80.1000 (23c) |
| Effective ac                                                                                            | 0.2856 | 0.2820 | 0.2783 | 0.2601 | 0.2564 | 0.2382 | 0.2382 | 0.2345 | 0.2455 | 0.2564 | 0.2637 | 0.2711 | (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 |       |
|------------------------------------------------|-------------|----------------|---------------|----------------------|--------------|-------------------|---------------|-------|
| Door                                           |             |                | 2.2000        | 0.8000               | 1.7600       |                   |               | (26)  |
| Windows (Uw = 1.17)                            |             |                | 24.7900       | 1.1177               | 27.7076      |                   |               | (27)  |
| East Roof Light                                |             |                | 2.0000        | 1.1177               | 2.2354       |                   |               | (27a) |
| West Roof Light                                |             |                | 1.2800        | 1.1177               | 1.4306       |                   |               | (27a) |
| Heatloss Floor 1                               |             |                | 79.9000       | 0.1000               | 7.9900       | 75.0000           | 5992.5000     | (28a) |
| External Wall 1                                | 148.7200    | 21.5500        | 127.1700      | 0.1500               | 19.0755      | 60.0000           | 7630.2000     | (29a) |
| Dormer Wall                                    | 15.3700     | 5.4400         | 9.9300        | 0.1500               | 1.4895       | 18.0000           | 178.7400      | (29a) |
| Pitched Roof                                   | 30.0800     | 3.2800         | 26.8000       | 0.1000               | 2.6800       | 9.0000            | 241.2000      | (30)  |
| Plan Roof                                      | 50.7600     |                | 50.7600       | 0.0900               | 4.5684       | 9.0000            | 456.8400      | (30)  |
| Total net area of external elements Aum(A, m2) |             |                | 324.8300      |                      |              |                   |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)            |             |                |               | (26)...(30) + (32) = | 68.9370      |                   |               | (33)  |
| Internal Wall 1                                |             |                | 84.0000       |                      |              | 9.0000            | 756.0000      | (32c) |
| Internal Floor 1                               |             |                | 79.9000       |                      |              | 18.0000           | 1438.2000     | (32d) |
| Internal Ceiling 1                             |             |                | 79.9000       |                      |              | 9.0000            | 719.1000      | (32e) |

|                                                   |                                      |            |      |
|---------------------------------------------------|--------------------------------------|------------|------|
| Heat capacity Cm = Sum(A x k)                     | (28)...(30) + (32) + (32a)...(32e) = | 17412.7800 | (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K |                                      | 119.9062   | (35) |

### List of Thermal Bridges

| K1 Element                                       | Length  | Psi-value | Total  |
|--------------------------------------------------|---------|-----------|--------|
| E2 Other lintels (including other steel lintels) | 19.8000 | 0.0500    | 0.9900 |
| E3 Sill                                          | 18.8000 | 0.0400    | 0.7520 |
| E4 Jamb                                          | 20.8000 | 0.0500    | 1.0400 |
| E5 Ground floor (normal)                         | 35.6000 | 0.0800    | 2.8480 |
| E6 Intermediate floor within a dwelling          | 38.1000 | 0.0100    | 0.3810 |
| R11 Upstands or kerbs of rooflights              | 14.4000 | 0.0800    | 1.1520 |
| E10 Eaves (insulation at ceiling level)          | 10.8000 | 0.0500    | 0.5400 |
| E11 Eaves (insulation at rafter level)           | 18.8000 | 0.0400    | 0.7520 |
| E13 Gable (insulation at rafter level)           | 8.0000  | 0.0400    | 0.3200 |
| E16 Corner (normal)                              | 19.0000 | 0.0900    | 1.7100 |

|                                                            |                       |         |        |
|------------------------------------------------------------|-----------------------|---------|--------|
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |                       | 10.4850 | (36)   |
| Point Thermal bridges                                      |                       | (36a) = | 0.0000 |
| Total fabric heat loss                                     | (33) + (36) + (36a) = | 79.4220 | (37)   |

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

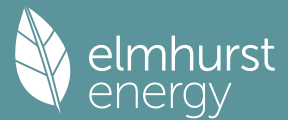
|                           |          |          |          |          |          |          |          |          |          |          |          |          |          |
|---------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| (38)m                     | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |          |
|                           | 32.4810  | 32.0660  | 31.6509  | 29.5757  | 29.1607  | 27.0855  | 27.0855  | 26.6705  | 27.9156  | 29.1607  | 29.9908  | 30.8208  | (38)     |
| Heat transfer coeff       | 111.9030 | 111.4880 | 111.0729 | 108.9977 | 108.5827 | 106.5075 | 106.5075 | 106.0925 | 107.3376 | 108.5827 | 109.4128 | 110.2429 | (39)     |
| Average = Sum(39)m / 12 = |          |          |          |          |          |          |          |          |          |          |          |          | 108.8940 |

|               |        |        |        |        |        |        |        |        |        |        |        |        |        |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| HLP           | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |        |
|               | 0.7706 | 0.7677 | 0.7649 | 0.7506 | 0.7477 | 0.7334 | 0.7334 | 0.7306 | 0.7391 | 0.7477 | 0.7534 | 0.7591 | (40)   |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        |        | 0.7499 |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |        |

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

|                                          |          |          |          |          |          |          |          |          |          |                    |          |          |               |
|------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------------|----------|----------|---------------|
| Assumed occupancy                        |          |          |          |          |          |          |          |          |          |                    |          |          | 2.9264 (42)   |
| Hot water usage for mixer showers        |          |          |          |          |          |          |          |          |          |                    |          |          |               |
|                                          | 73.2865  | 72.1852  | 70.5803  | 67.5096  | 65.2435  | 62.7164  | 61.2800  | 62.8728  | 64.6187  | 67.3320            | 70.4687  | 73.0057  | (42a)         |
| Hot water usage for baths                |          |          |          |          |          |          |          |          |          |                    |          |          |               |
|                                          | 31.6388  | 31.1689  | 30.5072  | 29.2872  | 28.3737  | 27.3607  | 26.8135  | 27.4706  | 28.1860  | 29.2699            | 30.5151  | 31.5319  | (42b)         |
| Hot water usage for other uses           |          |          |          |          |          |          |          |          |          |                    |          |          |               |
|                                          | 44.5996  | 42.9778  | 41.3560  | 39.7342  | 38.1124  | 36.4906  | 36.4906  | 38.1124  | 39.7342  | 41.3560            | 42.9778  | 44.5996  | (42c)         |
| Average daily hot water use (litres/day) |          |          |          |          |          |          |          |          |          |                    |          |          | 137.4470 (43) |
| Daily hot water use                      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct                | Nov      | Dec      |               |
|                                          | 149.5249 | 146.3319 | 142.4435 | 136.5310 | 131.7296 | 126.5677 | 124.5841 | 128.4557 | 132.5389 | 137.9580           | 143.9615 | 149.1372 | (44)          |
| Energy conte                             | 236.8109 | 208.3747 | 218.9304 | 186.9041 | 177.3333 | 155.6297 | 150.6737 | 159.0550 | 163.4337 | 187.2076           | 205.0996 | 233.5128 | (45)          |
| Energy content (annual)                  |          |          |          |          |          |          |          |          |          | Total = Sum(45)m = |          |          | 2282.9656     |
| Distribution loss (46)m = 0.15 x (45)m   |          |          |          |          |          |          |          |          |          |                    |          |          |               |
|                                          | 35.5216  | 31.2562  | 32.8396  | 28.0356  | 26.6000  | 23.3445  | 22.6011  | 23.8583  | 24.5151  | 28.0811            | 30.7649  | 35.0269  | (46)          |
| Water storage loss:                      |          |          |          |          |          |          |          |          |          |                    |          |          |               |

# Full SAP Calculation Printout



|                                                                 |                                                                                |          |          |          |          |          |          |          |          |          |          |                |
|-----------------------------------------------------------------|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| 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                                                      | 19.1013                                                                        | 17.2456  | 19.0780  | 18.4302  | 19.0240  | 18.3895  | 18.9893  | 19.0002  | 18.3997  | 19.0368  | 18.4538  | 19.0970 (51)   |
| Total heat required for water heating calculated for each month | 255.9122                                                                       | 225.6203 | 238.0084 | 205.3343 | 196.3573 | 174.0192 | 169.6630 | 178.0552 | 181.8334 | 206.2445 | 223.5534 | 252.6098 (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                                                 | 255.9122                                                                       | 225.6203 | 238.0084 | 205.3343 | 196.3573 | 174.0192 | 169.6630 | 178.0552 | 181.8334 | 206.2445 | 223.5534 | 252.6098 (64)  |
|                                                                 | Total per year (kWh/year) = Sum(64)m =                                         |          |          |          |          |          |          |          |          |          |          | 2507.2110 (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                        | 83.5150                                                                        | 73.5960  | 77.5639  | 66.7532  | 63.7193  | 56.3443  | 54.8463  | 57.6358  | 58.9416  | 67.0057  | 72.8091  | 82.4172 (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                                                                               | 175.5860  | 175.5860  | 175.5860  | 175.5860  | 175.5860  | 175.5860  | 175.5860  | 175.5860  | 175.5860  | 175.5860  | 175.5860  | 175.5860  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 48.2595   | 42.8636   | 34.8591   | 26.3905   | 19.7272   | 16.6546   | 17.9958   | 23.3917   | 31.3963   | 39.8648   | 46.5281   | 49.6008   | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 470.5567  | 475.4396  | 463.1348  | 436.9394  | 403.8725  | 372.7942  | 352.0320  | 347.1491  | 359.4538  | 385.6492  | 418.7162  | 449.7945  | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 55.4850   | 55.4850   | 55.4850   | 55.4850   | 55.4850   | 55.4850   | 55.4850   | 55.4850   | 55.4850   | 55.4850   | 55.4850   | 55.4850   | (69) |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | -117.0573 | (71) |
| Water heating gains (Table 5)                                                       | 112.2513  | 109.5178  | 104.2525  | 92.7127   | 85.6443   | 78.2559   | 73.7182   | 77.4675   | 81.8634   | 90.0615   | 101.1237  | 110.7759  | (72) |
| Total internal gains                                                                | 748.0812  | 744.8348  | 719.2601  | 673.0564  | 626.2577  | 581.7184  | 557.7597  | 562.0220  | 586.7272  | 632.5892  | 683.3817  | 727.1848  | (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    |
|-------------|-----------|-----------|-----------|------------|--------------------------------|-----------|------------------------------|-----------|-----------|------------------------------------|-----------|------------------------------|------|---------------|
|             |           |           |           |            |                                |           |                              |           |           |                                    |           |                              |      |               |
| East        |           |           |           | 4.2800     | 19.6403                        |           | 0.7600                       |           |           | 1.0000                             |           | 0.7700                       |      | 44.2729 (76)  |
| South       |           |           |           | 13.6500    | 46.7521                        |           | 0.7600                       |           |           | 1.0000                             |           | 0.7700                       |      | 336.1091 (78) |
| West        |           |           |           | 6.8600     | 19.6403                        |           | 0.7600                       |           |           | 1.0000                             |           | 0.7700                       |      | 70.9608 (80)  |
| East        |           |           |           | 2.0000     | 26.0000                        |           | 0.7600                       |           |           | 1.0000                             |           | 1.0000                       |      | 35.5680 (82)  |
| West        |           |           |           | 1.2800     | 26.0000                        |           | 0.7600                       |           |           | 1.0000                             |           | 1.0000                       |      | 22.7635 (82)  |
| Solar gains | 509.6743  | 897.0317  | 1287.8035 | 1670.4504  | 1920.1242                      | 1922.7026 | 1847.2167                    | 1661.8221 | 1422.2431 | 1009.2768                          | 616.1229  | 432.3057                     | (83) |               |
| Total gains | 1257.7554 | 1641.8664 | 2007.0636 | 2343.5068  | 2546.3818                      | 2504.4210 | 2404.9764                    | 2223.8440 | 2008.9702 | 1641.8659                          | 1299.5046 | 1159.4905                    | (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                                                                         | 43.2239 | 43.3848 | 43.5469 | 44.3760 | 44.5456 | 45.4135 | 45.4135 | 45.5912 | 45.0623 | 44.5456 | 44.2077 | 43.8748      |
| alpha                                                                       | 3.8816  | 3.8923  | 3.9031  | 3.9584  | 3.9697  | 4.0276  | 4.0276  | 4.0394  | 4.0042  | 3.9697  | 3.9472  | 3.9250       |
| util living area                                                            | 0.9178  | 0.8295  | 0.7007  | 0.5359  | 0.3904  | 0.2711  | 0.1946  | 0.2191  | 0.3644  | 0.6302  | 0.8553  | 0.9339 (86)  |
| MIT                                                                         | 19.9849 | 20.3840 | 20.7093 | 20.9100 | 20.9776 | 20.9962 | 20.9993 | 20.9988 | 20.9876 | 20.8646 | 20.4149 | 19.9026 (87) |
| Th 2                                                                        | 20.2789 | 20.2814 | 20.2839 | 20.2964 | 20.2989 | 20.3114 | 20.3114 | 20.3139 | 20.3064 | 20.2989 | 20.2939 | 20.2889 (88) |
| util rest of house                                                          | 0.9077  | 0.8125  | 0.6772  | 0.5090  | 0.3623  | 0.2423  | 0.1643  | 0.1865  | 0.3289  | 0.5971  | 0.8375  | 0.9255 (89)  |
| MIT 2                                                                       | 19.1004 | 19.5864 | 19.9701 | 20.2056 | 20.2785 | 20.3086 | 20.3110 | 20.3132 | 20.2965 | 20.1651 | 19.6423 | 19.0065 (90) |
| Living area fraction                                                        | 19.5822 | 20.0209 | 20.3727 | 20.5893 | 20.6593 | 20.6831 | 20.6859 | 20.6866 | 20.6729 | 20.5461 | 20.0631 | 0.5447 (91)  |
| MIT                                                                         | 19.5822 | 20.0209 | 20.3727 | 20.5893 | 20.6593 | 20.6831 | 20.6859 | 20.6866 | 20.6729 | 20.5461 | 20.0631 | 19.4946 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | -0.1500      |
| adjusted MIT                                                                | 19.4322 | 19.8709 | 20.2227 | 20.4393 | 20.5093 | 20.5331 | 20.5359 | 20.5366 | 20.5229 | 20.3961 | 19.9131 | 19.3446 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |           |          |          |          |          |          |           |           |           |       |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|-----------|-----------|-----------|-------|
| Utilisation                                                                    | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct       | Nov       | Dec       |       |
| Useful gains                                                                   | 1124.5563 | 1316.9127 | 1355.0835 | 1205.7649 | 944.1899 | 630.0758 | 418.8958 | 438.3652 | 683.1364 | 988.0881  | 1074.6197 | 1057.9433 | (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                                                               | 1693.3359 | 1669.0703 | 1524.2261 | 1257.7573 | 956.5346 | 631.9214 | 419.2003 | 438.8665 | 689.4185 | 1063.6888 | 1401.9166 | 1669.5855 | (97)  |
| Space heating kWh                                                              | 423.1720  | 236.6499  | 125.8421  | 37.4346   | 9.1845   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 56.2469   | 235.6538  | 455.0618  | (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |          |          |          |          |          |           |           | 1579.2456 |       |
| 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                                                              | 423.1720  | 236.6499  | 125.8421  | 37.4346   | 9.1845   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 56.2469   | 235.6538  | 455.0618  | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |          |          |          |          |          |           |           | 1579.2456 |       |
| Space heating per m <sup>2</sup>                                               |           |           |           |           |          |          |          |          |          |           |           | 10.8748   | (99)  |

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## 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 %)                                                     |          |          |          |          |           |           |           |           |          |          |          | 83.4000 (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                                                                            | 423.1720 | 236.6499 | 125.8421 | 37.4346  | 9.1845    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 56.2469  | 235.6538 | 455.0618 (98)    |
| Space heating efficiency (main heating system 1)                                                     | 83.4000  | 83.4000  | 83.4000  | 83.4000  | 83.4000   | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 83.4000  | 83.4000  | 83.4000 (210)    |
| Space heating fuel (main heating system)                                                             | 507.4005 | 283.7529 | 150.8898 | 44.8856  | 11.0126   | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 67.4423  | 282.5585 | 545.6376 (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                                                                            | 255.9122 | 225.6203 | 238.0084 | 205.3343 | 196.3573  | 174.0192  | 169.6630  | 178.0552  | 181.8334 | 206.2445 | 223.5534 | 252.6098 (64)    |
| Efficiency of water heater                                                                           | 87.9822  | 87.8597  | 87.6773  | 87.4678  | 87.3486   | 87.3000   | 87.3000   | 87.3000   | 87.3000  | 87.5334  | 87.8611  | 87.3000 (216)    |
| Fuel for water heating, kWh/month                                                                    | 290.8681 | 256.7961 | 271.4594 | 234.7541 | 224.7974  | 199.3348  | 194.3448  | 203.9579  | 208.2856 | 235.6180 | 254.4398 | 287.0429 (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                                                                                         | 44.7927  | 40.4579  | 44.7927  | 43.3478  | 44.7927   | 43.3478   | 44.7927   | 44.7927   | 43.3478  | 44.7927  | 43.3478  | 44.7927 (231)    |
| Lighting                                                                                             | 42.2412  | 33.8875  | 30.5119  | 22.3543  | 17.2671   | 14.1074   | 15.7517   | 20.4746   | 26.5945  | 34.8934  | 39.4120  | 43.4152 (232)    |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -35.9246 | -53.0097 | -79.8584 | -94.2540 | -105.5406 | -100.0886 | -98.9821  | -91.5619  | -78.9579 | -62.6801 | -40.3645 | -30.7912 (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)                                        | -14.1619 | -30.5702 | -62.4878 | -96.5180 | -130.1421 | -131.6252 | -129.6694 | -108.2121 | -77.5052 | -44.1658 | -19.0453 | -11.1226 (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                                                                   |          |          |          |          |           |           |           |           |          |          |          | 1893.5798 (211)  |
| Space heating fuel - main system 2                                                                   |          |          |          |          |           |           |           |           |          |          |          | 0.0000 (213)     |
| Space heating fuel - secondary                                                                       |          |          |          |          |           |           |           |           |          |          |          | 0.0000 (215)     |
| Efficiency of water heater                                                                           |          |          |          |          |           |           |           |           |          |          |          | 87.3000          |
| Water heating fuel used                                                                              |          |          |          |          |           |           |           |           |          |          |          | 2861.6989 (219)  |
| Space cooling fuel                                                                                   |          |          |          |          |           |           |           |           |          |          |          | 0.0000 (221)     |
| Electricity for pumps and fans:                                                                      |          |          |          |          |           |           |           |           |          |          |          |                  |
| (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.0500)                           |          |          |          |          |           |           |           |           |          |          |          |                  |
| mechanical ventilation fans (SFP = 1.0500)                                                           |          |          |          |          |           |           |           |           |          |          |          | 441.3980 (230a)  |
| central heating pump                                                                                 |          |          |          |          |           |           |           |           |          |          |          | 41.0000 (230c)   |
| main heating flue fan                                                                                |          |          |          |          |           |           |           |           |          |          |          | 45.0000 (230e)   |
| Total electricity for the above, kWh/year                                                            |          |          |          |          |           |           |           |           |          |          |          | 527.3980 (231)   |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |          |           |           |           |           |          |          |          | 340.9110 (232)   |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |          |           |           |           |           |          |          |          |                  |
| PV generation                                                                                        |          |          |          |          |           |           |           |           |          |          |          | -1727.2394 (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                                                                  |          |          |          |          |           |           |           |           |          |          |          | 3896.3483 (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               | 1893.5798        | 3.6400              | 68.9263 (240)       |
| Total CO2 associated with community systems |                  |                     | 0.0000 (473)        |
| Water heating (other fuel)                  | 2861.6989        | 3.6400              | 104.1658 (247)      |
| Energy for instantaneous electric shower(s) | 0.0000           | 16.4900             | 0.0000 (247a)       |
| Pumps, fans and electric keep-hot           | 527.3980         | 16.4900             | 86.9679 (249)       |
| Energy for lighting                         | 340.9110         | 16.4900             | 56.2162 (250)       |
| Additional standing charges                 |                  |                     | 92.0000 (251)       |
| Energy saving/generation technologies       |                  |                     |                     |
| PV Unit electricity used in dwelling        | -872.0139        | 16.4900             | -143.7951           |
| PV Unit electricity exported                | -855.2255        | 5.5900              | -47.8071            |
| Total                                       |                  |                     | -191.6022 (252)     |
| Total energy cost                           |                  |                     | 216.6741 (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] = | 0.4101 (257) |
| SAP value                        |                                  | 93.3528      |
| SAP rating (Section 12)          |                                  | 93 (258)     |
| SAP band                         |                                  | A            |

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

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|                                             | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|---------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1               | 1893.5798          | 0.2100                        | 397.6518 (261)           |
| Total CO2 associated with community systems |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                  | 2861.6989          | 0.2100                        | 600.9568 (264)           |
| Space and water heating                     |                    |                               | 998.6085 (265)           |
| Pumps, fans and electric keep-hot           | 527.3980           | 0.1387                        | 73.1566 (267)            |
| Energy for lighting                         | 340.9110           | 0.1443                        | 49.2040 (268)            |
| Energy saving/generation technologies       |                    |                               |                          |
| PV Unit electricity used in dwelling        | -872.0139          | 0.1336                        | -116.4893                |
| PV Unit electricity exported                | -855.2255          | 0.1252                        | -107.0509                |
| Total                                       |                    |                               | -223.5401 (269)          |
| Total CO2, kg/year                          |                    |                               | 897.4290 (272)           |
| CO2 emissions per m2                        |                    |                               | 6.1800 (273)             |
| EI value                                    |                    |                               | 93.6781                  |
| EI rating                                   |                    |                               | 94 (274)                 |
| EI band                                     |                    |                               | A                        |

SAP 10 WORKSHEET FOR New Build (As Built) (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)         |
|--------------------------------------------------------|--------------|---------------------------------|------------------------|
| Ground floor                                           | 79.1000 (1b) | x 2.3500 (2b)                   | = 185.8850 (1b) - (3b) |
| First floor                                            | 66.1200 (1c) | x 2.4000 (2c)                   | = 158.6880 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 145.2200     |                                 | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 344.5730 (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                                                                               | 2.9200 (17)                             |
| Infiltration rate                                                                                  | 0.1460 (18)                             |
| Number of sides sheltered                                                                          | 0 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 1.0000 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.1460 (21)        |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec           |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------------|
| Wind speed                                                                                              | 4.2000 | 3.9000 | 4.0000 | 3.7000 | 3.7000 | 3.3000 | 3.3000 | 3.2000 | 3.2000 | 3.5000 | 3.5000 | 3.8000 (22)   |
| Wind factor                                                                                             | 1.0500 | 0.9750 | 1.0000 | 0.9250 | 0.9250 | 0.8250 | 0.8250 | 0.8000 | 0.8000 | 0.8750 | 0.8750 | 0.9500 (22a)  |
| Adj infilt rate                                                                                         | 0.1533 | 0.1423 | 0.1460 | 0.1351 | 0.1351 | 0.1204 | 0.1204 | 0.1168 | 0.1168 | 0.1278 | 0.1278 | 0.1387 (22b)  |
| Balanced mechanical ventilation with heat recovery                                                      |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a)  |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b)  |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =            |        |        |        |        |        |        |        |        |        |        |        | 80.1000 (23c) |
| Effective ac                                                                                            | 0.2528 | 0.2418 | 0.2455 | 0.2345 | 0.2345 | 0.2199 | 0.2199 | 0.2163 | 0.2163 | 0.2272 | 0.2272 | 0.2382 (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   |
|---------------------------------------------------|-------------|----------------|----------------------|------------------|--------------|--------------------------------------|-----------------|
| Door                                              |             |                | 2.2000               | 0.8000           | 1.7600       |                                      | (26)            |
| Windows (Uw = 1.17)                               |             |                | 24.7900              | 1.1177           | 27.7076      |                                      | (27)            |
| East Roof Light                                   |             |                | 2.0000               | 1.1177           | 2.2354       |                                      | (27a)           |
| West Roof Light                                   |             |                | 1.2800               | 1.1177           | 1.4306       |                                      | (27a)           |
| Heatloss Floor 1                                  |             |                | 79.9000              | 0.1000           | 7.9900       | 75.0000                              | 5992.5000 (28a) |
| External Wall 1                                   | 148.7200    | 21.5500        | 127.1700             | 0.1500           | 19.0755      | 60.0000                              | 7630.2000 (29a) |
| Dormer Wall                                       | 15.3700     | 5.4400         | 9.9300               | 0.1500           | 1.4895       | 18.0000                              | 178.7400 (29a)  |
| Pitched Roof                                      | 30.0800     | 3.2800         | 26.8000              | 0.1000           | 2.6800       | 9.0000                               | 241.2000 (30)   |
| Plan Roof                                         | 50.7600     |                | 50.7600              | 0.0900           | 4.5684       | 9.0000                               | 456.8400 (30)   |
| Total net area of external elements Aum(A, m2)    |             |                | 324.8300             |                  |              |                                      | (31)            |
| Fabric heat loss, W/K = Sum (A x U)               |             |                | (26)...(30) + (32) = |                  | 68.9370      |                                      | (33)            |
| Internal Wall 1                                   |             |                | 84.0000              |                  |              | 9.0000                               | 756.0000 (32c)  |
| Internal Floor 1                                  |             |                | 79.9000              |                  |              | 18.0000                              | 1438.2000 (32d) |
| Internal Ceiling 1                                |             |                | 79.9000              |                  |              | 9.0000                               | 719.1000 (32e)  |
| Heat capacity Cm = Sum(A x k)                     |             |                |                      |                  |              | (28)...(30) + (32) + (32a)...(32e) = | 17412.7800 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K |             |                |                      |                  |              |                                      | 119.9062 (35)   |
| List of Thermal Bridges                           |             |                |                      |                  |              |                                      |                 |

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SAP 10 Online 2.13.6 Page 25 of 26

# Full SAP Calculation Printout



|                                                               |                  |
|---------------------------------------------------------------|------------------|
| Total electricity for the above, kWh/year                     | 527.3980 (231)   |
| Electricity for lighting (calculated in Appendix L)           | 340.9110 (232)   |
| Energy saving/generation technologies (Appendices M ,N and Q) |                  |
| PV generation                                                 | -1870.9238 (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                           | 3231.6103 (238)  |

## 10a. Fuel costs - using BEDF prices (540)

|                                             | Fuel<br>kWh/year | Fuel price<br>p/kWh | Fuel cost<br>£/year |
|---------------------------------------------|------------------|---------------------|---------------------|
| Space heating - main system 1               | 1370.7089        | 6.1900              | 84.8469 (240)       |
| Total CO2 associated with community systems |                  |                     | 0.0000 (473)        |
| Water heating (other fuel)                  | 2863.5162        | 6.1900              | 177.2517 (247)      |
| Energy for instantaneous electric shower(s) | 0.0000           | 25.1600             | 0.0000 (247a)       |
| Pumps, fans and electric keep-hot           | 527.3980         | 25.1600             | 132.6933 (249)      |
| Energy for lighting                         | 340.9110         | 25.1600             | 85.7732 (250)       |
| Additional standing charges                 |                  |                     | 102.0000 (251)      |
| Energy saving/generation technologies       |                  |                     |                     |
| PV Unit electricity used in dwelling        | -922.3710        | 25.1600             | -232.0686           |
| PV Unit electricity exported                | -948.5527        | 5.8100              | -55.1109            |
| Total                                       |                  |                     | -287.1795 (252)     |
| Total energy cost                           |                  |                     | 295.3856 (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               | 1370.7089          | 0.2100                        | 287.8489 (261)           |
| Total CO2 associated with community systems |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                  | 2863.5162          | 0.2100                        | 601.3384 (264)           |
| Space and water heating                     |                    |                               | 889.1873 (265)           |
| Pumps, fans and electric keep-hot           | 527.3980           | 0.1387                        | 73.1566 (267)            |
| Energy for lighting                         | 340.9110           | 0.1443                        | 49.2040 (268)            |
| Energy saving/generation technologies       |                    |                               |                          |
| PV Unit electricity used in dwelling        | -922.3710          | 0.1338                        | -123.4019                |
| PV Unit electricity exported                | -948.5527          | 0.1251                        | -118.6248                |
| Total                                       |                    |                               | -242.0268 (269)          |
| Total CO2, kg/year                          |                    |                               | 769.5211 (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               | 1370.7089          | 1.1300                              | 1548.9011 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2863.5162          | 1.1300                              | 3235.7733 (278)            |
| Space and water heating                     |                    |                                     | 4784.6744 (279)            |
| Pumps, fans and electric keep-hot           | 527.3980           | 1.5128                              | 797.8477 (281)             |
| Energy for lighting                         | 340.9110           | 1.5338                              | 522.9006 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -922.3710          | 1.4944                              | -1378.3896                 |
| PV Unit electricity exported                | -948.5527          | 0.4589                              | -435.3206                  |
| Total                                       |                    |                                     | -1813.7102 (283)           |
| Total Primary energy kWh/year               |                    |                                     | 4291.7126 (286)            |

# Summary for Input Data



|                      |                                     |                |            |
|----------------------|-------------------------------------|----------------|------------|
| Property Reference   | Plot 1 Whitely                      | Issued on Date | 29/04/2024 |
| Assessment Reference | As Built                            | Prop Type Ref  |            |
| Property             | 20, Byworth Close, Reading, RG2 8SH |                |            |

|                                    |          |               |       |      |       |
|------------------------------------|----------|---------------|-------|------|-------|
| SAP Rating                         | 87 B     | DER           | 7.95  | TER  | 9.04  |
| Environmental                      | 92 A     | % DER < TER   |       |      | 12.06 |
| CO <sub>2</sub> Emissions (t/year) | 1.01     | DFEE          | 28.63 | TFEE | 38.88 |
| Compliance Check                   | See BREL | % DFEE < TFEE |       |      | 26.36 |
| % DPER < TPER                      | 0.01     | DPER          | 47.34 | TPER | 47.34 |

|                  |                     |             |           |
|------------------|---------------------|-------------|-----------|
| Assessor Details | Mr. Andrew Sadler   | Assessor ID | P628-0001 |
| Client           | shgltd, Alex Omirou |             |           |

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

|                            |                     |
|----------------------------|---------------------|
| Orientation                | North               |
| Property Tenture           | 1                   |
| Transaction Type           | 6                   |
| Terrain Type               | Suburban            |
| 1.0 Property Type          | House, Detached     |
| 2.0 Number of Storeys      | 2                   |
| 3.0 Date Built             | 2023                |
| 4.0 Sheltered Sides        | 0                   |
| 5.0 Sunlight/Shade         | Average or unknown  |
| 6.0 Thermal Mass Parameter | Precise calculation |

|                                |          |
|--------------------------------|----------|
| 7.0 Electricity Tariff         | Standard |
| Smart electricity meter fitted | Yes      |
| Smart gas meter fitted         | Yes      |

| 7.0 Measurements | Heat Loss Perimeter | Internal Floor Area  | Average Storey Height |
|------------------|---------------------|----------------------|-----------------------|
| Ground floor:    | 35.60 m             | 79.10 m <sup>2</sup> | 2.35 m                |
| 1st Storey:      | 38.10 m             | 66.12 m <sup>2</sup> | 2.40 m                |

|                 |                      |
|-----------------|----------------------|
| 8.0 Living Area | 79.10 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 1 | Cavity Wall  | Cavity wall : plasterboard on dabs, AAC block, filled cavity, any outside structure | 0.15                         | 60.00                       | 148.72                      | 127.17                      | 0.00        | None    | 21.55    | Enter Gross Area      |
|                    | Dormer Wall     | Timber Frame | Timber framed wall (two layers of plasterboard)                                     | 0.15                         | 18.00                       | 15.37                       | 9.93                        | 0.00        | None    | 5.44     | Enter Gross Area      |

| 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                        | 84.00                  |

| 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 | CalculationOpenings Type |
|---------------------|--------------|---------------------|------------------------------------------|------------------------------|-----------------------------|-----------------------------|-----------------------------|--------------|----------------|--------------------------|
|                     | Pitched Roof | External Slope Roof | Plasterboard, insulated slope            | 0.10                         | 9.00                        | 30.08                       | 26.80                       | None         | 0.00           | Enter Gross Area         |
|                     | Plan Roof    | External Plane Roof | Plasterboard, insulated at ceiling level | 0.09                         | 9.00                        | 50.76                       | 50.76                       | None         | 0.00           | Enter Gross Area         |

| 10.2 Internal Ceilings | Description        | Storey          | Construction                                   | Area (m <sup>2</sup> ) |
|------------------------|--------------------|-----------------|------------------------------------------------|------------------------|
|                        | Internal Ceiling 1 | Lowest occupied | Plasterboard ceiling, carpeted chipboard floor | 79.90                  |

| 11.0 Heat Loss Floors | Description      | Type                 | Storey Index    | Construction                       | U-Value (W/m <sup>2</sup> K) | Shelter Code | Shelter Factor | Kappa (kJ/m <sup>2</sup> K) | Area (m <sup>2</sup> ) |
|-----------------------|------------------|----------------------|-----------------|------------------------------------|------------------------------|--------------|----------------|-----------------------------|------------------------|
|                       | Heatloss Floor 1 | Ground Floor - Solid | Lowest occupied | Suspended concrete floor, carpeted | 0.10                         | None         | 0.00           | 75.00                       | 79.90                  |

| 11.2 Internal Floors | Description | Storey Index | Construction | Kappa (kJ/m <sup>2</sup> K) | Area (m <sup>2</sup> ) |
|----------------------|-------------|--------------|--------------|-----------------------------|------------------------|
|----------------------|-------------|--------------|--------------|-----------------------------|------------------------|

# Summary for Input Data

Internal Floor 1      Plasterboard ceiling, carpeted chipboard floor      9.00      79.90

## 12.0 Opening Types

| Description | Data Source  | Type       | Glazing       | Glazing Gap | Filling Type | G-value | Frame Type | Frame Factor | U Value (W/m²K) |
|-------------|--------------|------------|---------------|-------------|--------------|---------|------------|--------------|-----------------|
| Door        | Manufacturer | Solid Door |               |             |              |         |            |              | 0.80            |
| Windows     | Manufacturer | Window     | Double glazed |             |              | 0.76    |            | 1.00         | 1.17            |
| Roof Light  | Manufacturer | Roof Light | Double glazed |             |              | 0.76    |            | 1.00         | 1.17            |

## 13.0 Openings

| Name            | Opening Type | Location        | Orientation | Area (m²) | Pitch |
|-----------------|--------------|-----------------|-------------|-----------|-------|
| Front Door      | Door         | External Wall 1 | North       | 2.20      |       |
| South Windows   | Windows      | External Wall 1 | South       | 13.65     |       |
| East Windows    | Windows      | External Wall 1 | East        | 3.00      |       |
| East Dormer     | Windows      | Dormer Wall     | East        | 1.28      |       |
| East Roof Light | Roof Light   | Pitched Roof    | East        | 2.00      | 0     |
| West Window     | Windows      | External Wall 1 | West        | 2.70      |       |
| West Dormer     | Windows      | Dormer Wall     | West        | 4.16      |       |
| West Roof Light | Roof Light   | Pitched Roof    | West        | 1.28      | 0     |

## 14.0 Conservatory

None

## 15.0 Draught Proofing

100 %

## 16.0 Draught Lobby

No

## 17.0 Thermal Bridging

Calculate Bridges

### 17.1 List of Bridges

| Bridge Type                                      | Source Type         | Length | Psi  | Adjusted Reference: | Imported |
|--------------------------------------------------|---------------------|--------|------|---------------------|----------|
| E2 Other lintels (including other steel lintels) | Gov Approved Scheme | 19.80  | 0.05 | 0.05                | Yes      |
| E3 Sill                                          | Gov Approved Scheme | 18.80  | 0.04 | 0.04                | Yes      |
| E4 Jamb                                          | Gov Approved Scheme | 20.80  | 0.05 | 0.05                | Yes      |
| E5 Ground floor (normal)                         | Gov Approved Scheme | 35.60  | 0.08 | 0.08                | Yes      |
| E6 Intermediate floor within a dwelling          | Gov Approved Scheme | 38.10  | 0.01 | 0.01                | Yes      |
| R11 Upstands or kerbs of rooflights              | Gov Approved Scheme | 14.40  | 0.08 | 0.08                | Yes      |
| E10 Eaves (insulation at ceiling level)          | Gov Approved Scheme | 10.80  | 0.05 | 0.05                | No       |
| E11 Eaves (insulation at rafter level)           | Gov Approved Scheme | 18.80  | 0.04 | 0.04                | No       |
| E13 Gable (insulation at rafter level)           | Gov Approved Scheme | 8.00   | 0.04 | 0.04                | No       |
| E16 Corner (normal)                              | Gov Approved Scheme | 19.00  | 0.09 | 0.09                | No       |

Y-value      0.03      W/m²K

## 18.0 Pressure Testing

Yes

Designed AP<sub>50</sub>      2.92      m³/(h.m²) @ 50 Pa

Property Tested?      Yes

Test Method      Blower Door

As Built AP<sub>50</sub>      2.92      m³/(h.m²) @ 50 Pa

## 19.0 Mechanical Ventilation

### Mechanical Ventilation

Mechanical Ventilation System Present      Yes

Approved Installation      Yes

Mechanical Ventilation data Type      Database

Type      Balanced mechanical ventilation with heat recovery

MV Reference Number      500686

Configuration      3

Manufacturer SFP      0.84

Duct Type      Rigid

MVHR Efficiency      89.00

Wet Rooms      3

SFP from Installer Commissioning Certificate      No

MVHR System Location      Inside heated envelope (installed exclusively)

Duct Installation Specification      Level 1

### 19.1 Mechanical extract ventilation - Decentralised

| SFP  | Fan/Room Type       | Count |
|------|---------------------|-------|
| 0.13 | In Room Fan         | 0     |
|      | Kitchen             |       |
| 0.11 | In Room Fan Other   | 0     |
|      | Wet Room            |       |
| 0.00 | In Duct Fan Kitchen | 0     |

# Summary for Input Data



|      |                   |   |
|------|-------------------|---|
| 0.00 | In Duct Fan Other | 1 |
| 0.10 | Wet Room          |   |
|      | Through Wall Fan  | 1 |
|      | Kitchen           |   |
| 0.10 | Through Wall Fan  | 0 |
|      | Other Wet Room    |   |

## 20.0 Fans, Open Fireplaces, Flues

### 21.0 Fixed Cooling System

No

### 22.0 Lighting

No Fixed Lighting

No

| Name       | Efficacy | Power | Capacity | Count |
|------------|----------|-------|----------|-------|
| Lighting 1 | 75.00    | 8     | 600      | 11    |

### 24.0 Main Heating 1

|                     |                      |
|---------------------|----------------------|
| Database            |                      |
| Percentage of Heat  | 100.00 %             |
| Database Ref. No.   | 17178                |
| Fuel Type           | Mains gas            |
| In Winter           | 83.40                |
| In Summer           | 87.30                |
| Model Name          | LOGIC CODE COMBI     |
| Manufacturer        | Ideal Boilers        |
| System Type         | Combi boiler         |
| Controls SAP Code   | 2112                 |
| Delayed Start Stat  | Yes                  |
| Flue Type           | Balanced             |
| Fan Assisted Flue   | Yes                  |
| Is MHS Pumped       | Pump in heated space |
| Heating Pump Age    | 2013 or later        |
| Heat Emitter        | Radiators            |
| Flow Temperature    | Unknown              |
| Combi boiler type   | Standard Combi       |
| Combi keep hot type | None                 |

### 25.0 Main Heating 2

None

### 26.0 Heat Networks

None

| Heat Source   | Fuel Type | Heating Use | Efficiency | Percentage Of Heat | Heat | Heat Power Ratio | Electrical | Fuel Factor | Efficiency type |
|---------------|-----------|-------------|------------|--------------------|------|------------------|------------|-------------|-----------------|
| Heat source 1 |           |             |            |                    |      |                  |            |             |                 |
| Heat source 2 |           |             |            |                    |      |                  |            |             |                 |
| Heat source 3 |           |             |            |                    |      |                  |            |             |                 |
| Heat source 4 |           |             |            |                    |      |                  |            |             |                 |
| Heat source 5 |           |             |            |                    |      |                  |            |             |                 |

### 28.0 Water Heating

|                                                  |                |
|--------------------------------------------------|----------------|
| Water Heating                                    | Main Heating 1 |
| SAP Code                                         | 901            |
| Flue Gas Heat Recovery System                    | Yes            |
| 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              |

### 28.1 Showers

# Summary for Input Data



| Description                                       | Shower Type                       | Flow Rate<br>[l/min] | Rated Power<br>[kW]      | Connected | Connected To |                           |     |     |            |     |     |
|---------------------------------------------------|-----------------------------------|----------------------|--------------------------|-----------|--------------|---------------------------|-----|-----|------------|-----|-----|
| <b>28.2 Flue Gas Heat Recovery System</b>         |                                   |                      |                          |           |              |                           |     |     |            |     |     |
| Database ID                                       | <input type="text" value="0"/>    |                      |                          |           |              |                           |     |     |            |     |     |
| Brand Model                                       | <input type="text"/>              |                      |                          |           |              |                           |     |     |            |     |     |
| Details                                           | <input type="text"/>              |                      |                          |           |              |                           |     |     |            |     |     |
| <b>28.3 Waste Water Heat Recovery System</b>      |                                   |                      |                          |           |              |                           |     |     |            |     |     |
| <b>29.0 Hot Water Cylinder</b>                    |                                   |                      |                          |           |              |                           |     |     |            |     |     |
|                                                   | <input type="text" value="None"/> |                      |                          |           |              |                           |     |     |            |     |     |
| In Airing Cupboard                                | <input type="text" value="No"/>   |                      |                          |           |              |                           |     |     |            |     |     |
| <b>34.0 Small-scale Hydro</b>                     |                                   |                      |                          |           |              |                           |     |     |            |     |     |
|                                                   | <input type="text" value="None"/> |                      |                          |           |              |                           |     |     |            |     |     |
| Jan                                               | Feb                               | Mar                  | Apr                      | May       | Jun          | Jul                       | Aug | Sep | Oct        | Nov | Dec |
| <b>Recommendations</b>                            |                                   |                      |                          |           |              |                           |     |     |            |     |     |
| Lower cost measures                               |                                   |                      |                          |           |              |                           |     |     |            |     |     |
| None                                              |                                   |                      |                          |           |              |                           |     |     |            |     |     |
| Further measures to achieve even higher standards |                                   |                      |                          |           |              |                           |     |     |            |     |     |
| Typical Cost                                      |                                   |                      | Typical savings per year |           |              | Ratings after improvement |     |     | SAP rating |     |     |
|                                                   |                                   |                      |                          |           |              | B 88                      |     |     | A 93       |     |     |
|                                                   |                                   |                      |                          |           |              | A 93                      |     |     | A 94       |     |     |
|                                                   |                                   |                      |                          |           |              | 0                         |     |     | 0          |     |     |

# Thermal Bridging

|                      |                                     |                |                |
|----------------------|-------------------------------------|----------------|----------------|
| Property Reference   | Plot 1 Whitely                      | Issued on Date | 29/04/2024     |
| Assessment Reference | As Built                            | Prop Type Ref  | Detached House |
| Property             | 20, Byworth Close, Reading, RG2 8SH |                |                |

|                                    |          |               |       |      |       |
|------------------------------------|----------|---------------|-------|------|-------|
| SAP Rating                         | 87 B     | DER           | 7.95  | TER  | 9.04  |
| Environmental                      | 92 A     | % DER < TER   |       |      | 12.06 |
| CO <sub>2</sub> Emissions (t/year) | 1.01     | DFEE          | 28.63 | TFEE | 38.88 |
| Compliance Check                   | See BREL | % DFEE < TFEE |       |      | 26.36 |
| % DPER < TPER                      | 0.01     | DPER          | 47.34 | TPER | 47.34 |

|                  |                     |             |           |
|------------------|---------------------|-------------|-----------|
| Assessor Details | Mr. Andrew Sadler   | Assessor ID | P628-0001 |
| Client           | shgltd, Alex Omirou |             |           |

|               | Junction details                                 | Source Type         | Psi (W/mK) | Length (m) | Result | Reference |
|---------------|--------------------------------------------------|---------------------|------------|------------|--------|-----------|
| External wall | E2 Other lintels (including other steel lintels) | Gov Approved Scheme | 0.050      | 19.80      | 0.99   |           |
| External wall | E3 Sill                                          | Gov Approved Scheme | 0.040      | 18.80      | 0.75   |           |
| External wall | E4 Jamb                                          | Gov Approved Scheme | 0.050      | 20.80      | 1.04   |           |
| External wall | E5 Ground floor (normal)                         | Gov Approved Scheme | 0.080      | 35.60      | 2.85   |           |
| External wall | E6 Intermediate floor within a dwelling          | Gov Approved Scheme | 0.010      | 38.10      | 0.38   |           |
| External roof | R11 Upstands or kerbs of rooflights              | Gov Approved Scheme | 0.080      | 14.40      | 1.15   |           |
| External wall | E10 Eaves (insulation at ceiling level)          | Gov Approved Scheme | 0.050      | 10.80      | 0.54   |           |
| External wall | E11 Eaves (insulation at rafter level)           | Gov Approved Scheme | 0.040      | 18.80      | 0.75   |           |
| External wall | E13 Gable (insulation at rafter level)           | Gov Approved Scheme | 0.040      | 8.00       | 0.32   |           |
| External wall | E16 Corner (normal)                              | Gov Approved Scheme | 0.090      | 19.00      | 1.71   |           |

Total: 204.10 W/mK:  
Y-Value: 0.03 W/m²K:

# Overview Report

|                              |                                     |
|------------------------------|-------------------------------------|
| Dwelling Address             | 20, Byworth Close, Reading, RG2 8SH |
| Report Date                  | 29/04/2024                          |
| Property Type                | House, Detached                     |
| Floor Area [m <sup>2</sup> ] | 145                                 |

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

## Energy Rating

The current energy rating represents the overall energy efficiency of the dwelling. The potential energy rating is the overall energy rating of the dwelling after all of the recommend measures provided on the next page have been installed. A higher score represents a more energy efficient dwelling with lower fuel bills.

Most energy efficient - lower running costs

CURRENT

POTENTIAL

(92 plus)

A

(81-91)

B

(69-80)

C

(55-68)

D

(39-54)

E

(21-38)

F

(1-20)

G

87

93

Least energy efficient - higher running costs

## 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 0.09 W/m <sup>2</sup> K                      | Very Good          |
| Floor                 | Average thermal transmittance 0.1 W/m <sup>2</sup> K                       | Very Good          |
| Windows               | High performance glazing                                                   | Very Good          |
| Main heating          | Boiler and radiators, mains gas                                            | Very Good          |
| Main heating controls | Time and temperature zone control                                          | Very Good          |
| Secondary heating     | None                                                                       |                    |
| Hot water             | From main system                                                           | Very Good          |
| Lighting              | Good lighting efficiency                                                   | Good               |
| Air tightness         | Air permeability [AP50] = 2.9 m <sup>3</sup> /h.m <sup>2</sup> (as tested) | Very Good          |

## Primary Energy use

The primary energy use for this property per year is 42 kilowatt hour (kWh) per square metre

## Estimated CO<sub>2</sub> emissions of the dwelling

The estimated CO rating provides an indication of the dwelling's impact on the environment in terms of carbon dioxide emissions; the higher the rating the less impact it has on the environment.

The estimated CO emissions for this dwellings is: **1.0** per year

# Overview Report

With the recommended measures the potential CO emissions could be: **0.8** per year

## 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 measure | Typical<br>Yearly<br>Saving | Potential Rating<br>after<br>measure installed                                      | Cumulative<br>savings<br>(per year) | Cumulative<br>Potential<br>Rating                                                        |
|---------------------|-----------------------------|-------------------------------------------------------------------------------------|-------------------------------------|------------------------------------------------------------------------------------------|
| Solar water heating |                             |  1 | £29                                 |  B 88 |
| Photovoltaic        | £287                        |  5 | £316                                |  A 93 |

## Estimated energy use and potential savings

Estimated energy cost for  
this property over a year

**£583**

Over a year you could  
save

**£287**

The estimated cost and savings show how much the average household would spend in this property for heating, lighting and hot water. It is not based on how energy is used by the people living at the property.

## Contacting the assessor and the accreditation scheme

# Overview Report

## Assessor contact details

|                                 |                   |
|---------------------------------|-------------------|
| Assessor name                   | Mr. Andrew Sadler |
| Assessor's accreditation number |                   |
| Email Address                   |                   |

## Accreditation scheme contact details

|                      |  |
|----------------------|--|
| Accreditation scheme |  |
| Telephone            |  |
| Email Address        |  |

## Assessment details

|                          |                   |
|--------------------------|-------------------|
| Related party disclosure |                   |
| Date of assessment       | 24/04/2024        |
| Date of certificate      | 24/04/2024        |
| Type of assessment       | SAP, new dwelling |