

# Summary for Input Data

|                      |                 |                |            |
|----------------------|-----------------|----------------|------------|
| Plot Reference       | B 1505          | Issued on Date | 15/05/2026 |
| Assessment Reference | Be Green 260515 | Plot Type Ref  |            |
| Plot Address         |                 | SAP Version    | 10.2       |

|                                    |          |               |       |      |       |
|------------------------------------|----------|---------------|-------|------|-------|
| SAP Rating                         | 81 B     | DER           | 5.67  | TER  | 15.04 |
| Environmental                      | 96 A     | % DER < TER   |       |      | 62.30 |
| CO <sub>2</sub> Emissions (t/year) | 0.36     | DFEE          | 39.24 | TFEE | 37.76 |
| Compliance Check                   | See BREL | % DFEE < TFEE |       |      | -3.91 |
| % DPER < TPER                      | 27.34    | DPER          | 59.60 | TPER | 82.03 |

|                  |                   |             |           |
|------------------|-------------------|-------------|-----------|
| Assessor Details | Mr. Robert Tanner | Assessor ID | W344-0001 |
| Client           |                   |             |           |

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

|                                |                     |        |
|--------------------------------|---------------------|--------|
| Orientation                    | Southwest           |        |
| Property Tenture               | 1                   |        |
| Transaction Type               | 6                   |        |
| Terrain Type                   | Suburban            |        |
| 1.0 Property Type              | Flat, Semi-Detached |        |
| Position of Flat               | Top-floor flat      |        |
| Which Floor                    | 15                  |        |
| 2.0 Number of Storeys          | 1                   |        |
| 3.0 Date Built                 | 2026                |        |
| 4.0 Sheltered Sides            | 2                   |        |
| 5.0 Sunlight/Shade             | Average or unknown  |        |
| 6.0 Thermal Mass Parameter     | Precise calculation |        |
| Thermal Mass                   | 134.73              | kJ/m²K |
|                                |                     |        |
| 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: | 29.34 m             | 70.49 m <sup>2</sup> | 2.50 m                |

|                 |       |                |
|-----------------|-------|----------------|
| 8.0 Living Area | 32.21 | m <sup>2</sup> |
|-----------------|-------|----------------|

| Description     | Type        | Construction                                                                 | U-Value (W/m <sup>2</sup> K) | Kappa (kJ/m <sup>2</sup> K) | Gross Area(m <sup>2</sup> ) | Nett Area (m <sup>2</sup> ) | Shelter Res | Shelter                     | Openings | Area Calculation Type |
|-----------------|-------------|------------------------------------------------------------------------------|------------------------------|-----------------------------|-----------------------------|-----------------------------|-------------|-----------------------------|----------|-----------------------|
| External Wall 1 | Cavity Wall | Cavity wall : dense plaster, AAC block, filled cavity, any outside structure | 0.15                         | 70.00                       | 43.63                       | 22.43                       | 0.00        | None                        | 21.20    | Enter Gross Area      |
| Corridor wall   | Cavity Wall | Cavity wall : dense plaster, AAC block, filled cavity, any outside structure | 0.22                         | 70.00                       | 29.73                       | 27.31                       | 0.70        | Stairwell Access Corridor 3 | 2.42     | Enter Gross Area      |

| Description  | Type                            | Construction                                                                   | U-Value (W/m <sup>2</sup> K) | Kappa (kJ/m <sup>2</sup> K) | Area (m <sup>2</sup> ) | Shelter Res | Shelter |
|--------------|---------------------------------|--------------------------------------------------------------------------------|------------------------------|-----------------------------|------------------------|-------------|---------|
| Party Wall 1 | Filled Cavity with Edge Sealing | Single plasterboard on dabs on both sides, dense blocks, cavity or cavity fill | 0.00                         | 70.00                       | 16.40                  | 0.00        | None    |

| Description     | Construction                 | Kappa (kJ/m <sup>2</sup> K) | Area (m <sup>2</sup> ) |
|-----------------|------------------------------|-----------------------------|------------------------|
| Internal Wall 1 | Plasterboard on timber frame | 9.00                        | 157.13                 |

| Description     | Type               | Construction                      | U-Value (W/m <sup>2</sup> K) | Kappa (kJ/m <sup>2</sup> K) | Gross Area(m <sup>2</sup> ) | Nett Area (m <sup>2</sup> ) | Shelter Code | Shelter Factor | Calculation Type | Openings |
|-----------------|--------------------|-----------------------------------|------------------------------|-----------------------------|-----------------------------|-----------------------------|--------------|----------------|------------------|----------|
| External Roof 1 | External Flat Roof | Plasterboard, insulated flat roof | 0.10                         | 9.00                        | 70.49                       | 70.49                       | None         | 0.00           | Enter Gross Area | 0.00     |

## 11.1 Party Floors

# Summary for Input Data



| Description   | Storey Index    | Construction                                    | Kappa (kJ/m²K) | Area (m²) |
|---------------|-----------------|-------------------------------------------------|----------------|-----------|
| Party Floor 1 | Lowest occupied | Precast concrete planks floor, screed, carpeted | 40.00          | 70.49     |

## 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 | Door to Corridor |                       |             |              | 0.00    |            |              | 1.00            |
| Window      | Manufacturer | Window           | Double Low-E Soft 0.1 |             |              | 0.35    |            | 0.70         | 1.20            |

## 13.0 Openings

| Name       | Opening Type | Location        | Orientation | Area (m²) | Pitch |
|------------|--------------|-----------------|-------------|-----------|-------|
| Door       | Door         | Corridor wall   | South West  | 2.42      |       |
| SE Windows | Window       | External Wall 1 | South East  | 8.15      |       |
| NE windows | Window       | External Wall 1 | North East  | 13.06     |       |

## 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 |
|---------------------------------------------------------------------------|------------------------|--------|------|---------------------|----------|
| E1 Steel lintel with perforated steel base plate                          | Independently assessed | 9.85   | 0.05 | 0.05                | No       |
| E4 Jamb                                                                   | Independently assessed | 33.60  | 0.04 | 0.04                | No       |
| E7 Party floor between dwellings (in blocks of flats)                     | Independently assessed | 14.05  | 0.05 | 0.05                | No       |
| E7 Party floor between dwellings (in blocks of flats)                     | Independently assessed | 11.89  | 0.04 | 0.04                | No       |
| E9 Balcony between dwellings, wall insulation continuous                  | Independently assessed | 3.40   | 0.05 | 0.05                | No       |
| E16 Corner (normal)                                                       | Independently assessed | 5.00   | 0.05 | 0.05                | No       |
| E16 Corner (normal)                                                       | Independently assessed | 5.00   | 0.04 | 0.04                | No       |
| E17 Corner (inverted – internal area greater than external area)          | Table K1 - Default     | 5.00   | 0.00 | 0.00                | No       |
| E18 Party wall between dwellings                                          | Independently assessed | 2.50   | 0.05 | 0.05                | No       |
| E18 Party wall between dwellings                                          | Independently assessed | 2.50   | 0.04 | 0.04                | No       |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | Table K1 - Default     | 6.56   | 0.00 | 0.00                | No       |
| E14 Flat roof                                                             | Independently assessed | 29.34  | 0.05 | 0.05                | No       |
| P4 Party wall - Roof (insulation at ceiling level)                        | Independently assessed | 6.56   | 0.05 | 0.05                | No       |

Y-value

0.04 W/m²K

## 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                          | 500625                                             |
| Configuration                                | 2                                                  |
| Manufacturer SFP                             | 0.61                                               |
| Duct Type                                    | Rigid                                              |
| MVHR Efficiency                              | 89.00                                              |
| Wet Rooms                                    | 2                                                  |
| SFP from Installer Commissioning Certificate | No                                                 |
| MVHR System Location                         | Inside heated envelope (installed exclusively)     |
| Duct Installation Specification              | Level 1                                            |

## 20.0 Fans, Open Fireplaces, Flues

|                                                  |   |
|--------------------------------------------------|---|
| Number of open chimneys                          | 0 |
| Number of open flues                             | 0 |
| Number of chimneys/flues attached to closed fire | 0 |
| Number of flues attached to solid fuel boiler    | 0 |
| Number of flues attached to other heater         | 0 |
| Number of blocked chimneys                       | 0 |
| Number of intermittent extract fans              | 0 |

# Summary for Input Data

Number of passive vents

Number of flueless gas fires

**21.0 Fixed Cooling System**

**22.0 Pressure Testing**

Designed AP<sub>50</sub>  m<sup>2</sup>/(h.m<sup>2</sup>) @ 50 Pa

Test Method

**22.0 Lighting**

No Fixed Lighting

| Name       | Efficacy | Power | Capacity | Count |
|------------|----------|-------|----------|-------|
| Lighting 1 | 75.00    | 15.00 | 1125.00  | 7     |

**24.0 Main Heating 1**

**25.0 Main Heating 2**

**26.0 Heat Networks**

**Space Community Heating**

Distribution Loss

Distribution Loss Value

SAP Code

|               | Heat Source | Fuel Type   | Heating Use     | Efficiency | Percentage Of Heat | Heat | Heat Power Ratio | Electrical | Fuel Factor | Efficiency type |
|---------------|-------------|-------------|-----------------|------------|--------------------|------|------------------|------------|-------------|-----------------|
| Heat source 1 | Heat pump   | Electricity | Space and Water | 232.00     | 100.00             |      |                  |            |             |                 |
| Heat source 2 | None        |             |                 |            |                    |      |                  |            |             |                 |
| Heat source 3 | None        |             |                 |            |                    |      |                  |            |             |                 |
| Heat source 4 | None        |             |                 |            |                    |      |                  |            |             |                 |
| Heat source 5 | None        |             |                 |            |                    |      |                  |            |             |                 |

**27.0 Secondary Heating**

**28.0 Water Heating**

Water Heating

SAP Code

Flue Gas Heat Recovery System

Waste Water Heat Recovery Instantaneous System 1

Waste Water Heat Recovery Instantaneous System 2

Waste Water Heat Recovery Storage System

Solar Panel

Water use <= 125 litres/person/day

Cold Water Source

Bath Count

**28.1 Showers**

| Description | Shower Type                               | Flow Rate [l/min] | Rated Power [kW] | Connected | Connected To |
|-------------|-------------------------------------------|-------------------|------------------|-----------|--------------|
| Shower 1    | Combi boiler or unvented hot water system | 8.00              |                  | No        |              |
| Shower 2    | Combi boiler or unvented hot water system | 8.00              |                  | No        |              |

**28.3 Waste Water Heat Recovery System**

**29.0 Hot Water Cylinder**

Insulation Type

Cylinder Volume  L

Loss  kWh/day

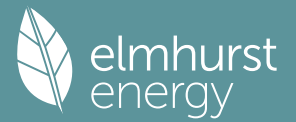
**32.0 Photovoltaic Unit**

Export Capable Meter?

Connected To Dwelling

Diverter

# Summary for Input Data



Battery Capacity [kWh]

0.00

**PV Cells kWp**

**Orientation**

**Elevation**

**Overshading**

**FGHRS**

**MCS Certificate**

**Overshading  
Factor**

**MCS  
Certificate  
Reference**

**Panel  
Manufacturer**

0.34

North West

Horizontal

Modest

No

0.80

**34.0 Small-scale Hydro**

None

**Jan**

**Feb**

**Mar**

**Apr**

**May**

**Jun**

**Jul**

**Aug**

**Sep**

**Oct**

**Nov**

**Dec**

**Recommendations**

**Lower cost measures**

None

**Further measures to achieve even higher standards**

None

# Full SAP Calculation Printout



|                                    |                   |                |            |
|------------------------------------|-------------------|----------------|------------|
| Plot Reference                     | B 1505            | Issued on Date | 15/05/2026 |
| Assessment Reference               | Be Green 260515   | Plot Type Ref  |            |
| Plot Address                       |                   | SAP Version    | 10.2       |
| SAP Rating                         | 81 B              | DER            | 5.67       |
| Environmental                      | 96 A              | TER            | 15.04      |
| CO <sub>2</sub> Emissions (t/year) | 0.36              | % DER < TER    | 62.30      |
| Compliance Check                   | See BREL          | DFEE           | 39.24      |
| % DPER < TPER                      | 27.34             | TFEE           | 37.76      |
|                                    |                   | % DFEE < TFEE  | -3.91      |
|                                    |                   | TPER           | 82.03      |
| Assessor Details                   | Mr. Robert Tanner | Assessor ID    | W344-0001  |
| Client                             |                   |                |            |

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

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                 |                             |
| Ground floor                                           | 70.4900 (1b)              | 2.5000 (2b)                     | 176.2250 (1b) - (3b)        |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 70.4900                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | 176.2250 (5)                |

## 2. Ventilation rate

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

|                                                                                                    |                |            |
|----------------------------------------------------------------------------------------------------|----------------|------------|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 / (5) = | 0.0000 (8) |
| Pressure test                                                                                      | Yes            |            |
| Pressure Test Method                                                                               | Blower Door    |            |
| Measured/design AP50                                                                               | 3.0000         | (17)       |
| Infiltration rate                                                                                  | 0.1500         | (18)       |
| Number of sides sheltered                                                                          | 2              | (19)       |

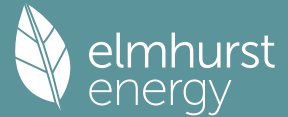
|                                                      |                             |             |
|------------------------------------------------------|-----------------------------|-------------|
| Shelter factor                                       | (20) = 1 - [0.075 x (19)] = | 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor | (21) = (18) x (20) =        | 0.1275 (21) |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec           |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------------|
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)   |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a)  |
| Adj infilt rate                                                                                         | 0.1626 | 0.1594 | 0.1562 | 0.1403 | 0.1371 | 0.1211 | 0.1211 | 0.1179 | 0.1275 | 0.1371 | 0.1434 | 0.1498 (22b)  |
| 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                                                                                            | 0.2621 | 0.2589 | 0.2557 | 0.2397 | 0.2366 | 0.2206 | 0.2206 | 0.2174 | 0.2270 | 0.2366 | 0.2429 | 0.2493 (25)   |

## 3. Heat losses and heat loss parameter

| Element                                                        | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K                         | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K   |
|----------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------------------------------|--------------------------------|-----------------|
| Main dwelling                                                  |                         |                            |                           |                               |                                      |                                |                 |
| Door                                                           |                         |                            | 2.4200                    | 1.0000                        | 2.4200                               |                                | (26)            |
| Window                                                         |                         |                            | 21.2100                   | 1.1450                        | 24.2863                              |                                | (27)            |
| External Wall 1                                                | 43.6300                 | 21.2100                    | 22.4200                   | 0.1500                        | 3.3630                               | 70.0000                        | 1569.4001 (29a) |
| Corridor wall                                                  | 29.7300                 | 2.4200                     | 27.3100                   | 0.1900                        | 5.1889                               | 70.0000                        | 1911.7000 (29a) |
| External Roof 1                                                | 70.4900                 |                            | 70.4900                   | 0.1000                        | 7.0490                               | 9.0000                         | 634.4100 (30)   |
| Total net area of external elements Aum(A, m <sup>2</sup> )    |                         |                            | 143.8500                  |                               |                                      |                                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                            |                         |                            |                           | (26)...(30) + (32) =          | 42.3072                              |                                | (33)            |
| Main dwelling                                                  |                         |                            |                           |                               |                                      |                                |                 |
| Party Wall 1                                                   |                         |                            | 16.4000                   | 0.0000                        | 0.0000                               | 70.0000                        | 1148.0000 (32)  |
| Party Floor 1                                                  |                         |                            | 70.4900                   |                               |                                      | 40.0000                        | 2819.6000 (32d) |
| Internal Wall 1                                                |                         |                            | 157.1300                  |                               |                                      | 9.0000                         | 1414.1700 (32c) |
| Heat capacity Cm = Sum(A x k)                                  |                         |                            |                           |                               | (28)...(30) + (32) + (32a)...(32e) = |                                | 9497.2801 (34)  |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K |                         |                            |                           |                               |                                      |                                | 134.7323 (35)   |
| List of Thermal Bridges                                        |                         |                            |                           |                               |                                      |                                |                 |

# Full SAP Calculation Printout



|                                                                           |         |                       |                |
|---------------------------------------------------------------------------|---------|-----------------------|----------------|
| K1 Element                                                                | Length  | Psi-value             | Total          |
| E1 Steel lintel with perforated steel base plate                          | 9.8500  | 0.0500                | 0.4925         |
| E4 Jamb                                                                   | 33.6000 | 0.0400                | 1.3440         |
| E7 Party floor between dwellings (in blocks of flats)                     | 14.0500 | 0.0500                | 0.7025         |
| E7 Party floor between dwellings (in blocks of flats)                     | 11.8900 | 0.0390                | 0.4637         |
| E9 Balcony between dwellings, wall insulation continuous                  | 3.4000  | 0.0500                | 0.1700         |
| E16 Corner (normal)                                                       | 5.0000  | 0.0500                | 0.2500         |
| E16 Corner (normal)                                                       | 5.0000  | 0.0390                | 0.1950         |
| E17 Corner (inverted - internal area greater than external area)          | 5.0000  | 0.0000                | 0.0000         |
| E18 Party wall between dwellings                                          | 2.5000  | 0.0500                | 0.1250         |
| E18 Party wall between dwellings                                          | 2.5000  | 0.0390                | 0.0975         |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | 6.5600  | 0.0000                | 0.0000         |
| E14 Flat roof                                                             | 29.3400 | 0.0500                | 1.4670         |
| P4 Party wall - Roof (insulation at ceiling level)                        | 6.5600  | 0.0500                | 0.3280         |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                |         |                       | 5.6352 (36)    |
| Point Thermal bridges                                                     |         |                       | 0.0000 (36a) = |
| Total fabric heat loss                                                    |         | (33) + (36) + (36a) = | 47.9424 (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          |
|                                                                     | 15.2400 | 15.0547 | 14.8693 | 13.9425 | 13.7571 | 12.8303 | 12.8303 | 12.6449 | 13.2010 | 13.7571 | 14.1278 | 14.4986 (38) |
| Heat transfer coeff                                                 | 63.1824 | 62.9971 | 62.8117 | 61.8849 | 61.6995 | 60.7727 | 60.7727 | 60.5873 | 61.1434 | 61.6995 | 62.0702 | 62.4410 (39) |
| Average = Sum(39)m / 12 =                                           |         |         |         |         |         |         |         |         |         |         |         | 61.8385      |
| HLP                                                                 | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
|                                                                     | 0.8963  | 0.8937  | 0.8911  | 0.8779  | 0.8753  | 0.8621  | 0.8621  | 0.8595  | 0.8674  | 0.8753  | 0.8806  | 0.8858 (40)  |
| HLP (average)                                                       |         |         |         |         |         |         |         |         |         |         |         | 0.8773       |
| Days in mont                                                        | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31           |

|                                                                                |          |          |          |          |          |          |          |          |          |                                        |          |                |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------------------------------|----------|----------------|
| 4. Water heating energy requirements (kWh/year)                                |          |          |          |          |          |          |          |          |          |                                        |          |                |
| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |                                        |          | 2.2580 (42)    |
| Hot water usage for mixer showers                                              |          |          |          |          |          |          |          |          |          |                                        |          |                |
|                                                                                | 60.5098  | 59.5834  | 58.2182  | 56.1179  | 54.2362  | 51.6036  | 49.5214  | 51.9556  | 53.1799  | 55.7874                                | 58.5028  | 60.4553 (42a)  |
| Hot water usage for baths                                                      |          |          |          |          |          |          |          |          |          |                                        |          |                |
|                                                                                | 26.2210  | 25.8252  | 25.2621  | 24.4188  | 23.6589  | 22.6127  | 21.8189  | 22.7895  | 23.2989  | 24.3355                                | 25.4133  | 26.2002 (42b)  |
| Hot water usage for other uses                                                 |          |          |          |          |          |          |          |          |          |                                        |          |                |
|                                                                                | 37.7538  | 36.3809  | 35.0081  | 33.6352  | 32.2623  | 30.8895  | 30.8895  | 32.2623  | 33.6352  | 35.0081                                | 36.3809  | 37.7538 (42c)  |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |                                        |          | 114.4201 (43)  |
| Daily hot water use                                                            | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct                                    | Nov      | Dec            |
|                                                                                | 124.4847 | 121.7896 | 118.4884 | 114.1720 | 110.1574 | 105.1057 | 102.2298 | 107.0075 | 110.1140 | 115.1310                               | 120.2970 | 124.4093 (44)  |
| Energy conte                                                                   | 183.2630 | 161.1523 | 169.3174 | 149.1371 | 141.9489 | 121.5513 | 112.9670 | 125.9498 | 127.7268 | 148.3579                               | 162.5854 | 182.7042 (45)  |
| Energy content (annual)                                                        |          |          |          |          |          |          |          |          |          | Total = Sum(45)m =                     |          | 1786.6610      |
| Distribution loss (46)m = 0.15 x (45)m                                         |          |          |          |          |          |          |          |          |          |                                        |          |                |
|                                                                                | 27.4894  | 24.1728  | 25.3976  | 22.3706  | 21.2923  | 18.2327  | 16.9450  | 18.8925  | 19.1590  | 22.2537                                | 24.3878  | 27.4056 (46)   |
| Water storage loss (or HIU loss):                                              |          |          |          |          |          |          |          |          |          |                                        |          |                |
| Store volume                                                                   |          |          |          |          |          |          |          |          |          |                                        |          | 110.0000 (47)  |
| b) If manufacturer declared loss factor is not known :                         |          |          |          |          |          |          |          |          |          |                                        |          |                |
| Hot water storage loss factor from Table 2 (kWh/litre/day)                     |          |          |          |          |          |          |          |          |          |                                        |          | 0.0152 (51)    |
| Volume factor from Table 2a                                                    |          |          |          |          |          |          |          |          |          |                                        |          | 1.0294 (52)    |
| Temperature factor from Table 2b                                               |          |          |          |          |          |          |          |          |          |                                        |          | 0.6000 (53)    |
| Enter (49) or (54) in (55)                                                     |          |          |          |          |          |          |          |          |          |                                        |          | 1.0327 (55)    |
| Total storage loss                                                             |          |          |          |          |          |          |          |          |          |                                        |          |                |
|                                                                                | 32.0144  | 28.9162  | 32.0144  | 30.9817  | 32.0144  | 30.9817  | 32.0144  | 32.0144  | 30.9817  | 32.0144                                | 30.9817  | 32.0144 (56)   |
| If cylinder contains dedicated solar storage                                   |          |          |          |          |          |          |          |          |          |                                        |          |                |
|                                                                                | 32.0144  | 28.9162  | 32.0144  | 30.9817  | 32.0144  | 30.9817  | 32.0144  | 32.0144  | 30.9817  | 32.0144                                | 30.9817  | 32.0144 (57)   |
| Primary loss                                                                   | 23.2624  | 21.0112  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624  | 23.2624  | 22.5120  | 23.2624                                | 22.5120  | 23.2624 (59)   |
| Combi loss                                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000 (61)    |
| Total heat required for water heating calculated for each month                |          |          |          |          |          |          |          |          |          |                                        |          |                |
|                                                                                | 238.5398 | 211.0797 | 224.5942 | 202.6308 | 197.2257 | 175.0450 | 168.2438 | 181.2266 | 181.2204 | 203.6347                               | 216.0791 | 237.9810 (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                                                                |          |          |          |          |          |          |          |          |          |                                        |          |                |
|                                                                                | 238.5398 | 211.0797 | 224.5942 | 202.6308 | 197.2257 | 175.0450 | 168.2438 | 181.2266 | 181.2204 | 203.6347                               | 216.0791 | 237.9810 (64)  |
| 12Total per year (kWh/year)                                                    |          |          |          |          |          |          |          |          |          | Total per year (kWh/year) = Sum(64)m = |          | 2437.5007 (64) |
| Electric shower(s)                                                             |          |          |          |          |          |          |          |          |          |                                        |          | 2438 (64)      |
|                                                                                | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000 (64a)   |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |                                        |          | 0.0000 (64a)   |
| Heat gains from water heating, kWh/month                                       |          |          |          |          |          |          |          |          |          |                                        |          |                |
|                                                                                | 105.1564 | 93.5251  | 100.5195 | 92.3830  | 91.4195  | 83.2107  | 81.7830  | 86.0997  | 85.2641  | 93.5504                                | 96.8546  | 104.9706 (65)  |

|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| 5. Internal gains (see Table 5 and 5a)                                              |          |          |          |          |          |          |          |          |          |          |          |               |
| Metabolic gains (Table 5), Watts                                                    |          |          |          |          |          |          |          |          |          |          |          |               |
| (66)m                                                                               | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
|                                                                                     | 112.8981 | 112.8981 | 112.8981 | 112.8981 | 112.8981 | 112.8981 | 112.8981 | 112.8981 | 112.8981 | 112.8981 | 112.8981 | 112.8981 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                     | 100.0892 | 110.8130 | 100.0892 | 103.4255 | 100.0892 | 103.4255 | 100.0892 | 100.0892 | 103.4255 | 100.0892 | 103.4255 | 100.0892 (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                     | 198.4380 | 200.4971 | 195.3081 | 184.2613 | 170.3166 | 157.2106 | 148.4550 | 146.3959 | 151.5849 | 162.6317 | 176.5764 | 189.6824 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                     | 34.2898  | 34.2898  | 34.2898  | 34.2898  | 34.2898  | 34.2898  | 34.2898  | 34.2898  | 34.2898  | 34.2898  | 34.2898  | 34.2898 (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)                                 |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                     | -90.3185 | -90.3185 | -90.3185 | -90.3185 | -90.3185 | -90.3185 | -90.3185 | -90.3185 | -90.3185 | -90.3185 | -90.3185 | -90.3185 (71) |
| Water heating gains (Table 5)                                                       |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                     | 141.3392 | 139.1742 | 135.1068 | 128.3098 | 122.8756 | 115.5705 | 109.9233 | 115.7254 | 118.4223 | 125.7398 | 134.5203 | 141.0895 (72) |
| Total internal gains                                                                |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                     | 496.7358 | 507.3538 | 487.3736 | 472.8660 | 450.1509 | 433.0760 | 415.3370 | 419.0799 | 430.3022 | 445.3302 | 471.3916 | 487.7305 (73) |

|                |      |            |               |               |          |       |  |  |  |  |  |  |
|----------------|------|------------|---------------|---------------|----------|-------|--|--|--|--|--|--|
| 6. Solar gains |      |            |               |               |          |       |  |  |  |  |  |  |
| [Jan]          | Area | Solar flux | g             | FF            | Access   | Gains |  |  |  |  |  |  |
|                | m2   | Table 6a   | Specific data | Specific data | factor   | W     |  |  |  |  |  |  |
|                |      | W/m2       | or Table 6b   | or Table 6c   | Table 6d |       |  |  |  |  |  |  |

# Full SAP Calculation Printout



|                                                                                         |                           |          |          |          |          |          |          |          |          |          |          |          |                 |              |
|-----------------------------------------------------------------------------------------|---------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|--------------|
| Northeast                                                                               |                           | 13.0600  |          |          | 11.2829  |          | 0.3500   |          | 0.7000   |          | 0.7700   |          | 25.0187 (75)    |              |
| Southeast                                                                               |                           | 8.1500   |          |          | 36.7938  |          | 0.3500   |          | 0.7000   |          | 0.7700   |          | 50.9134 (77)    |              |
|                                                                                         |                           |          |          |          |          |          |          |          |          |          |          |          |                 |              |
| Solar gains                                                                             | 75.9321                   | 137.6506 | 210.4130 | 297.7103 | 367.2307 | 379.4296 | 359.6288 | 305.4925 | 240.2861 | 158.0848 | 92.4625  | 64.0028  | (83)            |              |
| Total gains                                                                             | 572.6679                  | 645.0044 | 697.7866 | 770.5762 | 817.3816 | 812.5056 | 774.9658 | 724.5724 | 670.5883 | 603.4150 | 563.8541 | 551.7332 | (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                                                                                     | 41.7542                   | 41.8771  | 42.0007  | 42.6297  | 42.7578  | 43.4099  | 43.4099  | 43.5427  | 43.1467  | 42.7578  | 42.5024  | 42.2501  |                 |              |
| alpha                                                                                   | 3.7836                    | 3.7918   | 3.8000   | 3.8420   | 3.8505   | 3.8940   | 3.8940   | 3.9028   | 3.8764   | 3.8505   | 3.8335   | 3.8167   |                 |              |
| util living area                                                                        | 0.9521                    | 0.9261   | 0.8822   | 0.7820   | 0.6367   | 0.4641   | 0.3414   | 0.3789   | 0.5859   | 0.8175   | 0.9222   | 0.9573   | (86)            |              |
| MIT                                                                                     | 19.6842                   | 19.9233  | 20.2371  | 20.6204  | 20.8614  | 20.9691  | 20.9927  | 20.9891  | 20.9245  | 20.6146  | 20.1111  | 19.6515  | (87)            |              |
| Th 2                                                                                    | 20.1706                   | 20.1729  | 20.1751  | 20.1863  | 20.1886  | 20.1998  | 20.1998  | 20.2020  | 20.1953  | 20.1886  | 20.1841  | 20.1796  | (88)            |              |
| util rest of house                                                                      | 0.9447                    | 0.9152   | 0.8650   | 0.7528   | 0.5939   | 0.4105   | 0.2808   | 0.3154   | 0.5289   | 0.7859   | 0.9089   | 0.9506   | (89)            |              |
| MIT 2                                                                                   | 18.6416                   | 18.9405  | 19.3282  | 19.7921  | 20.0608  | 20.1771  | 20.1960  | 20.1960  | 20.1351  | 19.7973  | 19.1870  | 18.6071  | (90)            |              |
| Living area fraction                                                                    | fLA = Living area / (4) = |          |          |          |          |          |          |          |          |          |          |          | 0.4569 (91)     |              |
| MIT                                                                                     | 19.1180                   | 19.3896  | 19.7435  | 20.1706  | 20.4266  | 20.5390  | 20.5600  | 20.5584  | 20.4958  | 20.1708  | 19.6092  | 19.0843  | (92)            |              |
| Temperature adjustment                                                                  |                           |          |          |          |          |          |          |          |          |          |          |          | 0.0000          |              |
| adjusted MIT                                                                            | 19.1180                   | 19.3896  | 19.7435  | 20.1706  | 20.4266  | 20.5390  | 20.5600  | 20.5584  | 20.4958  | 20.1708  | 19.6092  | 19.0843  | (93)            |              |
|                                                                                         |                           |          |          |          |          |          |          |          |          |          |          |          |                 |              |
| 8. Space heating requirement                                                            |                           |          |          |          |          |          |          |          |          |          |          |          |                 |              |
|                                                                                         |                           |          |          |          |          |          |          |          |          |          |          |          |                 |              |
|                                                                                         | Jan                       | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |                 |              |
| Utilisation                                                                             | 0.9332                    | 0.9030   | 0.8550   | 0.7522   | 0.6068   | 0.4335   | 0.3083   | 0.3440   | 0.5508   | 0.7852   | 0.8979   | 0.9396   | (94)            |              |
| Useful gains                                                                            | 534.4006                  | 582.4412 | 596.5762 | 579.6287 | 496.0020 | 352.2545 | 238.9094 | 249.2709 | 369.3457 | 473.7834 | 506.3118 | 518.3895 | (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                                                                        | 936.2384                  | 912.8005 | 831.8463 | 697.4800 | 538.4281 | 360.9310 | 240.6620 | 251.9482 | 391.0631 | 590.5118 | 776.4507 | 929.3923 | (97)            |              |
| Space heating kWh                                                                       | 298.9673                  | 222.0015 | 175.0409 | 84.8530  | 31.5650  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 86.8459  | 194.5000 | 305.7861 | (98a)           |              |
| Space heating requirement - total per year (kWh/year)                                   |                           |          |          |          |          |          |          |          |          |          |          |          | 1399.5598       |              |
| 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                                                                       | 298.9673                  | 222.0015 | 175.0409 | 84.8530  | 31.5650  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 86.8459  | 194.5000 | 305.7861 | (98c)           |              |
| Space heating requirement after solar contribution - total per year (kWh/year)          |                           |          |          |          |          |          |          |          |          |          |          |          | 1399.5598       |              |
| Space heating per m2                                                                    | (98c) / (4) =             |          |          |          |          |          |          |          |          |          |          |          | 19.8547 (99)    |              |
|                                                                                         |                           |          |          |          |          |          |          |          |          |          |          |          |                 |              |
| 9b. Energy requirements                                                                 |                           |          |          |          |          |          |          |          |          |          |          |          |                 |              |
|                                                                                         |                           |          |          |          |          |          |          |          |          |          |          |          |                 |              |
| Fraction of space heat from secondary/supplementary system (Table 11)                   |                           |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (301)    |              |
| Fraction of space heat from community system                                            |                           |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (302)    |              |
| Fraction of heat from community Heat pump-Space and Water                               |                           |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (303a)   |              |
| Factor for control and charging method (Table 4c(3)) for space heating                  |                           |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (305)    |              |
| Factor for charging method (Table 4c(3)) for water heating                              |                           |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (305a)   |              |
| Distribution loss factor (Table 12c) for community heating system                       |                           |          |          |          |          |          |          |          |          |          |          |          | 1.5000 (306)    |              |
| Efficiency of secondary/supplementary heating system, %                                 |                           |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |              |
| Space heating:                                                                          |                           |          |          |          |          |          |          |          |          |          |          |          |                 |              |
| Space heating requirement                                                               |                           |          |          |          |          |          |          |          |          |          |          |          |                 |              |
|                                                                                         | 298.9673                  | 222.0015 | 175.0409 | 84.8530  | 31.5650  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 86.8459  | 194.5000 | 305.7861 | (98)            |              |
| Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.50                                   |                           |          |          |          |          |          |          |          |          |          |          |          |                 |              |
| 307a                                                                                    | 448.4510                  | 333.0022 | 262.5614 | 127.2795 | 47.3475  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 130.2689 | 291.7500 | 458.6791 |                 |              |
| Space heating requirement                                                               | 448.4510                  | 333.0022 | 262.5614 | 127.2795 | 47.3475  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 130.2689 | 291.7500 | 458.6791 | (307)           |              |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) |                           |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (308)    |              |
| Space heating fuel for secondary/supplementary system                                   | 0.0000                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (309)           |              |
|                                                                                         |                           |          |          |          |          |          |          |          |          |          |          |          |                 |              |
| Water heating                                                                           |                           |          |          |          |          |          |          |          |          |          |          |          |                 |              |
| Annual water heating requirement                                                        |                           |          |          |          |          |          |          |          |          |          |          |          |                 |              |
|                                                                                         | 238.5398                  | 211.0797 | 224.5942 | 202.6308 | 197.2257 | 175.0450 | 168.2438 | 181.2266 | 181.2204 | 203.6347 | 216.0791 | 237.9810 | (64)            |              |
| Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.50                                   |                           |          |          |          |          |          |          |          |          |          |          |          |                 |              |
| 310a                                                                                    | 357.8096                  | 316.6195 | 336.8914 | 303.9462 | 295.8386 | 262.5674 | 252.3656 | 271.8398 | 271.8306 | 305.4520 | 324.1187 | 356.9715 |                 |              |
| Water heating fuel                                                                      | 357.8096                  | 316.6195 | 336.8914 | 303.9462 | 295.8386 | 262.5674 | 252.3656 | 271.8398 | 271.8306 | 305.4520 | 324.1187 | 356.9715 | (310)           |              |
| Cooling System Energy Efficiency Ratio                                                  |                           |          |          |          |          |          |          |          |          |          |          |          |                 | 0.0000 (314) |
| Space coolin                                                                            | 0.0000                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (315)           |              |
| Pumps and Fa                                                                            | 13.9231                   | 12.5757  | 13.9231  | 13.4740  | 13.9231  | 13.4740  | 13.9231  | 13.9231  | 13.4740  | 13.9231  | 13.4740  | 13.9231  | (331)           |              |
| Lighting                                                                                | 21.2783                   | 17.0702  | 15.3699  | 11.2606  | 8.6980   | 7.1064   | 7.9346   | 10.3137  | 13.3965  | 17.5770  | 19.8531  | 21.8697  | (332)           |              |
| Electricity generated by PVs (Appendix M) (negative quantity)                           |                           |          |          |          |          |          |          |          |          |          |          |          |                 |              |
| (333a)m                                                                                 | -3.7262                   | -6.6144  | -12.2021 | -17.1713 | -21.4631 | -21.1656 | -20.7209 | -17.8316 | -13.4074 | -8.6228  | -4.4739  | -3.0419  | (333a)          |              |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                 |                           |          |          |          |          |          |          |          |          |          |          |          |                 |              |
| (334a)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   | (334a)          |              |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)     |                           |          |          |          |          |          |          |          |          |          |          |          |                 |              |
| (335a)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   | (335a)          |              |
| Electricity generated by PVs (Appendix M) (negative quantity)                           |                           |          |          |          |          |          |          |          |          |          |          |          |                 |              |
| (333b)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   | (333b)          |              |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                 |                           |          |          |          |          |          |          |          |          |          |          |          |                 |              |
| (334b)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   | (334b)          |              |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)     |                           |          |          |          |          |          |          |          |          |          |          |          |                 |              |
| (335b)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   | (335b)          |              |
| Annual totals kWh/year                                                                  |                           |          |          |          |          |          |          |          |          |          |          |          |                 |              |
| Space heating fuel - community heating                                                  |                           |          |          |          |          |          |          |          |          |          |          |          | 2099.3396 (307) |              |
| Space heating fuel - secondary                                                          |                           |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (309)    |              |
| Water heating fuel - community heating                                                  |                           |          |          |          |          |          |          |          |          |          |          |          | 3656.2511 (310) |              |
| Efficiency of water heater                                                              |                           |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (311)    |              |
| Electricity used for heat distribution                                                  |                           |          |          |          |          |          |          |          |          |          |          |          | 20.9934 (313)   |              |
| Space cooling fuel                                                                      |                           |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (321)    |              |
|                                                                                         |                           |          |          |          |          |          |          |          |          |          |          |          |                 |              |
| Electricity for pumps and fans:                                                         |                           |          |          |          |          |          |          |          |          |          |          |          |                 |              |
| (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7625)              |                           |          |          |          |          |          |          |          |          |          |          |          |                 |              |
| mechanical ventilation fans (SFP = 0.7625)                                              |                           |          |          |          |          |          |          |          |          |          |          |          | 163.9333 (330a) |              |
| Total electricity for the above, kWh/year                                               |                           |          |          |          |          |          |          |          |          |          |          |          | 163.9333 (331)  |              |

# Full SAP Calculation Printout



|                                                               |                 |
|---------------------------------------------------------------|-----------------|
| Electricity for lighting (calculated in Appendix L)           | 171.7281 (332)  |
| Energy saving/generation technologies (Appendices M ,N and Q) |                 |
| PV generation                                                 | -150.4412 (333) |
| Wind generation                                               | 0.0000 (334)    |
| Hydro-electric generation (Appendix N)                        | 0.0000 (335a)   |
| Electricity generated - Micro CHP (Appendix N)                | 0.0000 (335)    |
| Appendix Q - special features                                 |                 |
| Energy saved or generated                                     | -0.0000 (336)   |
| Energy used                                                   | 0.0000 (337)    |
| Total delivered energy for all uses                           | 5940.8109 (338) |

## 12b. Carbon dioxide emissions - Community heating scheme

|                                                         | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|---------------------------------------------------------|--------------------|-------------------------------|--------------------------|
| Efficiency of heat source Heat pump                     |                    |                               | 232.0000 (367)           |
| Space and Water heating from Heat pump                  | 2480.8581          | 0.1560                        | 141.1794 (367)           |
| Electrical energy for heat distribution (space & water) | 20.9934            | 0.0000                        | 8.4238 (372)             |
| Overall CO2 factor for heat network                     |                    |                               | 0.0645 (386)             |
| Total CO2 associated with community systems             |                    |                               | 371.5175 (373)           |
| Space and water heating                                 |                    |                               | 371.5175 (376)           |
| Pumps, fans and electric keep-hot                       | 163.9333           | 0.1387                        | 22.7396 (378)            |
| Energy for lighting                                     | 171.7281           | 0.1443                        | 24.7857 (379)            |
| Energy saving/generation technologies                   |                    |                               |                          |
| PV Unit electricity used in dwelling                    | -150.4412          | 0.1305                        | -19.6380                 |
| PV Unit electricity exported                            | 0.0000             | 0.0000                        | 0.0000                   |
| Total                                                   |                    |                               | -19.6380 (380)           |
| Total CO2, kg/year                                      |                    |                               | 399.4047 (383)           |
| EPC Dwelling Carbon Dioxide Emission Rate (DER)         |                    |                               | 5.6700 (384)             |

## 13b. Primary energy - Community heating scheme

|                                                         | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Efficiency of heat source Heat pump                     |                    |                                     | 232.0000 (467a)            |
| Space and Water heating from Heat pump                  | 2480.8581          | 1.5776                              | 1427.5530 (467)            |
| Electrical energy for heat distribution (space & water) | 20.9934            | 0.0000                              | 88.7185 (472)              |
| Overall CO2 factor for heat network                     |                    |                                     | 0.6798 (486)               |
| Total CO2 associated with community systems             |                    |                                     | 3912.7921 (473)            |
| Space and water heating                                 |                    |                                     | 3912.7921 (476)            |
| Pumps, fans and electric keep-hot                       | 163.9333           | 1.5128                              | 247.9983 (478)             |
| Energy for lighting                                     | 171.7281           | 1.5338                              | 263.4022 (479)             |
| Energy saving/generation technologies                   |                    |                                     |                            |
| PV Unit electricity used in dwelling                    | -150.4412          | 1.4822                              | -222.9845                  |
| PV Unit electricity exported                            | 0.0000             | 0.0000                              | 0.0000                     |
| Total                                                   |                    |                                     | -222.9845 (480)            |
| Total Primary energy kWh/year                           |                    |                                     | 4201.2082 (483)            |
| Dwelling Primary energy Rate (DPER)                     |                    |                                     | 59.6000 (484)              |

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

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m)            | Volume<br>(m3)       |
|--------------------------------------------------------|--------------|---------------------------------|----------------------|
| Main dwelling                                          | 70.4900 (1b) | 2.5000 (2b)                     | 176.2250 (1b) - (3b) |
| Ground floor                                           |              |                                 |                      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 70.4900      |                                 | (4)                  |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | 176.2250 (5)         |

## 2. Ventilation rate

|                                                                                                  | m3 per hour                             |
|--------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                          | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                             | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                               | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                    | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                         | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                       | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                              | 3 * 10 = 30.0000 (7a)                   |
| Number of passive vents                                                                          | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                     | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) | 30.0000 / (5) = 0.1702 (8)              |
| Pressure test                                                                                    | Yes                                     |
| Pressure Test Method                                                                             | Blower Door                             |
| Measured/design AP50                                                                             | 5.0000 (17)                             |
| Infiltration rate                                                                                | 0.4202 (18)                             |
| Number of sides sheltered                                                                        | 2 (19)                                  |
| Shelter factor                                                                                   | (20) = 1 - [0.075 x (19)] = 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor                                             | (21) = (18) x (20) = 0.3572 (21)        |

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

# Full SAP Calculation Printout



|                 |        |        |        |        |        |        |        |        |        |        |        |              |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| 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 |        |        |        |        |        |        |        |        |        |        |        |              |
| Effective ac    | 0.4554 | 0.4465 | 0.4376 | 0.3929 | 0.3840 | 0.3393 | 0.3393 | 0.3304 | 0.3572 | 0.3840 | 0.4019 | 0.4197 (22b) |
|                 | 0.6037 | 0.5997 | 0.5957 | 0.5772 | 0.5737 | 0.5576 | 0.5576 | 0.5546 | 0.5638 | 0.5737 | 0.5807 | 0.5881 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                        | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K | A x U<br>W/K | K-value<br>kJ/m2K | A x K<br>kJ/K |
|------------------------------------------------|-------------|----------------|---------------|------------------|--------------|-------------------|---------------|
| Main dwelling                                  |             |                |               |                  |              |                   |               |
| TER Opaque door                                |             |                | 2.4200        | 1.0000           | 2.4200       |                   | (26)          |
| TER Opening Type                               |             |                | 15.1800       | 1.1450           | 17.3817      |                   | (27)          |
| External Wall 1                                | 43.6300     | 15.1800        | 28.4500       | 0.1800           | 5.1210       |                   | (29a)         |
| Corridor wall                                  | 29.7300     | 2.4200         | 27.3100       | 0.1800           | 4.9158       |                   | (29a)         |
| External Roof 1                                | 70.4900     |                | 70.4900       | 0.1100           | 7.7539       |                   | (30)          |
| Total net area of external elements Aum(A, m2) |             |                | 143.8500      |                  |              |                   | (31)          |
| Fabric heat loss, W/K = Sum (A x U)            |             |                |               |                  | 37.5924      |                   | (33)          |
| Main dwelling                                  |             |                |               |                  |              |                   |               |
| Party Wall 1                                   |             |                | 16.4000       | 0.0000           | 0.0000       |                   | (32)          |

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

134.7323 (35)

### List of Thermal Bridges

| K1 Element                                                                | Length  | Psi-value | Total   |
|---------------------------------------------------------------------------|---------|-----------|---------|
| E1 Steel lintel with perforated steel base plate                          | 9.8500  | 0.0500    | 0.4925  |
| E4 Jamb                                                                   | 33.6000 | 0.0500    | 1.6800  |
| E7 Party floor between dwellings (in blocks of flats)                     | 14.0500 | 0.0700    | 0.9835  |
| E7 Party floor between dwellings (in blocks of flats)                     | 11.8900 | 0.0700    | 0.8323  |
| E9 Balcony between dwellings, wall insulation continuous                  | 3.4000  | 0.0200    | 0.0680  |
| E16 Corner (normal)                                                       | 5.0000  | 0.0900    | 0.4500  |
| E16 Corner (normal)                                                       | 5.0000  | 0.0900    | 0.4500  |
| E17 Corner (inverted - internal area greater than external area)          | 5.0000  | -0.0900   | -0.4500 |
| E18 Party wall between dwellings                                          | 2.5000  | 0.0600    | 0.1500  |
| E18 Party wall between dwellings                                          | 2.5000  | 0.0600    | 0.1500  |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | 6.5600  | 0.0000    | 0.0000  |
| E14 Flat roof                                                             | 29.3400 | 0.0800    | 2.3472  |
| P4 Party wall - Roof (insulation at ceiling level)                        | 6.5600  | 0.1200    | 0.7872  |

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

7.9407 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 45.5331 (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       | 35.1082 | 34.8740 | 34.6445 | 33.5663 | 33.3645 | 32.4254 | 32.4254 | 32.2515 | 32.7872 | 33.3645 | 33.7726 | 34.1993 (38) |
| Average = Sum(39)m / 12 = | 80.6413 | 80.4071 | 80.1776 | 79.0993 | 78.8976 | 77.9585 | 77.9585 | 77.7846 | 78.3202 | 78.8976 | 79.3057 | 79.7324 (39) |

Heat transfer coeff

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec         |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
| HLP           | 1.1440 | 1.1407 | 1.1374 | 1.1221 | 1.1193 | 1.1060 | 1.1060 | 1.1035 | 1.1111 | 1.1193 | 1.1251 | 1.1311 (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 1.1221      |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31          |

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

|                                          |         |         |         |         |         |         |         |         |         |         |               |               |
|------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------------|---------------|
| Assumed occupancy                        |         |         |         |         |         |         |         |         |         |         |               | 2.2580 (42)   |
| Hot water usage for mixer showers        |         |         |         |         |         |         |         |         |         |         |               |               |
| 62.0782                                  | 61.1453 | 59.7859 | 57.1848 | 55.2653 | 53.1247 | 51.9080 | 53.2572 | 54.7361 | 57.0344 | 59.6914 | 61.8404 (42a) |               |
| Hot water usage for baths                |         |         |         |         |         |         |         |         |         |         |               |               |
| 26.8189                                  | 26.4206 | 25.8597 | 24.8255 | 24.0512 | 23.1925 | 22.7287 | 23.2857 | 23.8921 | 24.8109 | 25.8664 | 26.7282 (42b) |               |
| Hot water usage for other uses           |         |         |         |         |         |         |         |         |         |         |               |               |
| 37.7538                                  | 36.3809 | 35.0081 | 33.6352 | 32.2623 | 30.8895 | 30.8895 | 32.2623 | 33.6352 | 35.0081 | 36.3809 | 37.7538 (42c) |               |
| Average daily hot water use (litres/day) |         |         |         |         |         |         |         |         |         |         |               | 116.4210 (43) |

|                         | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov         | Dec           |
|-------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-------------|---------------|
| Daily hot water use     | 126.6509 | 123.9469 | 120.6537 | 115.6456 | 111.5788 | 107.2067 | 105.5262 | 108.8051 | 112.2634 | 116.8534 | 121.9386    | 126.3224 (44) |
| Energy conte            | 200.5841 | 176.4987 | 185.4402 | 158.3130 | 150.2066 | 131.8231 | 127.6247 | 134.7235 | 138.4319 | 158.5689 | 173.7240    | 197.7904 (45) |
| Energy content (annual) |          |          |          |          |          |          |          |          |          | Total =  | Sum (45)m = | 1933.7292     |

Water storage loss (or HIU loss):

|              |  |  |  |  |  |  |  |  |  |  |  |               |
|--------------|--|--|--|--|--|--|--|--|--|--|--|---------------|
| Store volume |  |  |  |  |  |  |  |  |  |  |  | 180.0000 (47) |
|--------------|--|--|--|--|--|--|--|--|--|--|--|---------------|

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

|                                  |  |  |  |  |  |  |  |  |  |  |  |             |
|----------------------------------|--|--|--|--|--|--|--|--|--|--|--|-------------|
| Temperature factor from Table 2b |  |  |  |  |  |  |  |  |  |  |  | 1.5520 (48) |
| Enter (49) or (54) in (55)       |  |  |  |  |  |  |  |  |  |  |  | 0.5400 (49) |
| Total storage loss               |  |  |  |  |  |  |  |  |  |  |  | 0.8381 (55) |

|         |         |         |         |         |         |         |         |         |         |         |         |              |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| 25.9803 | 23.4661 | 25.9803 | 25.1422 | 25.9803 | 25.1422 | 25.9803 | 25.9803 | 25.9803 | 25.1422 | 25.9803 | 25.1422 | 25.9803 (56) |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|

|         |         |         |         |         |         |         |         |         |         |         |         |              |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| 25.9803 | 23.4661 | 25.9803 | 25.1422 | 25.9803 | 25.1422 | 25.9803 | 25.9803 | 25.9803 | 25.1422 | 25.9803 | 25.1422 | 25.9803 (57) |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|

|         |         |         |         |         |         |         |         |         |         |         |         |              |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| 23.2624 | 21.0112 | 23.2624 | 22.5120 | 23.2624 | 22.5120 | 23.2624 | 23.2624 | 23.2624 | 22.5120 | 23.2624 | 22.5120 | 23.2624 (59) |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|

|        |        |        |        |        |        |        |        |        |        |        |        |             |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (61) |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|

|          |          |          |          |          |          |          |          |          |          |          |               |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| 249.8268 | 220.9759 | 234.6829 | 205.9672 | 199.4492 | 179.4773 | 176.8674 | 183.9662 | 186.0861 | 207.8116 | 221.3781 | 247.0331 (62) |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|

|          |          |          |          |          |          |          |          |          |          |          |                |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| -28.3796 | -25.0991 | -26.2824 | -21.7628 | -20.2822 | -17.3556 | -16.2681 | -17.2995 | -17.9568 | -21.1691 | -23.9820 | -27.8540 (63a) |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|

|         |         |         |         |         |         |         |         |         |         |         |               |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------------|
| -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) |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------------|

|        |        |        |        |        |        |        |        |        |        |        |              |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| 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) |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|

|        |        |        |        |        |        |        |        |        |        |        |              |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| 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) |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|

|          |          |          |          |          |          |          |          |          |          |          |               |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| 221.4472 | 195.8768 | 208.4005 | 184.2044 | 179.1670 | 162.1217 | 160.5993 | 166.6666 | 168.1294 | 186.6426 | 197.3962 | 219.1790 (64) |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|

|                             |  |  |  |  |  |  |  |  |  |  |  |                |
|-----------------------------|--|--|--|--|--|--|--|--|--|--|--|----------------|
| 12Total per year (kWh/year) |  |  |  |  |  |  |  |  |  |  |  | 2249.8307 (64) |
|-----------------------------|--|--|--|--|--|--|--|--|--|--|--|----------------|

|                    |  |  |  |  |  |  |  |  |  |  |  |           |
|--------------------|--|--|--|--|--|--|--|--|--|--|--|-----------|
| Electric shower(s) |  |  |  |  |  |  |  |  |  |  |  | 2250 (64) |
|--------------------|--|--|--|--|--|--|--|--|--|--|--|-----------|

|        |        |        |        |        |        |        |        |        |        |        |              |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (64a) |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|

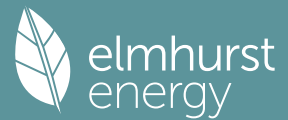
|                                          |  |  |  |  |  |  |  |  |  |  |  |              |
|------------------------------------------|--|--|--|--|--|--|--|--|--|--|--|--------------|
| Heat gains from water heating, kWh/month |  |  |  |  |  |  |  |  |  |  |  | 0.0000 (64a) |
|------------------------------------------|--|--|--|--|--|--|--|--|--|--|--|--------------|

|          |         |          |         |         |         |         |         |         |         |         |               |
|----------|---------|----------|---------|---------|---------|---------|---------|---------|---------|---------|---------------|
| 106.0884 | 94.2676 | 101.0530 | 90.7624 | 89.3378 | 81.9545 | 81.8294 | 84.1897 | 84.1520 | 92.1183 | 95.8866 | 105.1594 (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 |
|----------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|----------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|

# Full SAP Calculation Printout



|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |          |      |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| (66)m                                                                               | 112.8981 | 112.8981 | 112.8981 | 112.8981 | 112.8981 | 112.8981 | 112.8981 | 112.8981 | 112.8981 | 112.8981 | 112.8981 | 112.8981 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 100.2116 | 110.9485 | 100.2116 | 103.5520 | 100.2116 | 103.5520 | 100.2116 | 100.2116 | 103.5520 | 100.2116 | 103.5520 | 100.2116 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 198.4380 | 200.4971 | 195.3081 | 184.2613 | 170.3166 | 157.2106 | 148.4550 | 146.3959 | 151.5849 | 162.6317 | 176.5764 | 189.6824 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 34.2898  | 34.2898  | 34.2898  | 34.2898  | 34.2898  | 34.2898  | 34.2898  | 34.2898  | 34.2898  | 34.2898  | 34.2898  | 34.2898  | (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)                                 | -90.3185 | -90.3185 | -90.3185 | -90.3185 | -90.3185 | -90.3185 | -90.3185 | -90.3185 | -90.3185 | -90.3185 | -90.3185 | -90.3185 | (71) |
| Water heating gains (Table 5)                                                       | 142.5919 | 140.2792 | 135.8239 | 126.0589 | 120.0777 | 113.8258 | 109.9857 | 113.1582 | 116.8777 | 123.8149 | 133.1758 | 141.3433 | (72) |
| Total internal gains                                                                | 501.1109 | 511.5943 | 491.2130 | 473.7416 | 450.4754 | 431.4578 | 415.5217 | 416.6351 | 428.8840 | 446.5277 | 473.1736 | 491.1067 | (73) |

## 6. Solar gains

| [Jan]       |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c |          |          |          | Access<br>factor<br>Table 6d |          |      | Gains<br>W   |
|-------------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|----------|----------|----------|------------------------------|----------|------|--------------|
| Northeast   |          |          |          | 9.3500     | 11.2829                        | 0.6300                            | 0.7000                             |          |          |          | 0.7700                       |          |      | 32.2408 (75) |
| Southeast   |          |          |          | 5.8300     | 36.7938                        | 0.6300                            | 0.7000                             |          |          |          | 0.7700                       |          |      | 65.5564 (77) |
|             |          |          |          |            |                                |                                   |                                    |          |          |          |                              |          |      |              |
| Solar gains | 97.7972  | 177.2940 | 271.0266 | 383.4937   | 473.0637                       | 488.7853                          | 463.2749                           | 393.5251 | 309.5128 | 203.6172 | 119.0888                     |          |      | 82.4321 (83) |
| Total gains | 598.9081 | 688.8882 | 762.2397 | 857.2353   | 923.5391                       | 920.2431                          | 878.7967                           | 810.1602 | 738.3968 | 650.1449 | 592.2623                     | 573.5388 | (84) |              |

## 7. Mean internal temperature (heating season)

|                                                                             |                                       |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) | 21.0000 (85)                          |         |         |         |         |         |         |         |         |         |         |              |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          | Jan                                   | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 32.7144                               | 32.8097 | 32.9036 | 33.3522 | 33.4374 | 33.8402 | 33.8402 | 33.9159 | 33.6839 | 33.4374 | 33.2654 | 33.0874      |
| alpha                                                                       | 3.1810                                | 3.1873  | 3.1936  | 3.2235  | 3.2292  | 3.2560  | 3.2560  | 3.2611  | 3.2456  | 3.2292  | 3.2177  | 3.2058       |
| util living area                                                            | 0.9563                                | 0.9326  | 0.8922  | 0.8034  | 0.6696  | 0.5057  | 0.3790  | 0.4239  | 0.6348  | 0.8436  | 0.9324  | 0.9612 (86)  |
| MIT                                                                         | 19.1448                               | 19.4353 | 19.8412 | 20.3526 | 20.7216 | 20.9186 | 20.9759 | 20.9652 | 20.8266 | 20.3432 | 19.6741 | 19.1036 (87) |
| Th 2                                                                        | 19.9651                               | 19.9677 | 19.9704 | 19.9828 | 19.9851 | 19.9960 | 19.9960 | 19.9980 | 19.9918 | 19.9851 | 19.9804 | 19.9755 (88) |
| util rest of house                                                          | 0.9488                                | 0.9212  | 0.8741  | 0.7717  | 0.6196  | 0.4370  | 0.2970  | 0.3383  | 0.5659  | 0.8106  | 0.9191  | 0.9544 (89)  |
| MIT 2                                                                       | 17.8272                               | 18.1915 | 18.6954 | 19.3169 | 19.7328 | 19.9384 | 19.9843 | 19.9800 | 19.8566 | 19.3239 | 18.5048 | 17.7822 (90) |
| Living area fraction                                                        | fLA = Living area / (4) = 0.4569 (91) |         |         |         |         |         |         |         |         |         |         |              |
| MIT                                                                         | 18.4293                               | 18.7599 | 19.2190 | 19.7902 | 20.1846 | 20.3863 | 20.4374 | 20.4302 | 20.2998 | 19.7897 | 19.0391 | 18.3860 (92) |
| Temperature adjustment                                                      | 0.0000                                |         |         |         |         |         |         |         |         |         |         |              |
| adjusted MIT                                                                | 18.4293                               | 18.7599 | 19.2190 | 19.7902 | 20.1846 | 20.3863 | 20.4374 | 20.4302 | 20.2998 | 19.7897 | 19.0391 | 18.3860 (93) |

## 8. Space heating requirement

|                                                                                |                            |           |           |          |          |          |          |          |          |          |          |                |
|--------------------------------------------------------------------------------|----------------------------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Utilisation                                                                    | Jan                        | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec            |
| Useful gains                                                                   | 0.9342                     | 0.9049    | 0.8586    | 0.7651   | 0.6300   | 0.4644   | 0.3336   | 0.3760   | 0.5881   | 0.8034   | 0.9040   | 0.9407 (94)    |
| Ext temp.                                                                      | 559.5044                   | 623.3656  | 654.4568  | 655.8517 | 581.7863 | 427.3815 | 293.1907 | 304.6413 | 434.2595 | 522.3024 | 535.3887 | 539.5325 (95)  |
| Heat loss rate W                                                               | 4.3000                     | 4.9000    | 6.5000    | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000  | 7.1000   | 4.2000 (96)    |
| Space heating kWh                                                              | 1139.4046                  | 1114.4309 | 1019.7748 | 861.4076 | 669.4143 | 451.0893 | 299.1589 | 313.4859 | 485.5708 | 725.0417 | 946.8403 | 1131.0848 (97) |
| Space heating requirement - total per year (kWh/year)                          | 431.4457                   | 329.9959  | 271.7966  | 148.0002 | 65.1953  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 150.8380 | 296.2451 | 440.1149 (98a) |
| Solar heating kWh                                                              | 2133.6318                  |           |           |          |          |          |          |          |          |          |          |                |
| Solar heating contribution - total per year (kWh/year)                         | 0.0000                     | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (98b)   |
| Space heating kWh                                                              | 431.4457                   | 329.9959  | 271.7966  | 148.0002 | 65.1953  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 150.8380 | 296.2451 | 440.1149 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) | 2133.6318                  |           |           |          |          |          |          |          |          |          |          |                |
| Space heating per m2                                                           | (98c) / (4) = 30.2686 (99) |           |           |          |          |          |          |          |          |          |          |                |

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

|                                                                       |               |          |          |          |          |          |          |          |          |          |          |                |
|-----------------------------------------------------------------------|---------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Fraction of space heat from secondary/supplementary system (Table 11) | 0.0000 (201)  |          |          |          |          |          |          |          |          |          |          |                |
| Fraction of space heat from main system(s)                            | 1.0000 (202)  |          |          |          |          |          |          |          |          |          |          |                |
| Efficiency of main space heating system 1 (in %)                      | 92.3000 (206) |          |          |          |          |          |          |          |          |          |          |                |
| Efficiency of main space heating system 2 (in %)                      | 0.0000 (207)  |          |          |          |          |          |          |          |          |          |          |                |
| Efficiency of secondary/supplementary heating system, %               | 0.0000 (208)  |          |          |          |          |          |          |          |          |          |          |                |
| Space heating requirement                                             | Jan           | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec            |
| Space heating efficiency (main heating system 1)                      | 431.4457      | 329.9959 | 271.7966 | 148.0002 | 65.1953  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 150.8380 | 296.2451 | 440.1149 (98)  |
| Space heating fuel (main heating system)                              | 92.3000       | 92.3000  | 92.3000  | 92.3000  | 92.3000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 92.3000  | 92.3000  | 92.3000 (210)  |
| Space heating efficiency (main heating system 2)                      | 467.4384      | 357.5253 | 294.4709 | 160.3470 | 70.6341  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 163.4214 | 320.9590 | 476.8309 (211) |
| Space heating fuel (main heating system 2)                            | 0.0000        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)   |
| Space heating fuel (secondary)                                        | 0.0000        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)   |
| Space heating fuel (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                                             | 221.4472      | 195.8768 | 208.4005 | 184.2044 | 179.1670 | 162.1217 | 160.5993 | 166.6666 | 168.1294 | 186.6426 | 197.3962 | 219.1790 (64)  |
| Efficiency of water heater (217)m                                     | 85.5283       | 85.2200  | 84.6564  | 83.5736  | 82.0178  | 79.8000  | 79.8000  | 79.8000  | 79.8000  | 83.5864  | 84.9680  | 79.8000 (216)  |
| Fuel for water heating, kWh/month                                     | 258.9170      | 229.8484 | 246.1722 | 220.4098 | 218.4490 | 203.1601 | 201.2523 | 208.8554 | 210.6884 | 223.2930 | 232.3182 | 256.0776 (219) |
| Space cooling fuel requirement (221)m                                 | 0.0000        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)   |

# Full SAP Calculation Printout



|                                                                                                      |         |         |          |          |          |          |          |          |          |          |         |           |        |
|------------------------------------------------------------------------------------------------------|---------|---------|----------|----------|----------|----------|----------|----------|----------|----------|---------|-----------|--------|
| Pumps and Fa                                                                                         | 7.3041  | 6.5973  | 7.3041   | 7.0685   | 7.3041   | 7.0685   | 7.3041   | 7.3041   | 7.0685   | 7.3041   | 7.0685  | 7.3041    | (231)  |
| Lighting                                                                                             | 20.8220 | 16.7042 | 15.0403  | 11.0191  | 8.5115   | 6.9540   | 7.7645   | 10.0926  | 13.1092  | 17.2000  | 19.4274 | 21.4007   | (232)  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |         |         |          |          |          |          |          |          |          |          |         |           |        |
| (233a)m                                                                                              | -5.8703 | -9.1976 | -14.6732 | -18.3696 | -21.5346 | -20.7494 | -20.4989 | -18.4714 | -15.2517 | -11.2819 | -6.7721 | -4.9737   | (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                                                                                              | -1.0105 | -2.2267 | -4.6241  | -7.2513  | -9.9009  | -10.0657 | -9.9475  | -8.2762  | -5.8793  | -3.2798  | -1.3782 | -0.7918   | (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                                                                   |         |         |          |          |          |          |          |          |          |          |         | 2311.6270 | (211)  |
| Space heating fuel - main system 2                                                                   |         |         |          |          |          |          |          |          |          |          |         | 0.0000    | (213)  |
| Space heating fuel - secondary                                                                       |         |         |          |          |          |          |          |          |          |          |         | 0.0000    | (215)  |
| Efficiency of water heater                                                                           |         |         |          |          |          |          |          |          |          |          |         | 79.8000   |        |
| Water heating fuel used                                                                              |         |         |          |          |          |          |          |          |          |          |         | 2709.4412 | (219)  |
| Space cooling fuel                                                                                   |         |         |          |          |          |          |          |          |          |          |         | 0.0000    | (221)  |
| Electricity for pumps and fans:                                                                      |         |         |          |          |          |          |          |          |          |          |         |           |        |
| Total electricity for the above, kWh/year                                                            |         |         |          |          |          |          |          |          |          |          |         | 86.0000   | (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |         |         |          |          |          |          |          |          |          |          |         | 168.0454  | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |         |         |          |          |          |          |          |          |          |          |         |           |        |
| PV generation                                                                                        |         |         |          |          |          |          |          |          |          |          |         | -232.2763 | (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                                                                  |         |         |          |          |          |          |          |          |          |          |         | 5042.8373 | (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                 | 2311.6270          | 0.2100                        | 485.4417                 | (261) |
| Total CO2 associated with community systems   |                    |                               | 0.0000                   | (373) |
| Water heating (other fuel)                    | 2709.4412          | 0.2100                        | 568.9827                 | (264) |
| Space and water heating                       |                    |                               | 1054.4243                | (265) |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293                  | (267) |
| Energy for lighting                           | 168.0454           | 0.1443                        | 24.2541                  | (268) |
| Energy saving/generation technologies         |                    |                               |                          |       |
| PV Unit electricity used in dwelling          | -167.6444          | 0.1325                        | -22.2053                 |       |
| PV Unit electricity exported                  | -64.6319           | 0.1247                        | -8.0571                  |       |
| Total                                         |                    |                               | -30.2624                 | (269) |
| Total CO2, kg/year                            |                    |                               | 1060.3453                | (272) |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 15.0400                  | (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               | 2311.6270          | 1.1300                              | 2612.1386                  | (275) |
| Total CO2 associated with community systems |                    |                                     | 0.0000                     | (473) |
| Water heating (other fuel)                  | 2709.4412          | 1.1300                              | 3061.6686                  | (278) |
| Space and water heating                     |                    |                                     | 5673.8071                  | (279) |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008                   | (281) |
| Energy for lighting                         | 168.0454           | 1.5338                              | 257.7536                   | (282) |
| Energy saving/generation technologies       |                    |                                     |                            |       |
| PV Unit electricity used in dwelling        | -167.6444          | 1.4894                              | -249.6909                  |       |
| PV Unit electricity exported                | -64.6319           | 0.4575                              | -29.5709                   |       |
| Total                                       |                    |                                     | -279.2619                  | (283) |
| Total Primary energy kWh/year               |                    |                                     | 5782.3997                  | (286) |
| Target Primary Energy Rate (TPER)           |                    |                                     | 82.0300                    | (287) |

# Full SAP Calculation Printout



|                                    |                   |                |            |
|------------------------------------|-------------------|----------------|------------|
| Plot Reference                     | B 1505            | Issued on Date | 15/05/2026 |
| Assessment Reference               | Be Green 260515   | Plot Type Ref  |            |
| Plot Address                       |                   | SAP Version    | 10.2       |
| SAP Rating                         | 81 B              | DER            | 5.67       |
| Environmental                      | 96 A              | % DER < TER    | 62.30      |
| CO <sub>2</sub> Emissions (t/year) | 0.36              | DFEE           | 39.24      |
| Compliance Check                   | See BREL          | % DFEE < TFEE  | -3.91      |
| % DPER < TPER                      | 27.34             | DPER           | 59.60      |
|                                    |                   | TPER           | 82.03      |
| Assessor Details                   | Mr. Robert Tanner | Assessor ID    | W344-0001  |
| Client                             |                   |                |            |

SAP 10 WORKSHEET FOR New Build (As Designed) (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> ) |
|--------------------------------------------------------|---------------------------|----------------------|-----------------------------|
| Main dwelling                                          | 70.4900 (1b)              | 2.5000 (2b)          | 176.2250 (1b) - (3b)        |
| Ground floor                                           |                           |                      |                             |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 70.4900                   |                      | 176.2250 (4)                |
| Dwelling volume                                        |                           |                      | 176.2250 (5)                |

## 2. Ventilation rate

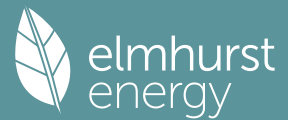
|                                                                                                    | m <sup>3</sup> per hour                 |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 3 * 10 = 30.0000 (7a)                   |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 30.0000 / (5) = 0.1702 (8)              |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 3.0000 (17)                             |
| Infiltration rate                                                                                  | 0.3202 (18)                             |
| Number of sides sheltered                                                                          | 2 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.2722 (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                                                                                         | 0.3471 | 0.3403 | 0.3334 | 0.2994 | 0.2926 | 0.2586 | 0.2586 | 0.2518 | 0.2722 | 0.2926 | 0.3062 | 0.3198 (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                                                                                            | 0.5602 | 0.5579 | 0.5556 | 0.5448 | 0.5428 | 0.5334 | 0.5334 | 0.5317 | 0.5370 | 0.5428 | 0.5469 | 0.5511 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                                                    | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K                                       |
|----------------------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|-----------------------------------------------------|
| Main dwelling                                                              |                         |                            |                           |                               |              |                                |                                                     |
| Door                                                                       |                         |                            | 2.4200                    | 1.0000                        | 2.4200       |                                | (26)                                                |
| Window                                                                     |                         |                            | 21.2100                   | 1.1450                        | 24.2863      |                                | (27)                                                |
| External Wall 1                                                            | 43.6300                 | 21.2100                    | 22.4200                   | 0.1500                        | 3.3630       | 70.0000                        | 1569.4001 (29a)                                     |
| Corridor wall                                                              | 29.7300                 | 2.4200                     | 27.3100                   | 0.1900                        | 5.1889       | 70.0000                        | 1911.7000 (29a)                                     |
| External Roof 1                                                            | 70.4900                 |                            | 70.4900                   | 0.1000                        | 7.0490       | 9.0000                         | 634.4100 (30)                                       |
| Total net area of external elements A <sub>um</sub> (A, m <sup>2</sup> )   |                         |                            | 143.8500                  |                               |              |                                | (31)                                                |
| Fabric heat loss, W/K = Sum (A x U)                                        |                         |                            |                           |                               | 42.3072      |                                | (33)                                                |
| Main dwelling                                                              |                         |                            |                           |                               |              |                                |                                                     |
| Party Wall 1                                                               |                         |                            | 16.4000                   | 0.0000                        | 0.0000       | 70.0000                        | 1148.0000 (32)                                      |
| Party Floor 1                                                              |                         |                            | 70.4900                   |                               |              | 40.0000                        | 2819.6000 (32a)                                     |
| Internal Wall 1                                                            |                         |                            | 157.1300                  |                               |              | 9.0000                         | 1414.1700 (32c)                                     |
| Heat capacity C <sub>m</sub> = Sum(A x k)                                  |                         |                            |                           |                               |              |                                | (28)...(30) + (32) + (32a)...(32e) = 9497.2801 (34) |
| Thermal mass parameter (TMP = C <sub>m</sub> / TFA) in kJ/m <sup>2</sup> K |                         |                            |                           |                               |              |                                | 134.7323 (35)                                       |
| List of Thermal Bridges                                                    |                         |                            |                           |                               |              |                                |                                                     |
| K1 Element                                                                 |                         |                            |                           |                               | Length       | Psi-value                      | Total                                               |
| E1 Steel lintel with perforated steel base plate                           |                         |                            |                           |                               | 9.8500       | 0.0500                         | 0.4925                                              |
| E4 Jamb                                                                    |                         |                            |                           |                               | 33.6000      | 0.0400                         | 1.3440                                              |

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|                                                                           |         |                       |              |
|---------------------------------------------------------------------------|---------|-----------------------|--------------|
| E7 Party floor between dwellings (in blocks of flats)                     | 14.0500 | 0.0500                | 0.7025       |
| E7 Party floor between dwellings (in blocks of flats)                     | 11.8900 | 0.0390                | 0.4637       |
| E9 Balcony between dwellings, wall insulation continuous                  | 3.4000  | 0.0500                | 0.1700       |
| E16 Corner (normal)                                                       | 5.0000  | 0.0500                | 0.2500       |
| E16 Corner (normal)                                                       | 5.0000  | 0.0390                | 0.1950       |
| E17 Corner (inverted - internal area greater than external area)          | 5.0000  | 0.0000                | 0.0000       |
| E18 Party wall between dwellings                                          | 2.5000  | 0.0500                | 0.1250       |
| E18 Party wall between dwellings                                          | 2.5000  | 0.0390                | 0.0975       |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | 6.5600  | 0.0000                | 0.0000       |
| E14 Flat roof                                                             | 29.3400 | 0.0500                | 1.4670       |
| P4 Party wall - Roof (insulation at ceiling level)                        | 6.5600  | 0.0500                | 0.3280       |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                |         |                       | 5.6352 (36)  |
| Point Thermal Bridges                                                     |         |                       | 0.0000       |
| Total fabric heat loss                                                    |         | (33) + (36) + (36a) = | 47.9424 (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                                                 | 32.5794 | 32.4434 | 32.3101 | 31.6840 | 31.5668 | 31.0215 | 31.0215 | 30.9205 | 31.2316 | 31.5668 | 31.8038 | 32.0516 (38) |
| Average = Sum(39)m / 12 =                                           | 80.5218 | 80.3858 | 80.2525 | 79.6264 | 79.5092 | 78.9639 | 78.9639 | 78.8629 | 79.1739 | 79.5092 | 79.7462 | 79.9940 (39) |
|                                                                     |         |         |         |         |         |         |         |         |         |         |         | 79.6258      |
| HLP                                                                 | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| HLP (average)                                                       | 1.1423  | 1.1404  | 1.1385  | 1.1296  | 1.1280  | 1.1202  | 1.1202  | 1.1188  | 1.1232  | 1.1280  | 1.1313  | 1.1348 (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                                                              |         |         |         |         |         |         |         |         |         |         |         | 2.2580 (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                                                      | 26.2210 | 25.8252 | 25.2621 | 24.4188 | 23.6589 | 22.6127 | 21.8189 | 22.7895 | 23.2989 | 24.3355 | 25.4133 | 26.2002 (42b)  |
| Hot water usage for other uses                                                 | 37.7538 | 36.3809 | 35.0081 | 33.6352 | 32.2623 | 30.8895 | 30.8895 | 32.2623 | 33.6352 | 35.0081 | 36.3809 | 37.7538 (42c)  |
| Average daily hot water use (litres/day)                                       |         |         |         |         |         |         |         |         |         |         |         | 58.6348 (43)   |
| Daily hot water use                                                            | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec            |
| Energy conte                                                                   | 63.9748 | 62.2061 | 60.2702 | 58.0540 | 55.9212 | 53.5021 | 52.7084 | 55.0519 | 56.9341 | 59.3436 | 61.7942 | 63.9540 (44)   |
| Energy content (annual)                                                        | 94.1820 | 82.3113 | 86.1248 | 75.8331 | 72.0601 | 61.8734 | 58.2443 | 64.7970 | 66.0407 | 76.4702 | 83.5169 | 93.9212 (45)   |
| Distribution loss (46)m = 0.15 x (45)m                                         | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (46)    |
| Water storage loss (or HIU loss):                                              |         |         |         |         |         |         |         |         |         |         |         |                |
| 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                                   |         |         |         |         |         |         |         |         |         |         |         |                |
| 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 (57)    |
| Combi loss                                                                     | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (59)    |
| Total heat required for water heating calculated for each month                |         |         |         |         |         |         |         |         |         |         |         |                |
| WWHRS                                                                          | 80.0547 | 69.9646 | 73.2061 | 64.4581 | 61.2511 | 52.5924 | 49.5077 | 55.0775 | 56.1346 | 64.9997 | 70.9894 | 79.8330 (62)   |
| PV diverter                                                                    | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (63a)   |
| Solar input                                                                    | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (63b)   |
| FGHRS                                                                          | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (63c)   |
| Output from w/h                                                                | 80.0547 | 69.9646 | 73.2061 | 64.4581 | 61.2511 | 52.5924 | 49.5077 | 55.0775 | 56.1346 | 64.9997 | 70.9894 | 79.8330 (64)   |
| 12Total per year (kWh/year)                                                    |         |         |         |         |         |         |         |         |         |         |         | 778.0689 (64)  |
| Electric shower(s)                                                             |         |         |         |         |         |         |         |         |         |         |         | 778 (64)       |
| Heat gains from water heating, kWh/month                                       | 49.7143 | 44.2959 | 48.3694 | 46.1583 | 47.0245 | 44.8568 | 46.3520 | 47.0245 | 46.1583 | 48.3694 | 47.4599 | 49.7143 (64a)  |
|                                                                                | 32.4423 | 28.5651 | 30.3939 | 27.6541 | 27.0689 | 24.3623 | 23.9649 | 25.5255 | 25.5732 | 28.3423 | 29.6123 | 32.3868 (65)   |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |         |         |         |         |         |         |         |         |         |         |         | 565.4976 (64a) |

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

|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Metabolic gains (Table 5), Watts                                                    |          |          |          |          |          |          |          |          |          |          |          |               |
| (66)m                                                                               | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 112.8981 | 112.8981 | 112.8981 | 112.8981 | 112.8981 | 112.8981 | 112.8981 | 112.8981 | 112.8981 | 112.8981 | 112.8981 | 112.8981 (66) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 100.0892 | 110.8130 | 100.0892 | 103.4255 | 100.0892 | 103.4255 | 100.0892 | 100.0892 | 103.4255 | 100.0892 | 103.4255 | 100.0892 (67) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 198.4380 | 200.4971 | 195.3081 | 184.2613 | 170.3166 | 157.2106 | 148.4550 | 146.3959 | 151.5849 | 162.6317 | 176.5764 | 189.6824 (68) |
| Pumps, fans                                                                         | 34.2898  | 34.2898  | 34.2898  | 34.2898  | 34.2898  | 34.2898  | 34.2898  | 34.2898  | 34.2898  | 34.2898  | 34.2898  | 34.2898 (69)  |
| Losses e.g. evaporation (negative values) (Table 5)                                 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (70)   |
| Water heating gains (Table 5)                                                       | -90.3185 | -90.3185 | -90.3185 | -90.3185 | -90.3185 | -90.3185 | -90.3185 | -90.3185 | -90.3185 | -90.3185 | -90.3185 | -90.3185 (71) |
| Total internal gains                                                                | 43.6052  | 42.5076  | 40.8520  | 38.4085  | 36.3829  | 33.8365  | 32.2109  | 34.3085  | 35.5184  | 38.0944  | 41.1282  | 43.5307 (72)  |
|                                                                                     | 399.0018 | 410.6872 | 393.1187 | 382.9647 | 363.6582 | 351.3421 | 337.6246 | 337.6629 | 347.3982 | 357.6848 | 377.9995 | 390.1717 (73) |

## 6. Solar gains

| [Jan]       |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W   |          |          |               |
|-------------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|----------|----------|---------------|
| Northeast   |          |          |          | 13.0600    | 11.2829                        | 0.3500                            | 0.7000                             | 0.7700                       | 25.0187 (75) |          |          |               |
| Southeast   |          |          |          | 8.1500     | 36.7938                        | 0.3500                            | 0.7000                             | 0.7700                       | 50.9134 (77) |          |          |               |
| Solar gains | 75.9321  | 137.6506 | 210.4130 | 297.7103   | 367.2307                       | 379.4296                          | 359.6288                           | 305.4925                     | 240.2861     | 158.0848 | 92.4625  | 64.0028 (83)  |
| Total gains | 474.9338 | 548.3378 | 603.5317 | 680.6749   | 730.8889                       | 730.7716                          | 697.2534                           | 643.1554                     | 587.6843     | 515.7696 | 470.4620 | 454.1744 (84) |

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## 7. Mean internal temperature (heating season)

|                                                                             |                           |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |                           |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |                           |         |         |         |         |         |         |         |         |         |         |              |
|                                                                             | Jan                       | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 32.7630                   | 32.8184 | 32.8729 | 33.1314 | 33.1802 | 33.4094 | 33.4094 | 33.4522 | 33.3207 | 33.1802 | 33.0816 | 32.9792      |
| alpha                                                                       | 3.1842                    | 3.1879  | 3.1915  | 3.2088  | 3.2120  | 3.2273  | 3.2273  | 3.2301  | 3.2214  | 3.2120  | 3.2054  | 3.1986       |
| util living area                                                            | 0.9762                    | 0.9616  | 0.9367  | 0.8747  | 0.7670  | 0.6094  | 0.4704  | 0.5216  | 0.7345  | 0.9043  | 0.9621  | 0.9792 (86)  |
| MIT                                                                         | 18.8869                   | 19.1598 | 19.5635 | 20.1140 | 20.5693 | 20.8551 | 20.9531 | 20.9341 | 20.7236 | 20.1319 | 19.4221 | 18.8389 (87) |
| Th 2                                                                        | 19.9664                   | 19.9680 | 19.9695 | 19.9767 | 19.9781 | 19.9844 | 19.9844 | 19.9855 | 19.9819 | 19.9781 | 19.9753 | 19.9725 (88) |
| util rest of house                                                          | 0.9717                    | 0.9546  | 0.9247  | 0.8503  | 0.7212  | 0.5347  | 0.3724  | 0.4218  | 0.6681  | 0.8803  | 0.9539  | 0.9753 (89)  |
| MIT 2                                                                       | 18.0479                   | 18.3175 | 18.7142 | 19.2469 | 19.6625 | 19.9012 | 19.9660 | 19.9578 | 19.8058 | 19.2758 | 18.5848 | 18.0047 (90) |
| Living area fraction                                                        | fLA = Living area / (4) = |         |         |         |         |         |         |         |         |         |         | 0.4569 (91)  |
| MIT                                                                         | 18.4313                   | 18.7024 | 19.1023 | 19.6431 | 20.0768 | 20.3371 | 20.4171 | 20.4039 | 20.2252 | 19.6670 | 18.9674 | 18.3859 (92) |
| Temperature adjustment                                                      | 0.0000                    |         |         |         |         |         |         |         |         |         |         |              |
| adjusted MIT                                                                | 18.4313                   | 18.7024 | 19.1023 | 19.6431 | 20.0768 | 20.3371 | 20.4171 | 20.4039 | 20.2252 | 19.6670 | 18.9674 | 18.3859 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |          |          |          |          |          |          |          |          |                            |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------------------|
|                                                                                | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec                        |
| Utilisation                                                                    | 0.9630    | 0.9436    | 0.9123    | 0.8412   | 0.7260   | 0.5619   | 0.4154   | 0.4645   | 0.6854   | 0.8716   | 0.9435   | 0.9672 (94)                |
| Useful gains                                                                   | 457.3505  | 517.3952  | 550.6012  | 572.5595 | 530.6457 | 410.6067 | 289.6471 | 298.7719 | 402.7919 | 449.5445 | 443.8783 | 439.2966 (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                                                               | 1137.8750 | 1109.5160 | 1011.3641 | 855.4345 | 666.0361 | 453.0223 | 301.4103 | 315.7579 | 484.9543 | 720.9083 | 946.3786 | 1134.7844 (97)             |
| Space heating kWh                                                              | 506.3102  | 397.9052  | 342.8076  | 203.6700 | 100.7304 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 201.8947 | 361.8002 | 517.4430 (98a)             |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |          |          |          |          |          |          |          |          | 2632.5612                  |
| 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                                                              | 506.3102  | 397.9052  | 342.8076  | 203.6700 | 100.7304 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 201.8947 | 361.8002 | 517.4430 (98c)             |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |          |          | 2632.5612                  |
| Space heating per m2                                                           |           |           |           |          |          |          |          |          |          |          |          | (98c) / (4) = 37.3466 (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  | 742.2603 | 584.3326 | 599.3579 | 0.0000  | 0.0000  | 0.0000 | 0.0000 (100)   |
| Utilisation                                         | 0.0000                   | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.7985   | 0.8598   | 0.8275   | 0.0000  | 0.0000  | 0.0000 | 0.0000 (101)   |
| Useful loss                                         | 0.0000                   | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 592.7257 | 502.3832 | 495.9476 | 0.0000  | 0.0000  | 0.0000 | 0.0000 (102)   |
| Total gains                                         | 0.0000                   | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 816.6908 | 779.5586 | 718.1438 | 0.0000  | 0.0000  | 0.0000 | 0.0000 (103)   |
| Space cooling kWh                                   |                          |        |        |        |         |          |          |          |         |         |        |                |
|                                                     | 0.0000                   | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 161.2548 | 206.2185 | 165.3140 | 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  | 40.3137  | 51.5546  | 41.3285  | 0.0000  | 0.0000  | 0.0000 | 0.0000 (107)   |
| Space cooling requirement                           |                          |        |        |        |         |          |          |          |         |         |        | 133.1968 (107) |
| Energy for space heating                            |                          |        |        |        |         |          |          |          |         |         |        | 37.3466 (99)   |
| Energy for space cooling                            |                          |        |        |        |         |          |          |          |         |         |        | 1.8896 (108)   |
| Total                                               |                          |        |        |        |         |          |          |          |         |         |        | 39.2362 (109)  |
| Fabric Energy Efficiency (DFEE)                     |                          |        |        |        |         |          |          |          |         |         |        | 39.2 (109)     |

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

### CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

## 1. Overall dwelling characteristics

|                                                        |              |                                   |                        |
|--------------------------------------------------------|--------------|-----------------------------------|------------------------|
| Main dwelling                                          | Area (m2)    | Storey height (m)                 | Volume (m3)            |
| Ground floor                                           | 70.4900 (1b) | x 2.5000 (2b)                     | = 176.2250 (1b) - (3b) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 70.4900      |                                   | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 176.2250 (5)           |

## 2. Ventilation rate

|                                                    |                       |
|----------------------------------------------------|-----------------------|
|                                                    | m3 per hour           |
| Number of open chimneys                            | 0 * 80 = 0.0000 (6a)  |
| Number of open flues                               | 0 * 20 = 0.0000 (6b)  |
| Number of chimneys / flues attached to closed fire | 0 * 10 = 0.0000 (6c)  |
| Number of flues attached to solid fuel boiler      | 0 * 20 = 0.0000 (6d)  |
| Number of flues attached to other heater           | 0 * 35 = 0.0000 (6e)  |
| Number of blocked chimneys                         | 0 * 20 = 0.0000 (6f)  |
| Number of intermittent extract fans                | 3 * 10 = 30.0000 (7a) |
| Number of passive vents                            | 0 * 10 = 0.0000 (7b)  |
| Number of flueless gas fires                       | 0 * 40 = 0.0000 (7c)  |

# Full SAP Calculation Printout



Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 30.0000 / (5) = 0.1702 (8)  
Pressure test Yes  
Pressure Test Method Blower Door  
Measured/design AP50 5.0000 (17)  
Infiltration rate 0.4202 (18)  
Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)  
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3572 (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                                                                                         | 0.4554 | 0.4465 | 0.4376 | 0.3929 | 0.3840 | 0.3393 | 0.3393 | 0.3304 | 0.3572 | 0.3840 | 0.4019 | 0.4197 | (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                                                                                            | 0.6037 | 0.5997 | 0.5957 | 0.5772 | 0.5737 | 0.5576 | 0.5576 | 0.5546 | 0.5638 | 0.5737 | 0.5807 | 0.5881 | (25)  |

## 3. Heat losses and heat loss parameter

| Element                                           | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K | A x U<br>W/K         | K-value<br>kJ/m2K | A x K<br>kJ/K |       |
|---------------------------------------------------|-------------|----------------|---------------|------------------|----------------------|-------------------|---------------|-------|
| Main dwelling                                     |             |                |               |                  |                      |                   |               |       |
| TER Opaque door                                   |             |                | 2.4200        | 1.0000           | 2.4200               |                   |               | (26)  |
| TER Opening Type                                  |             |                | 15.1800       | 1.1450           | 17.3817              |                   |               | (27)  |
| External Wall 1                                   | 43.6300     | 15.1800        | 28.4500       | 0.1800           | 5.1210               |                   |               | (29a) |
| Corridor wall                                     | 29.7300     | 2.4200         | 27.3100       | 0.1800           | 4.9158               |                   |               | (29a) |
| External Roof 1                                   | 70.4900     |                | 70.4900       | 0.1100           | 7.7539               |                   |               | (30)  |
| Total net area of external elements Aum(A, m2)    |             |                | 143.8500      |                  |                      |                   |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)               |             |                |               |                  | (26)...(30) + (32) = | 37.5924           |               | (33)  |
| Main dwelling                                     |             |                |               |                  |                      |                   |               |       |
| Party Wall 1                                      |             |                | 16.4000       | 0.0000           | 0.0000               |                   |               | (32)  |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K |             |                |               |                  |                      |                   | 134.7323      | (35)  |

List of Thermal Bridges

| K1 Element                                                                | Length  | Psi-value | Total                 |              |
|---------------------------------------------------------------------------|---------|-----------|-----------------------|--------------|
| E1 Steel lintel with perforated steel base plate                          | 9.8500  | 0.0500    | 0.4925                |              |
| E4 Jamb                                                                   | 33.6000 | 0.0500    | 1.6800                |              |
| E7 Party floor between dwellings (in blocks of flats)                     | 14.0500 | 0.0700    | 0.9835                |              |
| E7 Party floor between dwellings (in blocks of flats)                     | 11.8900 | 0.0700    | 0.8323                |              |
| E9 Balcony between dwellings, wall insulation continuous                  | 3.4000  | 0.0200    | 0.0680                |              |
| E16 Corner (normal)                                                       | 5.0000  | 0.0900    | 0.4500                |              |
| E16 Corner (normal)                                                       | 5.0000  | 0.0900    | 0.4500                |              |
| E17 Corner (inverted - internal area greater than external area)          | 5.0000  | -0.0900   | -0.4500               |              |
| E18 Party wall between dwellings                                          | 2.5000  | 0.0600    | 0.1500                |              |
| E18 Party wall between dwellings                                          | 2.5000  | 0.0600    | 0.1500                |              |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | 6.5600  | 0.0000    | 0.0000                |              |
| E14 Flat roof                                                             | 29.3400 | 0.0800    | 2.3472                |              |
| P4 Party wall - Roof (insulation at ceiling level)                        | 6.5600  | 0.1200    | 0.7872                |              |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                |         |           |                       | 7.9407 (36)  |
| Point Thermal bridges                                                     |         |           | (36a) =               | 0.0000       |
| Total fabric heat loss                                                    |         |           | (33) + (36) + (36a) = | 45.5331 (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                     | 35.1082 | 34.8740 | 34.6445 | 33.5663 | 33.3645 | 32.4254 | 32.4254 | 32.2515 | 32.7872 | 33.3645 | 33.7726 | 34.1993 | (38) |
| Heat transfer coeff       | 80.6413 | 80.4071 | 80.1776 | 79.0993 | 78.8976 | 77.9585 | 77.9585 | 77.7846 | 78.3202 | 78.8976 | 79.3057 | 79.7324 | (39) |
| Average = Sum(39)m / 12 = |         |         |         |         |         |         |         |         |         |         |         | 79.0984 |      |

|               |        |        |        |        |        |        |        |        |        |        |        |        |      |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |      |
| HLP           | 1.1440 | 1.1407 | 1.1374 | 1.1221 | 1.1193 | 1.1060 | 1.1060 | 1.1035 | 1.1111 | 1.1193 | 1.1251 | 1.1311 | (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 1.1221 |      |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |      |

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

|                                                                 |          |         |         |         |         |         |         |         |         |                                        |         |          |             |
|-----------------------------------------------------------------|----------|---------|---------|---------|---------|---------|---------|---------|---------|----------------------------------------|---------|----------|-------------|
| Assumed occupancy                                               |          |         |         |         |         |         |         |         |         |                                        |         |          | 2.2580 (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  | 0.0000   | (42a)       |
| Hot water usage for baths                                       |          |         |         |         |         |         |         |         |         |                                        |         |          |             |
| 26.8189                                                         | 26.4206  | 25.8597 | 24.8255 | 24.0512 | 23.1925 | 22.7287 | 23.2857 | 23.8921 | 24.8109 | 25.8664                                | 26.7282 | 26.7282  | (42b)       |
| Hot water usage for other uses                                  |          |         |         |         |         |         |         |         |         |                                        |         |          |             |
| 37.7538                                                         | 36.3809  | 35.0081 | 33.6352 | 32.2623 | 30.8895 | 30.8895 | 32.2623 | 33.6352 | 35.0081 | 36.3809                                | 37.7538 | 37.7538  | (42c)       |
| Average daily hot water use (litres/day)                        |          |         |         |         |         |         |         |         |         |                                        |         | 59.1870  | (43)        |
|                                                                 | Jan      | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct                                    | Nov     | Dec      |             |
| Daily hot water use                                             | 64.5727  | 62.8015 | 60.8678 | 58.4607 | 56.3135 | 54.0820 | 53.6182 | 55.5480 | 57.5273 | 59.8189                                | 62.2473 | 64.4820  | (44)        |
| Energy conte                                                    | 102.2674 | 89.4285 | 93.5515 | 80.0298 | 75.8088 | 66.5001 | 64.8465 | 68.7800 | 70.9369 | 81.1737                                | 88.6827 | 100.9633 | (45)        |
| Energy content (annual)                                         |          |         |         |         |         |         |         |         |         | Total = Sum(45)m =                     |         | 982.9692 |             |
| 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  | 0.0000   | (46)        |
| Water storage loss (or HIU loss):                               |          |         |         |         |         |         |         |         |         |                                        |         |          |             |
| Total storage loss                                              | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000   | (56)        |
| If cylinder contains dedicated solar storage                    |          |         |         |         |         |         |         |         |         |                                        |         |          |             |
| 0.0000                                                          | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000   | (57)        |
| Primary loss                                                    | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000   | (59)        |
| Combi loss                                                      | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000   | (61)        |
| Total heat required for water heating calculated for each month |          |         |         |         |         |         |         |         |         |                                        |         |          |             |
| 86.9273                                                         | 76.0143  | 79.5188 | 68.0254 | 64.4375 | 56.5251 | 55.1195 | 58.4630 | 60.2964 | 68.9977 | 75.3803                                | 85.8188 | 85.8188  | (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                                                 |          |         |         |         |         |         |         |         |         |                                        |         |          |             |
| 86.9273                                                         | 76.0143  | 79.5188 | 68.0254 | 64.4375 | 56.5251 | 55.1195 | 58.4630 | 60.2964 | 68.9977 | 75.3803                                | 85.8188 | 85.8188  | (64)        |
| 12Total per year (kWh/year)                                     |          |         |         |         |         |         |         |         |         | Total per year (kWh/year) = Sum(64)m = |         | 835.5238 | (64)        |
| Electric shower(s)                                              |          |         |         |         |         |         |         |         |         |                                        |         | 836      | (64)        |
| 49.7143                                                         | 44.2959  | 48.3694 | 46.1583 | 47.0245 | 44.8568 | 46.3520 | 47.0245 | 46.1583 | 48.3694 | 47.4599                                | 49.7143 | 49.7143  | (64a)       |

# Full SAP Calculation Printout



Heat gains from water heating, kWh/month  
34.1604 30.0775 31.9720 28.5459 27.8655 25.3455 25.3679 26.3719 26.6137 29.3418 30.7100 33.8833 (65)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 565.4976 (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                                                                               | 112.8981 | 112.8981 | 112.8981 | 112.8981 | 112.8981 | 112.8981 | 112.8981 | 112.8981 | 112.8981 | 112.8981 | 112.8981 | 112.8981 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 100.2116 | 110.9485 | 100.2116 | 103.5520 | 100.2116 | 103.5520 | 100.2116 | 100.2116 | 103.5520 | 100.2116 | 103.5520 | 100.2116 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 198.4380 | 200.4971 | 195.3081 | 184.2613 | 170.3166 | 157.2106 | 148.4550 | 146.3959 | 151.5849 | 162.6317 | 176.5764 | 189.6824 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 34.2898  | 34.2898  | 34.2898  | 34.2898  | 34.2898  | 34.2898  | 34.2898  | 34.2898  | 34.2898  | 34.2898  | 34.2898  | 34.2898  | (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)                                 | -90.3185 | -90.3185 | -90.3185 | -90.3185 | -90.3185 | -90.3185 | -90.3185 | -90.3185 | -90.3185 | -90.3185 | -90.3185 | -90.3185 | (71) |
| Water heating gains (Table 5)                                                       | 45.9145  | 44.7582  | 42.9732  | 39.6471  | 37.4536  | 35.2020  | 34.0966  | 35.4461  | 36.9634  | 39.4379  | 42.6528  | 45.5420  | (72) |
| Total internal gains                                                                | 401.4335 | 413.0733 | 395.3623 | 384.3298 | 364.8513 | 352.8341 | 339.6327 | 338.9229 | 348.9697 | 359.1506 | 379.6506 | 392.3054 | (73) |

## 6. Solar gains

| [Jan]       |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c |          |          |          | Access<br>factor<br>Table 6d | Gains<br>W    |  |
|-------------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|----------|----------|----------|------------------------------|---------------|--|
| Northeast   |          |          |          | 9.3500     | 11.2829                        | 0.6300                            | 0.7000                             |          |          |          | 0.7700                       | 32.2408 (75)  |  |
| Southeast   |          |          |          | 5.8300     | 36.7938                        | 0.6300                            | 0.7000                             |          |          |          | 0.7700                       | 65.5564 (77)  |  |
|             |          |          |          |            |                                |                                   |                                    |          |          |          |                              |               |  |
| Solar gains | 97.7972  | 177.2940 | 271.0266 | 383.4937   | 473.0637                       | 488.7853                          | 463.2749                           | 393.5251 | 309.5128 | 203.6172 | 119.0888                     | 82.4321 (83)  |  |
| Total gains | 499.2307 | 590.3673 | 666.3889 | 767.8235   | 837.9150                       | 841.6193                          | 802.9076                           | 732.4481 | 658.4825 | 562.7678 | 498.7394                     | 474.7375 (84) |  |

## 7. Mean internal temperature (heating season)

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

|                                                                    | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |              |
|--------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Utilisation factor for gains for living area, nil,m (see Table 9a) | 32.7144 | 32.8097 | 32.9036 | 33.3522 | 33.4374 | 33.8402 | 33.8402 | 33.9159 | 33.6839 | 33.4374 | 33.2654 | 33.0874 | 21.0000 (85) |
| tau                                                                | 3.1810  | 3.1873  | 3.1936  | 3.2235  | 3.2292  | 3.2560  | 3.2560  | 3.2611  | 3.2456  | 3.2292  | 3.2177  | 3.2058  |              |
| util living area                                                   | 0.9728  | 0.9537  | 0.9201  | 0.8395  | 0.7106  | 0.5435  | 0.4114  | 0.4632  | 0.6842  | 0.8834  | 0.9558  | 0.9765  | (86)         |
| MIT                                                                | 18.9360 | 19.2449 | 19.6805 | 20.2462 | 20.6661 | 20.8994 | 20.9693 | 20.9550 | 20.7825 | 20.2192 | 19.4920 | 18.8925 | (87)         |
| Th 2                                                               | 19.9651 | 19.9677 | 19.9704 | 19.9828 | 19.9851 | 19.9960 | 19.9960 | 19.9980 | 19.9918 | 19.9851 | 19.9804 | 19.9755 | (88)         |
| util rest of house                                                 | 0.9678  | 0.9455  | 0.9056  | 0.8111  | 0.6618  | 0.4722  | 0.3237  | 0.3717  | 0.6159  | 0.8559  | 0.9464  | 0.9721  | (89)         |
| MIT 2                                                              | 18.0951 | 18.4000 | 18.8259 | 19.3704 | 19.7457 | 19.9397 | 19.9843 | 19.9795 | 19.8565 | 19.3604 | 18.6561 | 18.0596 | (90)         |
| Living area fraction                                               | 18.4793 | 18.7861 | 19.2164 | 19.7706 | 20.1663 | 20.3782 | 20.4344 | 20.4252 | 20.2797 | 19.7528 | 19.0381 | 18.4402 | (91)         |
| MIT                                                                | 18.4793 | 18.7861 | 19.2164 | 19.7706 | 20.1663 | 20.3782 | 20.4344 | 20.4252 | 20.2797 | 19.7528 | 19.0381 | 18.4402 | (92)         |
| Temperature adjustment                                             | 18.4793 | 18.7861 | 19.2164 | 19.7706 | 20.1663 | 20.3782 | 20.4344 | 20.4252 | 20.2797 | 19.7528 | 19.0381 | 18.4402 | (93)         |
| adjusted MIT                                                       | 18.4793 | 18.7861 | 19.2164 | 19.7706 | 20.1663 | 20.3782 | 20.4344 | 20.4252 | 20.2797 | 19.7528 | 19.0381 | 18.4402 | (93)         |

## 8. Space heating requirement

|                                                                                | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov      | Dec       |       |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|---------------|----------|-----------|-------|
| Utilisation                                                                    | 0.9583    | 0.9336    | 0.8929    | 0.8045   | 0.6711   | 0.5003   | 0.3628   | 0.4117   | 0.6367   | 0.8486        | 0.9355   | 0.9635    | (94)  |
| Useful gains                                                                   | 478.4314  | 551.1477  | 595.0375  | 617.6986 | 562.2922 | 421.0519 | 291.2900 | 301.5755 | 419.2562 | 477.5722      | 466.5771 | 457.4200  | (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                                                               | 1143.4385 | 1116.5396 | 1019.5696 | 859.8579 | 667.9699 | 450.4632 | 298.9224 | 313.0999 | 483.9928 | 722.1362      | 946.7573 | 1135.4053 | (97)  |
| Space heating kWh                                                              | 494.7653  | 379.9433  | 315.8519  | 174.3547 | 78.6242  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 181.9556      | 345.7298 | 504.4211  | (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |          |          |          |          |          |          |               |          | 2475.6460 |       |
| 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                                                              | 494.7653  | 379.9433  | 315.8519  | 174.3547 | 78.6242  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 181.9556      | 345.7298 | 504.4211  | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |               |          | 2475.6460 |       |
| Space heating per m <sup>2</sup>                                               |           |           |           |          |          |          |          |          |          | (98c) / (4) = |          | 35.1205   | (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  | 732.8100 | 576.8930 | 591.1630 | 0.0000                   | 0.0000  | 0.0000 | 0.0000   | (100) |
| Utilisation                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.8519   | 0.9013   | 0.8730   | 0.0000                   | 0.0000  | 0.0000 | 0.0000   | (101) |
| Useful loss                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 624.2775 | 519.9513 | 516.1088 | 0.0000                   | 0.0000  | 0.0000 | 0.0000   | (102) |
| Total gains                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 945.8853 | 902.6007 | 822.1918 | 0.0000                   | 0.0000  | 0.0000 | 0.0000   | (103) |
| Space cooling kWh                | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 231.5576 | 284.6911 | 227.7257 | 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  | 57.8894  | 71.1728  | 56.9314  | 0.0000                   | 0.0000  | 0.0000 | 0.0000   | (107) |
| Space cooling requirement        |        |        |        |        |         |          |          |          |                          |         |        | 185.9936 | (107) |
| Energy for space heating         |        |        |        |        |         |          |          |          |                          |         |        | 35.1205  | (99)  |
| Energy for space cooling         |        |        |        |        |         |          |          |          |                          |         |        | 2.6386   | (108) |

Total  
Fabric Energy Efficiency (TFEE)

37.7591 (109)  
37.8 (109)