

# Summary for Input Data



|                      |          |                |            |
|----------------------|----------|----------------|------------|
| Plot Reference       | A 901    | Issued on Date | 19/03/2026 |
| Assessment Reference | Be Green | Plot Type Ref  |            |
| Plot Address         |          | SAP Version    | 10.2       |

|                                    |          |               |       |      |       |
|------------------------------------|----------|---------------|-------|------|-------|
| SAP Rating                         | 82 B     | DER           | 5.22  | TER  | 14.68 |
| Environmental                      | 96 A     | % DER < TER   |       |      | 64.44 |
| CO <sub>2</sub> Emissions (t/year) | 0.34     | DFEE          | 35.93 | TFEE | 37.39 |
| Compliance Check                   | See BREL | % DFEE < TFEE |       |      | 3.90  |
| % DPER < TPER                      | 30.67    | DPER          | 55.04 | TPER | 79.40 |

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

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

|                                |                     |        |
|--------------------------------|---------------------|--------|
| Orientation                    | Southeast           |        |
| Property Tenture               | 1                   |        |
| Transaction Type               | 6                   |        |
| Terrain Type                   | Suburban            |        |
| 1.0 Property Type              | Flat, Semi-Detached |        |
| Position of Flat               | Top-floor flat      |        |
| Which Floor                    | 9                   |        |
| 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                   | 149.69              | kJ/m²K |
|                                |                     |        |
| 7.0 Electricity Tariff         | Standard            |        |
| Smart electricity meter fitted | Yes                 |        |
| Smart gas meter fitted         | Yes                 |        |

| 7.0 Measurements | Ground floor: | Heat Loss Perimeter | Internal Floor Area  | Average Storey Height |
|------------------|---------------|---------------------|----------------------|-----------------------|
|                  |               | 28.77 m             | 72.54 m <sup>2</sup> | 2.80 m                |

|                 |       |                |
|-----------------|-------|----------------|
| 8.0 Living Area | 34.33 | m <sup>2</sup> |
|-----------------|-------|----------------|

| 9.0 External Walls | Description     | Type        | Construction                                                                 | U-Value (W/m <sup>2</sup> K) | Kappa (kJ/m <sup>2</sup> K) | Gross Area(m <sup>2</sup> ) | Nett Area (m <sup>2</sup> ) | Shelter Res | Shelter                     | Openings | Area Calculation Type |
|--------------------|-----------------|-------------|------------------------------------------------------------------------------|------------------------------|-----------------------------|-----------------------------|-----------------------------|-------------|-----------------------------|----------|-----------------------|
|                    | External Wall 1 | Cavity Wall | Cavity wall : dense plaster, AAC block, filled cavity, any outside structure | 0.15                         | 70.00                       | 48.38                       | 37.31                       | 0.00        | None                        | 11.07    | Enter Gross Area      |
|                    | Corridor wall   | Cavity Wall | Cavity wall : dense plaster, AAC block, filled cavity, any outside structure | 0.22                         | 70.00                       | 32.17                       | 29.75                       | 0.70        | Stairwell Access Corridor 3 | 2.42     | Enter Gross Area      |

| 9.1 Party Walls | Description  | Type                            | Construction                                                                   | U-Value (W/m <sup>2</sup> K) | Kappa (kJ/m <sup>2</sup> K) | Area (m <sup>2</sup> ) | Shelter Res | Shelter |
|-----------------|--------------|---------------------------------|--------------------------------------------------------------------------------|------------------------------|-----------------------------|------------------------|-------------|---------|
|                 | Party Wall 1 | Filled Cavity with Edge Sealing | Single plasterboard on dabs on both sides, dense blocks, cavity or cavity fill | 0.00                         | 70.00                       | 16.20                  | 0.00        | None    |

| 9.2 Internal Walls | Description     | Construction                 | Kappa (kJ/m <sup>2</sup> K) | Area (m <sup>2</sup> ) |
|--------------------|-----------------|------------------------------|-----------------------------|------------------------|
|                    | Internal Wall 1 | Plasterboard on timber frame | 9.00                        | 164.02                 |

| 10.0 External Roofs | Description     | Type               | Construction                      | U-Value (W/m <sup>2</sup> K) | Kappa (kJ/m <sup>2</sup> K) | Gross Area(m <sup>2</sup> ) | Nett Area (m <sup>2</sup> ) | Shelter Code | Shelter Factor | Calculation Type | Openings |
|---------------------|-----------------|--------------------|-----------------------------------|------------------------------|-----------------------------|-----------------------------|-----------------------------|--------------|----------------|------------------|----------|
|                     | External Roof 1 | External Flat Roof | Plasterboard, insulated flat roof | 0.10                         | 9.00                        | 72.54                       | 72.54                       | 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          | 72.54     |

### 12.0 Opening Types

| Description | Data Source  | Type             | Glazing               | Glazing Gap | Filling Type | G-value | Frame Type | Frame Factor | U Value (W/m²K) |
|-------------|--------------|------------------|-----------------------|-------------|--------------|---------|------------|--------------|-----------------|
| Windows     | Manufacturer | Window           | Double Low-E Soft 0.1 |             |              | 0.35    |            | 0.70         | 1.20            |
| Door        | Manufacturer | Door to Corridor |                       |             |              | 0.00    |            |              | 1.00            |

### 13.0 Openings

| Name       | Opening Type | Location        | Orientation | Area (m²) | Pitch |
|------------|--------------|-----------------|-------------|-----------|-------|
| Door       | Door         | Corridor wall   | South East  | 2.42      |       |
| NW windows | Windows      | External Wall 1 | North West  | 3.74      |       |
| SW windows | Windows      | External Wall 1 | South West  | 7.33      |       |

### 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 | 6.90   | 0.05 | 0.05                | No       |
| E4 Jamb                                                                   | Independently assessed | 18.60  | 0.04 | 0.04                | No       |
| E7 Party floor between dwellings (in blocks of flats)                     | Independently assessed | 12.92  | 0.05 | 0.05                | No       |
| E7 Party floor between dwellings (in blocks of flats)                     | Independently assessed | 11.49  | 0.04 | 0.04                | No       |
| E9 Balcony between dwellings, wall insulation continuous                  | Independently assessed | 4.36   | 0.05 | 0.05                | No       |
| E16 Corner (normal)                                                       | Independently assessed | 5.60   | 0.05 | 0.05                | No       |
| E16 Corner (normal)                                                       | Independently assessed | 2.80   | 0.04 | 0.04                | No       |
| E17 Corner (inverted – internal area greater than external area)          | Table K1 - Default     | 2.80   | 0.00 | 0.00                | No       |
| E18 Party wall between dwellings                                          | Independently assessed | 2.80   | 0.05 | 0.05                | No       |
| E18 Party wall between dwellings                                          | Independently assessed | 2.80   | 0.04 | 0.04                | No       |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | Table K1 - Default     | 5.79   | 0.00 | 0.00                | No       |
| E3 Sill                                                                   | Independently assessed | 3.41   | 0.04 | 0.04                | No       |
| E14 Flat roof                                                             | Independently assessed | 28.77  | 0.05 | 0.05                | No       |
| P4 Party wall - Roof (insulation at ceiling level)                        | Independently assessed | 5.79   | 0.05 | 0.05                | No       |

Y-value

0.03

 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

# Summary for Input Data

Number of intermittent extract fans

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>3</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  | 6     |

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

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Diverter

No

Battery Capacity [kWh]

0.00

**PV Cells kWp**

**Orientation**

**Elevation**

**Overshading**

**FGHRS**

**MCS Certificate**

**Overshading  
Factor**

**MCS  
Certificate  
Reference**

**Panel  
Manufacturer**

0.35

South 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                     | A 901             |  |               |               | Issued on Date | 19/03/2026 |       |
| Assessment Reference               | Be Green          |  |               | Plot Type Ref |                |            |       |
| Plot Address                       |                   |  |               |               | SAP Version    | 10.2       |       |
|                                    |                   |  |               |               |                |            |       |
| SAP Rating                         | 82 B              |  | DER           | 5.22          |                | TER        | 14.68 |
| Environmental                      | 96 A              |  | % DER < TER   |               |                |            | 64.44 |
| CO <sub>2</sub> Emissions (t/year) | 0.34              |  | DFEE          | 35.93         |                | TFEE       | 37.39 |
| Compliance Check                   | See BREL          |  | % DFEE < TFEE |               |                |            | 3.90  |
| % DPER < TPER                      | 30.67             |  | DPER          | 55.04         |                | TPER       | 79.40 |
|                                    |                   |  |               |               |                |            |       |
| 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                                           | 72.5400 (1b)              | 2.8000 (2b)                     | 203.1120 (1b) - (3b)        |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 72.5400                   |                                 |                             |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | 203.1120 (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                                                  |                         |                            |                           |                               |              |                                      |                 |
| Windows                                                        |                         |                            | 11.0700                   | 1.1450                        | 12.6756      |                                      | (27)            |
| Door                                                           |                         |                            | 2.4200                    | 1.0000                        | 2.4200       |                                      | (26)            |
| External Wall 1                                                | 48.3800                 | 11.0700                    | 37.3100                   | 0.1500                        | 5.5965       | 70.0000                              | 2611.7001 (29a) |
| Corridor wall                                                  | 32.1700                 | 2.4200                     | 29.7500                   | 0.1900                        | 5.6525       | 70.0000                              | 2082.4999 (29a) |
| External Roof 1                                                | 72.5400                 |                            | 72.5400                   | 0.1000                        | 7.2540       | 9.0000                               | 652.8600 (30)   |
| Total net area of external elements Aum(A, m <sup>2</sup> )    |                         |                            | 153.0900                  |                               |              |                                      | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                            |                         |                            |                           | (26)...(30) + (32) =          | 33.5986      |                                      | (33)            |
| Main dwelling                                                  |                         |                            |                           |                               |              |                                      |                 |
| Party Wall 1                                                   |                         |                            | 16.2000                   | 0.0000                        | 0.0000       | 70.0000                              | 1134.0001 (32)  |
| Party Floor 1                                                  |                         |                            | 72.5400                   |                               |              | 40.0000                              | 2901.6000 (32d) |
| Internal Wall 1                                                |                         |                            | 164.0200                  |                               |              | 9.0000                               | 1476.1800 (32c) |
| Heat capacity Cm = Sum(A x k)                                  |                         |                            |                           |                               |              | (28)...(30) + (32) + (32a)...(32e) = | 10858.8400 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K |                         |                            |                           |                               |              |                                      | 149.6945 (35)   |
| List of Thermal Bridges                                        |                         |                            |                           |                               |              |                                      |                 |

# Full SAP Calculation Printout



|                                                                           |         |                       |              |
|---------------------------------------------------------------------------|---------|-----------------------|--------------|
| K1 Element                                                                | Length  | Psi-value             | Total        |
| E1 Steel lintel with perforated steel base plate                          | 6.9000  | 0.0500                | 0.3450       |
| E4 Jamb                                                                   | 18.6000 | 0.0400                | 0.7440       |
| E7 Party floor between dwellings (in blocks of flats)                     | 12.9200 | 0.0500                | 0.6460       |
| E7 Party floor between dwellings (in blocks of flats)                     | 11.4900 | 0.0390                | 0.4481       |
| E9 Balcony between dwellings, wall insulation continuous                  | 4.3600  | 0.0500                | 0.2180       |
| E16 Corner (normal)                                                       | 5.6000  | 0.0500                | 0.2800       |
| E16 Corner (normal)                                                       | 2.8000  | 0.0390                | 0.1092       |
| E17 Corner (inverted - internal area greater than external area)          | 2.8000  | 0.0000                | 0.0000       |
| E18 Party wall between dwellings                                          | 2.8000  | 0.0500                | 0.1400       |
| E18 Party wall between dwellings                                          | 2.8000  | 0.0390                | 0.1092       |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | 5.7900  | 0.0000                | 0.0000       |
| E3 Sill                                                                   | 3.4100  | 0.0400                | 0.1364       |
| E14 Flat roof                                                             | 28.7700 | 0.0500                | 1.4385       |
| P4 Party wall - Roof (insulation at ceiling level)                        | 5.7900  | 0.0500                | 0.2895       |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                |         |                       | 4.9039 (36)  |
| Point Thermal bridges                                                     |         |                       | 0.0000       |
| Total fabric heat loss                                                    |         | (33) + (36) + (36a) = | 38.5025 (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                                                               | 17.5653 | 17.3516 | 17.1380 | 16.0697 | 15.8561 | 14.7878 | 14.7878 | 14.5742 | 15.2151 | 15.8561 | 16.2834 | 16.7107 | (38) |
| Heat transfer coeff                                                 | 56.0677 | 55.8541 | 55.6404 | 54.5722 | 54.3585 | 53.2903 | 53.2903 | 53.0767 | 53.7176 | 54.3585 | 54.7858 | 55.2131 | (39) |
| Average = Sum(39)m / 12 =                                           |         |         |         |         |         |         |         |         |         |         |         | 54.5188 |      |
| HLP                                                                 | 0.7729  | 0.7700  | 0.7670  | 0.7523  | 0.7494  | 0.7346  | 0.7346  | 0.7317  | 0.7405  | 0.7494  | 0.7553  | 0.7611  | (40) |
| HLP (average)                                                       |         |         |         |         |         |         |         |         |         |         |         | 0.7516  |      |
| Days in mont                                                        | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31      |      |

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

|                                                                                |          |          |          |          |          |          |          |          |          |                                        |          |           |             |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------------------------------|----------|-----------|-------------|
| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |                                        |          |           | 2.3062 (42) |
| Hot water usage for mixer showers                                              | 61.2978  | 60.3594  | 58.9763  | 56.8487  | 54.9425  | 52.2756  | 50.1663  | 52.6322  | 53.8725  | 56.5139                                | 59.2647  | 61.2426   | (42a)       |
| Hot water usage for baths                                                      | 26.5609  | 26.1600  | 25.5896  | 24.7354  | 23.9655  | 22.9058  | 22.1018  | 23.0849  | 23.6009  | 24.6510                                | 25.7427  | 26.5399   | (42b)       |
| Hot water usage for other uses                                                 | 38.2476  | 36.8567  | 35.4659  | 34.0751  | 32.6843  | 31.2935  | 31.2935  | 32.6843  | 34.0751  | 35.4659                                | 36.8567  | 38.2476   | (42c)       |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |                                        |          | 115.9107  | (43)        |
| Daily hot water use                                                            | 126.1064 | 123.3761 | 120.0319 | 115.6592 | 111.5923 | 106.4749 | 103.5615 | 108.4014 | 111.5485 | 116.6308                               | 121.8641 | 126.0300  | (44)        |
| Energy conte                                                                   | 185.6503 | 163.2516 | 171.5231 | 151.0799 | 143.7980 | 123.1346 | 114.4386 | 127.5905 | 129.3907 | 150.2905                               | 164.7034 | 185.0843  | (45)        |
| Energy content (annual)                                                        |          |          |          |          |          |          |          |          |          | Total = Sum(45)m =                     |          | 1809.9354 |             |
| Distribution loss (46)m = 0.15 x (45)m                                         | 27.8476  | 24.4877  | 25.7285  | 22.6620  | 21.5697  | 18.4702  | 17.1658  | 19.1386  | 19.4086  | 22.5436                                | 24.7055  | 27.7626   | (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                | 240.9271 | 213.1790 | 226.7999 | 204.5735 | 199.0748 | 176.6283 | 169.7154 | 182.8673 | 182.8843 | 205.5674                               | 218.1971 | 240.3611  | (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                                                                | 240.9271 | 213.1790 | 226.7999 | 204.5735 | 199.0748 | 176.6283 | 169.7154 | 182.8673 | 182.8843 | 205.5674                               | 218.1971 | 240.3611  | (64)        |
| Total per year (kWh/year)                                                      |          |          |          |          |          |          |          |          |          | Total per year (kWh/year) = Sum(64)m = |          | 2460.7752 | (64)        |
| Electric shower(s)                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000    | (64a)       |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |                                        |          | 0.0000    | (64a)       |
| Heat gains from water heating, kWh/month                                       | 105.9502 | 94.2231  | 101.2529 | 93.0290  | 92.0343  | 83.7372  | 82.2723  | 86.6453  | 85.8173  | 94.1930                                | 97.5588  | 105.7620  | (65)        |

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

|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |          |      |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| Metabolic gains (Table 5), Watts                                                    | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |      |
| (66)m                                                                               | 115.3089 | 115.3089 | 115.3089 | 115.3089 | 115.3089 | 115.3089 | 115.3089 | 115.3089 | 115.3089 | 115.3089 | 115.3089 | 115.3089 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 107.9293 | 119.4931 | 107.9293 | 111.5269 | 107.9293 | 111.5269 | 107.9293 | 107.9293 | 111.5269 | 107.9293 | 111.5269 | 107.9293 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 203.1512 | 205.2592 | 199.9470 | 188.6378 | 174.3619 | 160.9446 | 151.9811 | 149.8730 | 155.1853 | 166.4945 | 180.7703 | 194.1876 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 34.5309  | 34.5309  | 34.5309  | 34.5309  | 34.5309  | 34.5309  | 34.5309  | 34.5309  | 34.5309  | 34.5309  | 34.5309  | 34.5309  | (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)                                 | -92.2471 | -92.2471 | -92.2471 | -92.2471 | -92.2471 | -92.2471 | -92.2471 | -92.2471 | -92.2471 | -92.2471 | -92.2471 | -92.2471 | (71) |
| Water heating gains (Table 5)                                                       | 142.4062 | 140.2129 | 136.0926 | 129.2069 | 123.7020 | 116.3017 | 110.5810 | 116.4587 | 119.1908 | 126.6036 | 135.4984 | 142.1532 | (72) |
| Total internal gains                                                                | 511.0792 | 522.5579 | 501.5614 | 486.9643 | 463.5858 | 446.3659 | 428.0840 | 431.8536 | 443.4956 | 458.6200 | 485.3883 | 501.8627 | (73) |

## 6. Solar gains

| [Jan] | Area<br>m2 | Solar flux<br>Table 6a | g<br>Specific data | FF<br>Specific data | Access<br>factor | Gains<br>W |
|-------|------------|------------------------|--------------------|---------------------|------------------|------------|
|-------|------------|------------------------|--------------------|---------------------|------------------|------------|

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|                                                                                         |               |          |          |          | W/m2     | or Table 6b |          | or Table 6c |                     | Table 6d |          |                 |                 |
|-----------------------------------------------------------------------------------------|---------------|----------|----------|----------|----------|-------------|----------|-------------|---------------------|----------|----------|-----------------|-----------------|
| Southwest                                                                               |               |          |          |          | 7.3300   | 36.7938     |          | 0.3500      |                     | 0.7000   |          | 0.7700          | 45.7908 (79)    |
| Northwest                                                                               |               |          |          |          | 3.7400   | 11.2829     |          | 0.3500      |                     | 0.7000   |          | 0.7700          | 7.1646 (81)     |
|                                                                                         |               |          |          |          |          |             |          |             |                     |          |          |                 |                 |
| Solar gains                                                                             | 52.9554       | 92.5825  | 132.9966 | 175.3844 | 206.1160 | 208.8794    | 199.6118 | 176.0343    | 147.5734            | 104.0277 | 63.8618  | 45.0384 (83)    |                 |
| Total gains                                                                             | 564.0347      | 615.1404 | 634.5580 | 662.3487 | 669.7018 | 655.2453    | 627.6957 | 607.8879    | 591.0690            | 562.6477 | 549.2500 | 546.9011 (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                                                                                     | 53.7982       | 54.0040  | 54.2114  | 55.2726  | 55.4898  | 56.6021     | 56.6021  | 56.8300     | 56.1519             | 55.4898  | 55.0570  | 54.6309         |                 |
| alpha                                                                                   | 4.5865        | 4.6003   | 4.6141   | 4.6848   | 4.6993   | 4.7735      | 4.7735   | 4.7887      | 4.7435              | 4.6993   | 4.6705   | 4.6421          |                 |
| util living area                                                                        | 0.9587        | 0.9375   | 0.9048   | 0.8228   | 0.6931   | 0.5092      | 0.3714   | 0.3986      | 0.5996              | 0.8265   | 0.9281   | 0.9628 (86)     |                 |
| MIT                                                                                     | 20.0481       | 20.2231  | 20.4392  | 20.7208  | 20.8997  | 20.9820     | 20.9967  | 20.9955     | 20.9606             | 20.7569  | 20.3911  | 20.0316 (87)    |                 |
| Th 2                                                                                    | 20.2769       | 20.2794  | 20.2820  | 20.2949  | 20.2974  | 20.3103     | 20.3103  | 20.3129     | 20.3052             | 20.2974  | 20.2923  | 20.2871 (88)    |                 |
| util rest of house                                                                      | 0.9520        | 0.9278   | 0.8900   | 0.7971   | 0.6532   | 0.4579      | 0.3141   | 0.3403      | 0.5471              | 0.7966   | 0.9156   | 0.9567 (89)     |                 |
| MIT 2                                                                                   | 19.1689       | 19.3885  | 19.6569  | 20.0032  | 20.2045  | 20.2971     | 20.3086  | 20.3104     | 20.2741             | 20.0521  | 19.6099  | 19.1563 (90)    |                 |
| Living area fraction                                                                    |               |          |          |          |          |             |          |             | fLA = Living area / | (4) =    |          | 0.4733 (91)     |                 |
| MIT                                                                                     | 19.5850       | 19.7835  | 20.0272  | 20.3428  | 20.5335  | 20.6212     | 20.6343  | 20.6346     | 20.5990             | 20.3857  | 19.9796  | 19.5705 (92)    |                 |
| Temperature adjustment                                                                  |               |          |          |          |          |             |          |             |                     |          |          | 0.0000          |                 |
| adjusted MIT                                                                            | 19.5850       | 19.7835  | 20.0272  | 20.3428  | 20.5335  | 20.6212     | 20.6343  | 20.6346     | 20.5990             | 20.3857  | 19.9796  | 19.5705 (93)    |                 |
|                                                                                         |               |          |          |          |          |             |          |             |                     |          |          |                 |                 |
| 8. Space heating requirement                                                            |               |          |          |          |          |             |          |             |                     |          |          |                 |                 |
|                                                                                         |               |          |          |          |          |             |          |             |                     |          |          |                 |                 |
|                                                                                         | Jan           | Feb      | Mar      | Apr      | May      | Jun         | Jul      | Aug         | Sep                 | Oct      | Nov      | Dec             |                 |
| Utilisation                                                                             | 0.9444        | 0.9201   | 0.8842   | 0.7990   | 0.6670   | 0.4813      | 0.3411   | 0.3677      | 0.5697              | 0.8006   | 0.9093   | 0.9495 (94)     |                 |
| Useful gains                                                                            | 532.7005      | 566.0179 | 561.0697 | 529.2029 | 446.6890 | 315.3623    | 214.1372 | 223.5480    | 336.7504            | 450.4711 | 499.4429 | 519.2927 (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                                                                        | 856.9948      | 831.3035 | 752.6566 | 624.4605 | 480.1773 | 320.8721    | 214.9882 | 224.7597    | 349.1094            | 531.9338 | 705.6180 | 848.6554 (97)   |                 |
| Space heating kWh                                                                       | 241.2749      | 178.2719 | 142.5406 | 68.5854  | 24.9153  | 0.0000      | 0.0000   | 0.0000      | 0.0000              | 60.6082  | 148.4461 | 245.0459 (98a)  |                 |
| Space heating requirement - total per year (kWh/year)                                   |               |          |          |          |          |             |          |             |                     |          |          | 1109.6884       |                 |
| 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                                                                       | 241.2749      | 178.2719 | 142.5406 | 68.5854  | 24.9153  | 0.0000      | 0.0000   | 0.0000      | 0.0000              | 60.6082  | 148.4461 | 245.0459 (98c)  |                 |
| Space heating requirement after solar contribution - total per year (kWh/year)          |               |          |          |          |          |             |          |             |                     |          |          | 1109.6884       |                 |
| Space heating per m2                                                                    | (98c) / (4) = |          |          |          |          |             |          |             |                     |          |          | 15.2976 (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                                                               |               |          |          |          |          |             |          |             |                     |          |          |                 |                 |
| Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.50                                   |               |          |          |          |          |             |          |             |                     |          |          |                 | 245.0459 (98)   |
| 307a                                                                                    | 361.9124      | 267.4079 | 213.8109 | 102.8781 | 37.3729  | 0.0000      | 0.0000   | 0.0000      | 0.0000              | 90.9123  | 222.6691 | 367.5688        |                 |
| Space heating requirement                                                               |               |          |          |          |          |             |          |             |                     |          |          |                 |                 |
|                                                                                         | 361.9124      | 267.4079 | 213.8109 | 102.8781 | 37.3729  | 0.0000      | 0.0000   | 0.0000      | 0.0000              | 90.9123  | 222.6691 | 367.5688 (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                                                        |               |          |          |          |          |             |          |             |                     |          |          |                 |                 |
|                                                                                         | 240.9271      | 213.1790 | 226.7999 | 204.5735 | 199.0748 | 176.6283    | 169.7154 | 182.8673    | 182.8843            | 205.5674 | 218.1971 | 240.3611 (64)   |                 |
| Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.50                                   |               |          |          |          |          |             |          |             |                     |          |          |                 |                 |
| 310a                                                                                    | 361.3907      | 319.7685 | 340.1998 | 306.8603 | 298.6122 | 264.9425    | 254.5730 | 274.3009    | 274.3265            | 308.3510 | 327.2957 | 360.5417        |                 |
| Water heating fuel                                                                      |               |          |          |          |          |             |          |             |                     |          |          |                 |                 |
|                                                                                         | 361.3907      | 319.7685 | 340.1998 | 306.8603 | 298.6122 | 264.9425    | 254.5730 | 274.3009    | 274.3265            | 308.3510 | 327.2957 | 360.5417 (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                                                                            | 16.0474       | 14.4944  | 16.0474  | 15.5297  | 16.0474  | 15.5297     | 16.0474  | 16.0474     | 15.5297             | 16.0474  | 15.5297  | 16.0474 (331)   |                 |
| Lighting                                                                                | 24.4481       | 19.6132  | 17.6595  | 12.9381  | 9.9938   | 8.1650      | 9.1166   | 11.8502     | 15.3922             | 20.1954  | 22.8106  | 25.1276 (332)   |                 |
| Electricity generated by PVs (Appendix M) (negative quantity)                           |               |          |          |          |          |             |          |             |                     |          |          |                 |                 |
| (333a)m                                                                                 | -3.8380       | -6.8141  | -12.5720 | -17.6936 | -22.1173 | -21.8123    | -21.3574 | -18.3819    | -13.8209            | -8.8862  | -4.6090  | -3.1332 (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                                                  |               |          |          |          |          |             |          |             |                     |          |          | 1664.5327 (307) |                 |
| Space heating fuel - secondary                                                          |               |          |          |          |          |             |          |             |                     |          |          | 0.0000 (309)    |                 |
| Water heating fuel - community heating                                                  |               |          |          |          |          |             |          |             |                     |          |          | 3691.1628 (310) |                 |
| Efficiency of water heater                                                              |               |          |          |          |          |             |          |             |                     |          |          | 0.0000 (311)    |                 |
| Electricity used for heat distribution                                                  |               |          |          |          |          |             |          |             |                     |          |          | 16.6453 (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)                                              |               |          |          |          |          |             |          |             |                     |          |          |                 | 188.9449 (330a) |

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|                                                               |                 |
|---------------------------------------------------------------|-----------------|
| Total electricity for the above, kWh/year                     | 188.9449 (331)  |
| Electricity for lighting (calculated in Appendix L)           | 197.3102 (332)  |
| Energy saving/generation technologies (Appendices M ,N and Q) |                 |
| PV generation                                                 | -155.0359 (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                           | 5586.9147 (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                  | 2308.4894          | 0.1562                        | 112.0844 (367)           |
| Electrical energy for heat distribution (space & water) | 16.6453            | 0.0000                        | 7.7982 (372)             |
| Overall CO2 factor for heat network                     |                    |                               | 0.0642 (386)             |
| Total CO2 associated with community systems             |                    |                               | 343.9274 (373)           |
| Space and water heating                                 |                    |                               | 343.9274 (376)           |
| Pumps, fans and electric keep-hot                       | 188.9449           | 0.1387                        | 26.2090 (378)            |
| Energy for lighting                                     | 197.3102           | 0.1443                        | 28.4780 (379)            |
| Energy saving/generation technologies                   |                    |                               |                          |
| PV Unit electricity used in dwelling                    | -155.0359          | 0.1305                        | -20.2373                 |
| PV Unit electricity exported                            | 0.0000             | 0.0000                        | 0.0000                   |
| Total                                                   |                    |                               | -20.2373 (380)           |
| Total CO2, kg/year                                      |                    |                               | 378.3770 (383)           |
| EPC Dwelling Carbon Dioxide Emission Rate (DER)         |                    |                               | 5.2200 (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                  | 2308.4894          | 1.5784                              | 1132.4260 (467)            |
| Electrical energy for heat distribution (space & water) | 16.6453            | 0.0000                              | 82.4035 (472)              |
| Overall CO2 factor for heat network                     |                    |                                     | 0.6786 (486)               |
| Total CO2 associated with community systems             |                    |                                     | 3634.2763 (473)            |
| Space and water heating                                 |                    |                                     | 3634.2763 (476)            |
| Pumps, fans and electric keep-hot                       | 188.9449           | 1.5128                              | 285.8359 (478)             |
| Energy for lighting                                     | 197.3102           | 1.5338                              | 302.6410 (479)             |
| Energy saving/generation technologies                   |                    |                                     |                            |
| PV Unit electricity used in dwelling                    | -155.0359          | 1.4822                              | -229.7928                  |
| PV Unit electricity exported                            | 0.0000             | 0.0000                              | 0.0000                     |
| Total                                                   |                    |                                     | -229.7928 (480)            |
| Total Primary energy kWh/year                           |                    |                                     | 3992.9604 (483)            |
| Dwelling Primary energy Rate (DPER)                     |                    |                                     | 55.0400 (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                                          | 72.5400 (1b) | 2.8000 (2b)                       | 203.1120 (1b) - (3b) |
| Ground floor                                           |              |                                   |                      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 72.5400      |                                   | (4)                  |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 203.1120 (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) = 0.1477 (8)              |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 5.0000 (17)                             |
| Infiltration rate                                                                                  | 0.3977 (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) = 0.3380 (21)        |

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|                 |               |               |               |               |               |               |               |               |               |               |               |                    |
|-----------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|--------------------|
| Wind speed      | Jan<br>5.1000 | Feb<br>5.0000 | Mar<br>4.9000 | Apr<br>4.4000 | May<br>4.3000 | Jun<br>3.8000 | Jul<br>3.8000 | Aug<br>3.7000 | Sep<br>4.0000 | Oct<br>4.3000 | Nov<br>4.5000 | Dec<br>4.7000 (22) |
| Wind factor     | 1.2750        | 1.2500        | 1.2250        | 1.1000        | 1.0750        | 0.9500        | 0.9500        | 0.9250        | 1.0000        | 1.0750        | 1.1250        | 1.1750 (22a)       |
| Adj infilt rate |               |               |               |               |               |               |               |               |               |               |               |                    |
| Effective ac    | 0.4310        | 0.4226        | 0.4141        | 0.3719        | 0.3634        | 0.3211        | 0.3211        | 0.3127        | 0.3380        | 0.3634        | 0.3803        | 0.3972 (22b)       |
|                 | 0.5929        | 0.5893        | 0.5857        | 0.5691        | 0.5660        | 0.5516        | 0.5516        | 0.5489        | 0.5571        | 0.5660        | 0.5723        | 0.5789 (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                                  |             |                | 11.0700       | 1.1450               | 12.6756      |                   | (27)          |
| External Wall 1                                   | 48.3800     | 11.0700        | 37.3100       | 0.1800               | 6.7158       |                   | (29a)         |
| Corridor wall                                     | 32.1700     | 2.4200         | 29.7500       | 0.1800               | 5.3550       |                   | (29a)         |
| External Roof 1                                   | 72.5400     |                | 72.5400       | 0.1100               | 7.9794       |                   | (30)          |
| Total net area of external elements Aum(A, m2)    |             |                | 153.0900      |                      |              |                   | (31)          |
| Fabric heat loss, W/K = Sum (A x U)               |             |                |               | (26)...(30) + (32) = | 35.1458      |                   | (33)          |
| Main dwelling                                     |             |                |               |                      |              |                   |               |
| Party Wall 1                                      |             |                | 16.2000       | 0.0000               | 0.0000       |                   | (32)          |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K |             |                |               |                      |              |                   | 149.6945 (35) |

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

## List of Thermal Bridges

| K1 Element                                                                | Length  | Psi-value             | Total          |
|---------------------------------------------------------------------------|---------|-----------------------|----------------|
| E1 Steel lintel with perforated steel base plate                          | 6.9000  | 0.0500                | 0.3450         |
| E4 Jamb                                                                   | 18.6000 | 0.0500                | 0.9300         |
| E7 Party floor between dwellings (in blocks of flats)                     | 12.9200 | 0.0700                | 0.9044         |
| E7 Party floor between dwellings (in blocks of flats)                     | 11.4900 | 0.0700                | 0.8043         |
| E9 Balcony between dwellings, wall insulation continuous                  | 4.3600  | 0.0200                | 0.0872         |
| E16 Corner (normal)                                                       | 5.6000  | 0.0900                | 0.5040         |
| E16 Corner (normal)                                                       | 2.8000  | 0.0900                | 0.2520         |
| E17 Corner (inverted - internal area greater than external area)          | 2.8000  | -0.0900               | -0.2520        |
| E18 Party wall between dwellings                                          | 2.8000  | 0.0600                | 0.1680         |
| E18 Party wall between dwellings                                          | 2.8000  | 0.0600                | 0.1680         |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | 5.7900  | 0.0000                | 0.0000         |
| E3 Sill                                                                   | 3.4100  | 0.0500                | 0.1705         |
| E14 Flat roof                                                             | 28.7700 | 0.0800                | 2.3016         |
| P4 Party wall - Roof (insulation at ceiling level)                        | 5.7900  | 0.1200                | 0.6948         |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                |         |                       | 7.0778 (36)    |
| Point Thermal bridges                                                     |         |                       | (36a) = 0.0000 |
| Total fabric heat loss                                                    |         | (33) + (36) + (36a) = | 42.2236 (37)   |

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

|                           |                |                |                |                |                |                |                |                |                |                |                |                     |
|---------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|---------------------|
| (38)m                     | Jan<br>39.7392 | Feb<br>39.4975 | Mar<br>39.2605 | Apr<br>38.1475 | May<br>37.9393 | Jun<br>36.9698 | Jul<br>36.9698 | Aug<br>36.7903 | Sep<br>37.3432 | Oct<br>37.9393 | Nov<br>38.3605 | Dec<br>38.8010 (38) |
| Heat transfer coeff       | 81.9628        | 81.7211        | 81.4841        | 80.3711        | 80.1628        | 79.1934        | 79.1934        | 79.0139        | 79.5668        | 80.1628        | 80.5841        | 81.0245 (39)        |
| Average = Sum(39)m / 12 = |                |                |                |                |                |                |                |                |                |                |                | 80.3701             |
| HLP                       | Jan<br>1.1299  | Feb<br>1.1266  | Mar<br>1.1233  | Apr<br>1.1080  | May<br>1.1051  | Jun<br>1.0917  | Jul<br>1.0917  | Aug<br>1.0892  | Sep<br>1.0969  | Oct<br>1.1051  | Nov<br>1.1109  | Dec<br>1.1170 (40)  |
| HLP (average)             |                |                |                |                |                |                |                |                |                |                |                | 1.1079              |
| Days in mont              | 31             | 28             | 31             | 30             | 31             | 30             | 31             | 31             | 30             | 31             | 30             | 31                  |

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

|                                                                 |          |          |          |          |          |          |          |                                                                                 |          |                    |          |                |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|---------------------------------------------------------------------------------|----------|--------------------|----------|----------------|
| Assumed occupancy                                               |          |          |          |          |          |          |          |                                                                                 |          |                    |          | 2.3062 (42)    |
| Hot water usage for mixer showers                               | 62.8867  | 61.9416  | 60.5645  | 57.9295  | 55.9850  | 53.8166  | 52.5840  | 53.9507                                                                         | 55.4489  | 57.7772            | 60.4687  | 62.6457 (42a)  |
| Hot water usage for baths                                       | 27.1666  | 26.7631  | 26.1949  | 25.1474  | 24.3629  | 23.4931  | 23.0233  | 23.5875                                                                         | 24.2018  | 25.1325            | 26.2017  | 27.0747 (42b)  |
| Hot water usage for other uses                                  | 38.2476  | 36.8567  | 35.4659  | 34.0751  | 32.6843  | 31.2935  | 31.2935  | 32.6843                                                                         | 34.0751  | 35.4659            | 36.8567  | 38.2476 (42c)  |
| Average daily hot water use (litres/day)                        |          |          |          |          |          |          |          |                                                                                 |          |                    |          | 117.9376 (43)  |
| Daily hot water use                                             | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug                                                                             | Sep      | Oct                | Nov      | Dec            |
| Energy content (annual)                                         | 128.3008 | 125.5614 | 122.2253 | 117.1520 | 113.0323 | 108.6032 | 106.9008 | 110.2225                                                                        | 113.7258 | 118.3756           | 123.5271 | 127.9680 (44)  |
| Distribution loss (46)m = 0.15 x (45)m                          | 203.1971 | 178.7978 | 187.8558 | 160.3752 | 152.1631 | 133.5402 | 129.2872 | 136.4785                                                                        | 140.2353 | 160.6346           | 175.9870 | 200.3670 (45)  |
| Water storage loss (or HIU loss):                               |          |          |          |          |          |          |          |                                                                                 |          | Total = Sum(45)m = |          | 1958.9188      |
| Store volume                                                    | 30.4796  | 26.8197  | 28.1784  | 24.0563  | 22.8245  | 20.0310  | 19.3931  | 20.4718                                                                         | 21.0353  | 24.0952            | 26.3981  | 30.0550 (46)   |
| a) If manufacturer declared loss factor is known (kWh/day):     |          |          |          |          |          |          |          |                                                                                 |          |                    |          | 180.0000 (47)  |
| Temperature factor from Table 2b                                |          |          |          |          |          |          |          |                                                                                 |          |                    |          | 1.5520 (48)    |
| Enter (49) or (54) in (55)                                      |          |          |          |          |          |          |          |                                                                                 |          |                    |          | 0.5400 (49)    |
| Total storage loss                                              |          |          |          |          |          |          |          |                                                                                 |          |                    |          | 0.8381 (55)    |
| If cylinder contains dedicated solar storage                    | 25.9803  | 23.4661  | 25.9803  | 25.1422  | 25.9803  | 25.1422  | 25.9803  | 25.9803                                                                         | 25.1422  | 25.9803            | 25.1422  | 25.9803 (56)   |
| Primary loss                                                    | 25.9803  | 23.4661  | 25.9803  | 25.1422  | 25.9803  | 25.1422  | 25.9803  | 25.9803                                                                         | 25.1422  | 25.9803            | 25.1422  | 25.9803 (57)   |
| Combi loss                                                      | 23.2624  | 21.0112  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624  | 23.2624                                                                         | 22.5120  | 23.2624            | 22.5120  | 23.2624 (59)   |
| Total heat required for water heating calculated for each month | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                                                          | 0.0000   | 0.0000             | 0.0000   | 0.0000 (61)    |
| WWHRS                                                           | 252.4398 | 223.2751 | 237.0984 | 208.0294 | 201.4058 | 181.1944 | 178.5299 | 185.7211                                                                        | 187.8895 | 209.8773           | 223.6412 | 249.6096 (62)  |
| PV diverter                                                     | -28.7492 | -25.4260 | -26.6246 | -22.0463 | -20.5463 | -17.5816 | -16.4800 | -17.5248                                                                        | -18.1906 | -21.4447           | -24.2943 | -28.2168 (63a) |
| Solar input                                                     | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000                                                                         | -0.0000  | -0.0000            | -0.0000  | -0.0000 (63b)  |
| FGHRS                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                                                          | 0.0000   | 0.0000             | 0.0000   | 0.0000 (63c)   |
| Output from w/h                                                 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                                                          | 0.0000   | 0.0000             | 0.0000   | 0.0000 (63d)   |
| 12Total per year (kWh/year)                                     | 223.6906 | 197.8491 | 210.4738 | 185.9832 | 180.8595 | 163.6128 | 162.0499 | 168.1963                                                                        | 169.6988 | 188.4325           | 199.3469 | 221.3929 (64)  |
| Electric shower(s)                                              |          |          |          |          |          |          |          | Total per year (kWh/year) = Sum(64)m =                                          |          |                    |          | 2271.5863 (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                        | 106.9572 | 95.0321  | 101.8562 | 91.4481  | 89.9884  | 82.5255  | 82.3821  | 84.7732                                                                         | 84.7516  | 92.8051            | 96.6390  | 106.0162 (65)  |

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

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| Metabolic gains (Table 5), Watts                                                    | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |      |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| (66)m                                                                               | 115.3089 | 115.3089 | 115.3089 | 115.3089 | 115.3089 | 115.3089 | 115.3089 | 115.3089 | 115.3089 | 115.3089 | 115.3089 | 115.3089 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 107.9293 | 119.4931 | 107.9293 | 111.5269 | 107.9293 | 111.5269 | 107.9293 | 107.9293 | 111.5269 | 107.9293 | 111.5269 | 107.9293 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 203.1512 | 205.2592 | 199.9470 | 188.6378 | 174.3619 | 160.9446 | 151.9811 | 149.8730 | 155.1853 | 166.4945 | 180.7703 | 194.1876 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 34.5309  | 34.5309  | 34.5309  | 34.5309  | 34.5309  | 34.5309  | 34.5309  | 34.5309  | 34.5309  | 34.5309  | 34.5309  | 34.5309  | (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)                                 | -92.2471 | -92.2471 | -92.2471 | -92.2471 | -92.2471 | -92.2471 | -92.2471 | -92.2471 | -92.2471 | -92.2471 | -92.2471 | -92.2471 | (71) |
| Water heating gains (Table 5)                                                       | 143.7596 | 141.4168 | 136.9035 | 127.0113 | 120.9521 | 114.6187 | 110.7287 | 113.9425 | 117.7105 | 124.7381 | 134.2209 | 142.4948 | (72) |
| Total internal gains                                                                | 515.4327 | 526.7618 | 505.3724 | 487.7686 | 463.8360 | 444.6829 | 428.2317 | 429.3374 | 442.0154 | 459.7545 | 487.1108 | 505.2044 | (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   |               |
|-------------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|----------|------------------------------|----------|--------------|---------------|
| Southwest   |          |          |          | 7.3300     | 36.7938                        | 0.6300                            | 0.7000                             |          | 0.7700                       |          | 82.4235 (79) |               |
| Northwest   |          |          |          | 3.7400     | 11.2829                        | 0.6300                            | 0.7000                             |          | 0.7700                       |          | 12.8963 (81) |               |
| Solar gains | 95.3198  | 166.6485 | 239.3938 | 315.6920   | 371.0089                       | 375.9829                          | 359.3012                           | 316.8617 | 265.6322                     | 187.2499 | 114.9512     | 81.0691 (83)  |
| Total gains | 610.7525 | 693.4103 | 744.7662 | 803.4606   | 834.8448                       | 820.6658                          | 787.5328                           | 746.1991 | 707.6475                     | 647.0044 | 602.0620     | 586.2734 (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                                                                         | 36.8014 | 36.9102 | 37.0176 | 37.5302 | 37.6277 | 38.0883 | 38.0883 | 38.1749 | 37.9096                   | 37.6277 | 37.4310 | 37.2275 |              |
| alpha                                                                       | 3.4534  | 3.4607  | 3.4678  | 3.5020  | 3.5085  | 3.5392  | 3.5392  | 3.5450  | 3.5273                    | 3.5085  | 3.4954  | 3.4818  |              |
| util living area                                                            | 0.9649  | 0.9453  | 0.9145  | 0.8456  | 0.7323  | 0.5693  | 0.4283  | 0.4668  | 0.6718                    | 0.8649  | 0.9437  | 0.9690  | (86)         |
| MIT                                                                         | 19.3040 | 19.5622 | 19.9092 | 20.3584 | 20.7061 | 20.9128 | 20.9756 | 20.9667 | 20.8384                   | 20.3996 | 19.7929 | 19.2682 | (87)         |
| Th 2                                                                        | 19.9765 | 19.9792 | 19.9819 | 19.9943 | 19.9967 | 20.0076 | 20.0076 | 20.0096 | 20.0034                   | 19.9967 | 19.9919 | 19.9870 | (88)         |
| util rest of house                                                          | 0.9583  | 0.9352  | 0.8984  | 0.8165  | 0.6829  | 0.4955  | 0.3375  | 0.3743  | 0.6014                    | 0.8333  | 0.9317  | 0.9631  | (89)         |
| MIT 2                                                                       | 18.0231 | 18.3478 | 18.7808 | 19.3326 | 19.7297 | 19.9466 | 19.9962 | 19.9930 | 19.8791                   | 19.3948 | 18.6506 | 17.9851 | (90)         |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         | 0.4733  | (91)         |
| MIT                                                                         | 18.6293 | 18.9225 | 19.3148 | 19.8181 | 20.1917 | 20.4039 | 20.4597 | 20.4538 | 20.3331                   | 19.8703 | 19.1912 | 18.5924 | (92)         |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000  |              |
| adjusted MIT                                                                | 18.6293 | 18.9225 | 19.3148 | 19.8181 | 20.1917 | 20.4039 | 20.4597 | 20.4538 | 20.3331                   | 19.8703 | 19.1912 | 18.5924 | (93)         |

## 8. Space heating requirement

|                                                                                |           |           |           |          |          |          |          |          |          |               |          |           |       |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|---------------|----------|-----------|-------|
| Utilisation                                                                    | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov      | Dec       |       |
| Useful gains                                                                   | 0.9469    | 0.9223    | 0.8860    | 0.8108   | 0.6931   | 0.5259   | 0.3797   | 0.4168   | 0.6260   | 0.8287        | 0.9198   | 0.9525    | (94)  |
| Ext temp.                                                                      | 578.3431  | 639.5461  | 659.8456  | 651.4679 | 578.6315 | 431.6258 | 299.0075 | 310.9874 | 443.0184 | 536.1767      | 553.7581 | 558.3979  | (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                                                              | 1174.4685 | 1145.9327 | 1044.2032 | 877.4962 | 680.7219 | 459.6288 | 305.6625 | 320.3065 | 495.9503 | 743.1351      | 974.3589 | 1166.1337 | (97)  |
| Space heating requirement - total per year (kWh/year)                          | 443.5173  | 340.2918  | 285.9620  | 162.7403 | 75.9552  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 153.9771      | 302.8326 | 452.1554  | (98a) |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000   | 0.0000    | (98b) |
| Solar heating contribution - total per year (kWh/year)                         | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000   | 0.0000    | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) | 443.5173  | 340.2918  | 285.9620  | 162.7403 | 75.9552  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 153.9771      | 302.8326 | 452.1554  | (98c) |
| Space heating per m2                                                           |           |           |           |          |          |          |          |          |          | (98c) / (4) = |          | 30.5684   | (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)                      | 443.5173 | 340.2918 | 285.9620 | 162.7403 | 75.9552  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 153.9771 | 302.8326 | 452.1554 | (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)                      | 480.5171 | 368.6802 | 309.8180 | 176.3167 | 82.2917  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 166.8224 | 328.0960 | 489.8759 | (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                                             | 223.6906 | 197.8491 | 210.4738 | 185.9832 | 180.8595 | 163.6128 | 162.0499 | 168.1963 | 169.6988 | 188.4325 | 199.3469 | 221.3929 | (64)          |
| Efficiency of water heater                                            | 85.5647  | 85.2645  | 84.7477  | 83.7618  | 82.2660  | 79.8000  | 79.8000  | 79.8000  | 79.8000  | 83.6107  | 84.9948  | 85.6258  | (216)         |
| Fuel for water heating, kWh/month                                     | 261.4287 | 232.0415 | 248.3534 | 222.0383 | 219.8473 | 205.0286 | 203.0701 | 210.7724 | 212.6552 | 225.3690 | 234.5402 | 258.5587 | (219)         |

# Full SAP Calculation Printout



|                                                                                                      |         |          |          |          |          |          |          |          |          |          |          |         |           |        |
|------------------------------------------------------------------------------------------------------|---------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------|-----------|--------|
| 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  | 0.0000    | (221)  |
| Pumps and Fa                                                                                         | 7.3041  | 6.5973   | 7.3041   | 7.0685   | 7.3041   | 7.0685   | 7.3041   | 7.0685   | 7.3041   | 7.0685   | 7.3041   | 7.0685  | 7.3041    | (231)  |
| Lighting                                                                                             | 22.4256 | 17.9906  | 16.1986  | 11.8678  | 9.1670   | 7.4895   | 8.3624   | 10.8698  | 14.1188  | 18.5247  | 20.9236  | 23.0488 | 23.0488   | (232)  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |         |          |          |          |          |          |          |          |          |          |          |         |           |        |
| (233a)m                                                                                              | -9.5996 | -14.7803 | -23.1756 | -28.5009 | -32.9505 | -31.5819 | -31.2007 | -28.3351 | -23.7141 | -17.9220 | -10.9871 | -8.1608 | -8.1608   | (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  | 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  | 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  | 0.0000    | (235c) |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |         |          |          |          |          |          |          |          |          |          |          |         |           |        |
| (233b)m                                                                                              | -2.2018 | -4.8139  | -9.9219  | -15.4425 | -20.9656 | -21.2702 | -21.0191 | -17.5406 | -12.5284 | -7.0533  | -2.9919  | -1.7278 | -1.7278   | (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  | 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  | 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  | 0.0000    | (235d) |
| Annual totals kWh/year                                                                               |         |          |          |          |          |          |          |          |          |          |          |         |           |        |
| Space heating fuel - main system 1                                                                   |         |          |          |          |          |          |          |          |          |          |          |         | 2402.4181 | (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                                                                              |         |          |          |          |          |          |          |          |          |          |          |         | 2733.7033 | (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)                                                  |         |          |          |          |          |          |          |          |          |          |          |         | 180.9872  | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |         |          |          |          |          |          |          |          |          |          |          |         |           |        |
| PV generation                                                                                        |         |          |          |          |          |          |          |          |          |          |          |         | -398.3857 | (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                                                                  |         |          |          |          |          |          |          |          |          |          |          |         | 5004.7228 | (238)  |

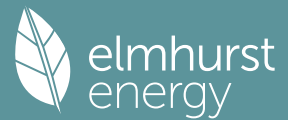
## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                               | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |       |
|-----------------------------------------------|--------------------|-------------------------------|--------------------------|-------|
| Space heating - main system 1                 | 2402.4181          | 0.2100                        | 504.5078                 | (261) |
| Total CO2 associated with community systems   |                    |                               | 0.0000                   | (373) |
| Water heating (other fuel)                    | 2733.7033          | 0.2100                        | 574.0777                 | (264) |
| Space and water heating                       |                    |                               | 1078.5855                | (265) |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293                  | (267) |
| Energy for lighting                           | 180.9872           | 0.1443                        | 26.1220                  | (268) |
| Energy saving/generation technologies         |                    |                               |                          |       |
| PV Unit electricity used in dwelling          | -260.9085          | 0.1328                        | -34.6469                 |       |
| PV Unit electricity exported                  | -137.4772          | 0.1249                        | -17.1670                 |       |
| Total                                         |                    |                               | -51.8139                 | (269) |
| Total CO2, kg/year                            |                    |                               | 1064.8229                | (272) |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 14.6800                  | (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               | 2402.4181          | 1.1300                              | 2714.7324                  | (275) |
| Total CO2 associated with community systems |                    |                                     | 0.0000                     | (473) |
| Water heating (other fuel)                  | 2733.7033          | 1.1300                              | 3089.0847                  | (278) |
| Space and water heating                     |                    |                                     | 5803.8171                  | (279) |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008                   | (281) |
| Energy for lighting                         | 180.9872           | 1.5338                              | 277.6042                   | (282) |
| Energy saving/generation technologies       |                    |                                     |                            |       |
| PV Unit electricity used in dwelling        | -260.9085          | 1.4907                              | -388.9308                  |       |
| PV Unit electricity exported                | -137.4772          | 0.4583                              | -63.0077                   |       |
| Total                                       |                    |                                     | -451.9385                  | (283) |
| Total Primary energy kWh/year               |                    |                                     | 5759.5836                  | (286) |
| Target Primary Energy Rate (TPER)           |                    |                                     | 79.4000                    | (287) |

# Full SAP Calculation Printout



|                                    |                   |               |       |               |                |            |  |
|------------------------------------|-------------------|---------------|-------|---------------|----------------|------------|--|
| Plot Reference                     | A 901             |               |       |               | Issued on Date | 19/03/2026 |  |
| Assessment Reference               | Be Green          |               |       | Plot Type Ref |                |            |  |
| Plot Address                       |                   |               |       |               | SAP Version    | 10.2       |  |
|                                    |                   |               |       |               |                |            |  |
| SAP Rating                         | 82 B              | DER           | 5.22  | TER           | 14.68          |            |  |
| Environmental                      | 96 A              | % DER < TER   |       |               |                | 64.44      |  |
| CO <sub>2</sub> Emissions (t/year) | 0.34              | DFEE          | 35.93 | TFEE          | 37.39          |            |  |
| Compliance Check                   | See BREL          | % DFEE < TFEE |       |               |                | 3.90       |  |
| % DPER < TPER                      | 30.67             | DPER          | 55.04 | TPER          | 79.40          |            |  |
|                                    |                   |               |       |               |                |            |  |
| 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                                          |                           |                      |                             |
| Ground floor                                           |                           |                      |                             |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 72.5400                   |                      |                             |
| Dwelling volume                                        |                           |                      |                             |

## 2. Ventilation rate

|                                                                                                    | m <sup>3</sup> per hour                 |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 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) = 0.1477 (8)              |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 3.0000 (17)                             |
| Infiltration rate                                                                                  | 0.2977 (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) = 0.2530 (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                                                                                         | 0.3226 | 0.3163 | 0.3100 | 0.2784 | 0.2720 | 0.2404 | 0.2404 | 0.2341 | 0.2530 | 0.2720 | 0.2847 | 0.2973 (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                                                                                            | 0.5520 | 0.5500 | 0.5480 | 0.5387 | 0.5370 | 0.5289 | 0.5289 | 0.5274 | 0.5320 | 0.5370 | 0.5405 | 0.5442 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                                                    | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K                 | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K                                        |
|----------------------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|------------------------------|--------------------------------|------------------------------------------------------|
| Main dwelling                                                              |                         |                            |                           |                               |                              |                                |                                                      |
| Windows                                                                    |                         |                            | 11.0700                   | 1.1450                        | 12.6756                      |                                | (27)                                                 |
| Door                                                                       |                         |                            | 2.4200                    | 1.0000                        | 2.4200                       |                                | (26)                                                 |
| External Wall 1                                                            | 48.3800                 | 11.0700                    | 37.3100                   | 0.1500                        | 5.5965                       | 70.0000                        | 2611.7001 (29a)                                      |
| Corridor wall                                                              | 32.1700                 | 2.4200                     | 29.7500                   | 0.1900                        | 5.6525                       | 70.0000                        | 2082.4999 (29a)                                      |
| External Roof 1                                                            | 72.5400                 |                            | 72.5400                   | 0.1000                        | 7.2540                       | 9.0000                         | 652.8600 (30)                                        |
| Total net area of external elements A <sub>um</sub> (A, m <sup>2</sup> )   |                         |                            | 153.0900                  |                               |                              |                                | (31)                                                 |
| Fabric heat loss, W/K = Sum (A x U)                                        |                         |                            |                           |                               | (26)...(30) + (32) = 33.5986 |                                | (33)                                                 |
| Main dwelling                                                              |                         |                            |                           |                               |                              |                                |                                                      |
| Party Wall 1                                                               |                         |                            | 16.2000                   | 0.0000                        | 0.0000                       | 70.0000                        | 1134.0001 (32)                                       |
| Party Floor 1                                                              |                         |                            | 72.5400                   |                               |                              | 40.0000                        | 2901.6000 (32a)                                      |
| Internal Wall 1                                                            |                         |                            | 164.0200                  |                               |                              | 9.0000                         | 1476.1800 (32c)                                      |
| Heat capacity C <sub>m</sub> = Sum(A x k)                                  |                         |                            |                           |                               |                              |                                | (28)...(30) + (32) + (32a)...(32e) = 10858.8400 (34) |
| Thermal mass parameter (TMP = C <sub>m</sub> / TFA) in kJ/m <sup>2</sup> K |                         |                            |                           |                               |                              |                                | 149.6945 (35)                                        |
| List of Thermal Bridges                                                    |                         |                            |                           |                               |                              |                                |                                                      |
| K1 Element                                                                 |                         |                            |                           |                               | Length                       | Psi-value                      | Total                                                |
| E1 Steel lintel with perforated steel base plate                           |                         |                            |                           |                               | 6.9000                       | 0.0500                         | 0.3450                                               |
| E4 Jamb                                                                    |                         |                            |                           |                               | 18.6000                      | 0.0400                         | 0.7440                                               |

# Full SAP Calculation Printout



|                                                                           |         |                       |              |
|---------------------------------------------------------------------------|---------|-----------------------|--------------|
| E7 Party floor between dwellings (in blocks of flats)                     | 12.9200 | 0.0500                | 0.6460       |
| E7 Party floor between dwellings (in blocks of flats)                     | 11.4900 | 0.0390                | 0.4481       |
| E9 Balcony between dwellings, wall insulation continuous                  | 4.3600  | 0.0500                | 0.2180       |
| E16 Corner (normal)                                                       | 5.6000  | 0.0500                | 0.2800       |
| E16 Corner (normal)                                                       | 2.8000  | 0.0390                | 0.1092       |
| E17 Corner (inverted - internal area greater than external area)          | 2.8000  | 0.0000                | 0.0000       |
| E18 Party wall between dwellings                                          | 2.8000  | 0.0500                | 0.1400       |
| E18 Party wall between dwellings                                          | 2.8000  | 0.0390                | 0.1092       |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | 5.7900  | 0.0000                | 0.0000       |
| E3 Sill                                                                   | 3.4100  | 0.0400                | 0.1364       |
| E14 Flat roof                                                             | 28.7700 | 0.0500                | 1.4385       |
| P4 Party wall - Roof (insulation at ceiling level)                        | 5.7900  | 0.0500                | 0.2895       |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                |         |                       | 4.9039 (36)  |
| Point Thermal bridges                                                     |         |                       | 0.0000       |
| Total fabric heat loss                                                    |         | (33) + (36) + (36a) = | 38.5025 (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                                                 | 37.0020 | 36.8665 | 36.7338 | 36.1101 | 35.9934 | 35.4502 | 35.4502 | 35.3496 | 35.6594 | 35.9934 | 36.2295 | 36.4762 (38) |
| Average = Sum(39)m / 12 =                                           | 75.5045 | 75.3690 | 75.2362 | 74.6126 | 74.4959 | 73.9527 | 73.9527 | 73.8521 | 74.1619 | 74.4959 | 74.7319 | 74.9787 (39) |
|                                                                     |         |         |         |         |         |         |         |         |         |         |         | 74.6120      |
| HLP                                                                 | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| HLP (average)                                                       | 1.0409  | 1.0390  | 1.0372  | 1.0286  | 1.0270  | 1.0195  | 1.0195  | 1.0181  | 1.0224  | 1.0270  | 1.0302  | 1.0336 (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                                               |         |         |         |         |         |         |         |         |         |                                        |         | 2.3062 (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                                       |         |         |         |         |         |         |         |         |         |                                        |         |                |
|                                                                 | 26.5609 | 26.1600 | 25.5896 | 24.7354 | 23.9655 | 22.9058 | 22.1018 | 23.0849 | 23.6009 | 24.6510                                | 25.7427 | 26.5399 (42b)  |
| Hot water usage for other uses                                  |         |         |         |         |         |         |         |         |         |                                        |         |                |
|                                                                 | 38.2476 | 36.8567 | 35.4659 | 34.0751 | 32.6843 | 31.2935 | 31.2935 | 32.6843 | 34.0751 | 35.4659                                | 36.8567 | 38.2476 (42c)  |
| Average daily hot water use (litres/day)                        |         |         |         |         |         |         |         |         |         |                                        |         | 59.3988 (43)   |
| Daily hot water use                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct                                    | Nov     | Dec            |
|                                                                 | 64.8085 | 63.0167 | 61.0555 | 58.8105 | 56.6498 | 54.1992 | 53.3952 | 55.7692 | 57.6760 | 60.1169                                | 62.5995 | 64.7874 (44)   |
| Energy conte                                                    | 95.4093 | 83.3839 | 87.2471 | 76.8212 | 72.9990 | 62.6796 | 59.0033 | 65.6414 | 66.9013 | 77.4667                                | 84.6053 | 95.1451 (45)   |
| Energy content (annual)                                         |         |         |         |         |         |         |         |         |         | Total = Sum(45)m =                     |         | 927.3032       |
| Distribution loss (46)m = 0.15 x (45)m                          |         |         |         |         |         |         |         |         |         |                                        |         |                |
|                                                                 | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000 (46)    |
| Water storage loss (or HIU loss):                               |         |         |         |         |         |         |         |         |         |                                        |         |                |
| Total storage loss                                              |         |         |         |         |         |         |         |         |         |                                        |         |                |
|                                                                 | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000 (56)    |
| If cylinder contains dedicated solar storage                    |         |         |         |         |         |         |         |         |         |                                        |         |                |
|                                                                 | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000 (57)    |
| Primary loss                                                    |         |         |         |         |         |         |         |         |         |                                        |         |                |
|                                                                 | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000 (59)    |
| Combi loss                                                      |         |         |         |         |         |         |         |         |         |                                        |         |                |
|                                                                 | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000 (61)    |
| Total heat required for water heating calculated for each month |         |         |         |         |         |         |         |         |         |                                        |         |                |
|                                                                 | 81.0979 | 70.8763 | 74.1600 | 65.2980 | 62.0492 | 53.2777 | 50.1528 | 55.7952 | 56.8661 | 65.8467                                | 71.9145 | 80.8733 (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                                                 |         |         |         |         |         |         |         |         |         |                                        |         |                |
|                                                                 | 81.0979 | 70.8763 | 74.1600 | 65.2980 | 62.0492 | 53.2777 | 50.1528 | 55.7952 | 56.8661 | 65.8467                                | 71.9145 | 80.8733 (64)   |
| 12Total per year (kWh/year)                                     |         |         |         |         |         |         |         |         |         | Total per year (kWh/year) = Sum(64)m = |         | 788.2077 (64)  |
| Electric shower(s)                                              |         |         |         |         |         |         |         |         |         |                                        |         | 788 (64)       |
|                                                                 | 50.3617 | 44.8727 | 48.9993 | 46.7594 | 47.6369 | 45.4409 | 46.9556 | 47.6369 | 46.7594 | 48.9993                                | 48.0779 | 50.3617 (64a)  |
|                                                                 |         |         |         |         |         |         |         |         |         |                                        |         | 572.8619 (64a) |
| Heat gains from water heating, kWh/month                        |         |         |         |         |         |         |         |         |         |                                        |         |                |
|                                                                 | 32.8649 | 28.9373 | 30.7898 | 28.0144 | 27.4215 | 24.6797 | 24.2771 | 25.8580 | 25.9064 | 28.7115                                | 29.9981 | 32.8088 (65)   |

|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| 5. Internal gains (see Table 5 and 5a)                                              |          |          |          |          |          |          |          |          |          |          |          |               |
| Metabolic gains (Table 5), Watts                                                    |          |          |          |          |          |          |          |          |          |          |          |               |
| (66)m                                                                               | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 115.3089 | 115.3089 | 115.3089 | 115.3089 | 115.3089 | 115.3089 | 115.3089 | 115.3089 | 115.3089 | 115.3089 | 115.3089 | 115.3089 (66) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 107.9293 | 119.4931 | 107.9293 | 111.5269 | 107.9293 | 111.5269 | 107.9293 | 107.9293 | 111.5269 | 107.9293 | 111.5269 | 107.9293 (67) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 203.1512 | 205.2592 | 199.9470 | 188.6378 | 174.3619 | 160.9446 | 151.9811 | 149.8730 | 155.1853 | 166.4945 | 180.7703 | 194.1876 (68) |
| Pumps, fans                                                                         | 34.5309  | 34.5309  | 34.5309  | 34.5309  | 34.5309  | 34.5309  | 34.5309  | 34.5309  | 34.5309  | 34.5309  | 34.5309  | 34.5309 (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)                                                       | -92.2471 | -92.2471 | -92.2471 | -92.2471 | -92.2471 | -92.2471 | -92.2471 | -92.2471 | -92.2471 | -92.2471 | -92.2471 | -92.2471 (71) |
| Total internal gains                                                                | 44.1733  | 43.0614  | 41.3842  | 38.9088  | 36.8569  | 34.2773  | 32.6305  | 34.7554  | 35.9811  | 38.5907  | 41.6640  | 44.0978 (72)  |
|                                                                                     | 412.8464 | 425.4064 | 406.8531 | 396.6662 | 376.7407 | 364.3415 | 350.1335 | 350.1503 | 360.2859 | 370.6071 | 391.5539 | 403.8073 (73) |

|                |          |          |          |            |             |             |          |          |          |          |          |               |
|----------------|----------|----------|----------|------------|-------------|-------------|----------|----------|----------|----------|----------|---------------|
| 6. Solar gains |          |          |          |            |             |             |          |          |          |          |          |               |
| [Jan]          |          |          |          |            |             |             |          |          |          |          |          |               |
|                |          |          | Area     | Solar flux | g           | FF          | Access   |          |          |          |          | Gains         |
|                |          |          | m2       | Table 6a   | or Table 6b | or Table 6c | factor   |          |          |          |          | W             |
| Southwest      |          |          | 7.3300   | 36.7938    | 0.3500      | 0.7000      | 0.7700   |          |          |          |          | 45.7908 (79)  |
| Northwest      |          |          | 3.7400   | 11.2829    | 0.3500      | 0.7000      | 0.7700   |          |          |          |          | 7.1646 (81)   |
| Solar gains    | 52.9554  | 92.5825  | 132.9966 | 175.3844   | 206.1160    | 208.8794    | 199.6118 | 176.0343 | 147.5734 | 104.0277 | 63.8618  | 45.0384 (83)  |
| Total gains    | 465.8018 | 517.9889 | 539.8496 | 572.0506   | 582.8567    | 573.2209    | 549.7453 | 526.1846 | 507.8594 | 474.6348 | 455.4157 | 448.8457 (84) |

# Full SAP Calculation Printout



|                                                                             |                           |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| 7. Mean internal temperature (heating season)                               |                           |         |         |         |         |         |         |         |         |         |              |
| Temperature during heating periods in the living area from Table 9, Th1 (C) |                           |         |         |         |         |         |         |         |         |         |              |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |                           |         |         |         |         |         |         |         |         |         |              |
|                                                                             | Jan                       | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov          |
| tau                                                                         | 39.9492                   | 40.0210 | 40.0916 | 40.4268 | 40.4901 | 40.7875 | 40.7875 | 40.8430 | 40.6724 | 40.4901 | 40.3622      |
| alpha                                                                       | 3.6633                    | 3.6681  | 3.6728  | 3.6951  | 3.6993  | 3.7192  | 3.7192  | 3.7229  | 3.7115  | 3.6993  | 3.6908       |
| util living area                                                            | 0.9834                    | 0.9743  | 0.9604  | 0.9231  | 0.8494  | 0.7070  | 0.5544  | 0.5942  | 0.7907  | 0.9298  | 0.9727       |
| MIT                                                                         | 19.2104                   | 19.4192 | 19.7226 | 20.1618 | 20.5575 | 20.8475 | 20.9538 | 20.9393 | 20.7532 | 20.2538 | 19.6680      |
| Th 2                                                                        | 20.0494                   | 20.0510 | 20.0525 | 20.0596 | 20.0609 | 20.0671 | 20.0671 | 20.0683 | 20.0647 | 20.0609 | 20.0582      |
| util rest of house                                                          | 0.9801                    | 0.9692  | 0.9520  | 0.9056  | 0.8125  | 0.6351  | 0.4514  | 0.4928  | 0.7303  | 0.9104  | 0.9663       |
| MIT 2                                                                       | 18.4163                   | 18.6238 | 18.9241 | 19.3560 | 19.7269 | 19.9768 | 20.0486 | 20.0423 | 19.9046 | 19.4507 | 18.8771      |
| Living area fraction                                                        | fLA = Living area / (4) = |         |         |         |         |         |         |         |         |         |              |
| MIT                                                                         | 18.7921                   | 19.0003 | 19.3020 | 19.7373 | 20.1200 | 20.3889 | 20.4770 | 20.4668 | 20.3062 | 19.8308 | 19.2514      |
| Temperature adjustment                                                      | 0.0000                    |         |         |         |         |         |         |         |         |         |              |
| adjusted MIT                                                                | 18.7921                   | 19.0003 | 19.3020 | 19.7373 | 20.1200 | 20.3889 | 20.4770 | 20.4668 | 20.3062 | 19.8308 | 19.2514      |
|                                                                             |                           |         |         |         |         |         |         |         |         |         | 18.7587 (93) |

|                                                                                |               |           |          |          |          |          |          |          |          |          |                |
|--------------------------------------------------------------------------------|---------------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| 8. Space heating requirement                                                   |               |           |          |          |          |          |          |          |          |          |                |
|                                                                                | Jan           | Feb       | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov            |
| Utilisation                                                                    | 0.9744        | 0.9619    | 0.9438   | 0.8986   | 0.8151   | 0.6615   | 0.4983   | 0.5381   | 0.7474   | 0.9047   | 0.9594         |
| Useful gains                                                                   | 453.8676      | 498.2774  | 509.5221 | 514.0414 | 475.0867 | 379.1629 | 273.9370 | 283.1411 | 379.5730 | 429.4089 | 436.9127       |
| Ext temp.                                                                      | 4.3000        | 4.9000    | 6.5000   | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000  | 7.1000         |
| Heat loss rate W                                                               | 1094.2202     | 1062.7227 | 963.1743 | 808.6017 | 627.2560 | 428.1032 | 286.7144 | 300.3425 | 460.2669 | 687.6555 | 908.0961       |
| Space heating kWh                                                              | 476.4223      | 379.3073  | 337.5172 | 212.0835 | 113.2139 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 192.1355 | 339.2520       |
| Space heating requirement - total per year (kWh/year)                          |               |           |          |          |          |          |          |          |          |          |                |
| Solar heating kWh                                                              | 0.0000        | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000         |
| Solar heating contribution - total per year (kWh/year)                         |               |           |          |          |          |          |          |          |          |          |                |
| Space heating kWh                                                              | 476.4223      | 379.3073  | 337.5172 | 212.0835 | 113.2139 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 192.1355 | 339.2520       |
| Space heating requirement after solar contribution - total per year (kWh/year) |               |           |          |          |          |          |          |          |          |          |                |
| Space heating per m2                                                           | (98c) / (4) = |           |          |          |          |          |          |          |          |          |                |
|                                                                                |               |           |          |          |          |          |          |          |          |          | 485.7797 (98a) |
|                                                                                |               |           |          |          |          |          |          |          |          |          | 2535.7114      |
|                                                                                |               |           |          |          |          |          |          |          |          |          | 0.0000 (98b)   |
|                                                                                |               |           |          |          |          |          |          |          |          |          | 0.0000         |
|                                                                                |               |           |          |          |          |          |          |          |          |          | 485.7797 (98c) |
|                                                                                |               |           |          |          |          |          |          |          |          |          | 2535.7114      |
|                                                                                |               |           |          |          |          |          |          |          |          |          | 34.9560 (99)   |

|                                                     |                          |        |        |        |         |          |          |          |         |         |               |
|-----------------------------------------------------|--------------------------|--------|--------|--------|---------|----------|----------|----------|---------|---------|---------------|
| 8c. Space cooling requirement                       |                          |        |        |        |         |          |          |          |         |         |               |
| Calculated for June, July and August. See Table 10b |                          |        |        |        |         |          |          |          |         |         |               |
|                                                     | Jan                      | Feb    | Mar    | Apr    | May     | Jun      | Jul      | Aug      | Sep     | Oct     | Nov           |
| Ext. temp.                                          | 4.3000                   | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000  | 16.6000  | 16.4000  | 14.1000 | 10.6000 | 7.1000        |
| Heat loss rate W                                    | 0.0000                   | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 695.1552 | 547.2499 | 561.2759 | 0.0000  | 0.0000  | 0.0000        |
| Utilisation                                         | 0.0000                   | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.7446   | 0.8229   | 0.7975   | 0.0000  | 0.0000  | 0.0000        |
| Useful loss                                         | 0.0000                   | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 517.5803 | 450.3375 | 447.6171 | 0.0000  | 0.0000  | 0.0000        |
| Total gains                                         | 0.0000                   | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 625.3481 | 600.2511 | 574.7310 | 0.0000  | 0.0000  | 0.0000        |
| Space cooling kWh                                   | 0.0000                   | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 77.5928  | 111.5357 | 94.5728  | 0.0000  | 0.0000  | 0.0000        |
| Cooled fraction                                     | fc = cooled area / (4) = |        |        |        |         |          |          |          |         |         |               |
| Intermittency factor (Table 10b)                    | 0.2500                   | 0.2500 | 0.2500 | 0.2500 | 0.2500  | 0.2500   | 0.2500   | 0.2500   | 0.2500  | 0.2500  | 0.2500        |
| Space cooling kWh                                   | 0.0000                   | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 19.3982  | 27.8839  | 23.6432  | 0.0000  | 0.0000  | 0.0000        |
| Space cooling requirement                           |                          |        |        |        |         |          |          |          |         |         |               |
| Energy for space heating                            |                          |        |        |        |         |          |          |          |         |         |               |
| Energy for space cooling                            |                          |        |        |        |         |          |          |          |         |         |               |
| Total                                               |                          |        |        |        |         |          |          |          |         |         |               |
| Fabric Energy Efficiency (DFEE)                     |                          |        |        |        |         |          |          |          |         |         |               |
|                                                     |                          |        |        |        |         |          |          |          |         |         | 0.0000 (100)  |
|                                                     |                          |        |        |        |         |          |          |          |         |         | 0.0000 (101)  |
|                                                     |                          |        |        |        |         |          |          |          |         |         | 0.0000 (102)  |
|                                                     |                          |        |        |        |         |          |          |          |         |         | 0.0000 (103)  |
|                                                     |                          |        |        |        |         |          |          |          |         |         | 0.0000 (104)  |
|                                                     |                          |        |        |        |         |          |          |          |         |         | 1.0000 (105)  |
|                                                     |                          |        |        |        |         |          |          |          |         |         | 0.2500 (106)  |
|                                                     |                          |        |        |        |         |          |          |          |         |         | 0.0000 (107)  |
|                                                     |                          |        |        |        |         |          |          |          |         |         | 70.9253 (107) |
|                                                     |                          |        |        |        |         |          |          |          |         |         | 34.9560 (99)  |
|                                                     |                          |        |        |        |         |          |          |          |         |         | 0.9777 (108)  |
|                                                     |                          |        |        |        |         |          |          |          |         |         | 35.9338 (109) |
|                                                     |                          |        |        |        |         |          |          |          |         |         | 35.9 (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                                           | 72.5400 (1b) | x                               | 2.8000 (2b) | =            | 203.1120 (1b) - (3b) |  |  |  |  |  |     |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 72.5400      |                                 |             |              |                      |  |  |  |  |  | (4) |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | =           | 203.1120 (5) |                      |  |  |  |  |  |     |

|                                                    |          |  |  |  |  |  |  |  |  |  |              |
|----------------------------------------------------|----------|--|--|--|--|--|--|--|--|--|--------------|
| 2. Ventilation rate                                |          |  |  |  |  |  |  |  |  |  |              |
| m3 per hour                                        |          |  |  |  |  |  |  |  |  |  |              |
| Number of open chimneys                            | 0 * 80 = |  |  |  |  |  |  |  |  |  |              |
| Number of open flues                               | 0 * 20 = |  |  |  |  |  |  |  |  |  |              |
| Number of chimneys / flues attached to closed fire | 0 * 10 = |  |  |  |  |  |  |  |  |  |              |
| Number of flues attached to solid fuel boiler      | 0 * 20 = |  |  |  |  |  |  |  |  |  |              |
| Number of flues attached to other heater           | 0 * 35 = |  |  |  |  |  |  |  |  |  |              |
| Number of blocked chimneys                         | 0 * 20 = |  |  |  |  |  |  |  |  |  |              |
| Number of intermittent extract fans                | 3 * 10 = |  |  |  |  |  |  |  |  |  |              |
| Number of passive vents                            | 0 * 10 = |  |  |  |  |  |  |  |  |  |              |
| Number of flueless gas fires                       | 0 * 40 = |  |  |  |  |  |  |  |  |  |              |
|                                                    |          |  |  |  |  |  |  |  |  |  | 0.0000 (6a)  |
|                                                    |          |  |  |  |  |  |  |  |  |  | 0.0000 (6b)  |
|                                                    |          |  |  |  |  |  |  |  |  |  | 0.0000 (6c)  |
|                                                    |          |  |  |  |  |  |  |  |  |  | 0.0000 (6d)  |
|                                                    |          |  |  |  |  |  |  |  |  |  | 0.0000 (6e)  |
|                                                    |          |  |  |  |  |  |  |  |  |  | 0.0000 (6f)  |
|                                                    |          |  |  |  |  |  |  |  |  |  | 30.0000 (7a) |
|                                                    |          |  |  |  |  |  |  |  |  |  | 0.0000 (7b)  |
|                                                    |          |  |  |  |  |  |  |  |  |  | 0.0000 (7c)  |

# Full SAP Calculation Printout



|                                                                                                         |                                                       |        |        |        |        |        |        |        |        |        |        |                             |             |
|---------------------------------------------------------------------------------------------------------|-------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-----------------------------|-------------|
| Infiltration due to chimneys, flues and fans                                                            | = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = |        |        |        |        |        |        |        |        |        |        | Air changes per hour        |             |
| Pressure test                                                                                           |                                                       |        |        |        |        |        |        |        |        |        |        | 30.0000 / (5) =             | 0.1477 (8)  |
| Pressure Test Method                                                                                    |                                                       |        |        |        |        |        |        |        |        |        |        | Yes                         |             |
| Measured/design AP50                                                                                    |                                                       |        |        |        |        |        |        |        |        |        |        | Blower Door                 |             |
| Infiltration rate                                                                                       |                                                       |        |        |        |        |        |        |        |        |        |        | 5.0000                      | (17)        |
| Number of sides sheltered                                                                               |                                                       |        |        |        |        |        |        |        |        |        |        | 0.3977                      | (18)        |
|                                                                                                         |                                                       |        |        |        |        |        |        |        |        |        |        | 2                           | (19)        |
| Shelter factor                                                                                          |                                                       |        |        |        |        |        |        |        |        |        |        | (20) = 1 - [0.075 x (19)] = | 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor                                                    |                                                       |        |        |        |        |        |        |        |        |        |        | (21) = (18) x (20) =        | 0.3380 (21) |
| Wind speed                                                                                              | Jan                                                   | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec                         |             |
| Wind factor                                                                                             | 5.1000                                                | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000                      | (22)        |
| Adj infilt rate                                                                                         | 1.2750                                                | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750                      | (22a)       |
|                                                                                                         | 0.4310                                                | 0.4226 | 0.4141 | 0.3719 | 0.3634 | 0.3211 | 0.3211 | 0.3127 | 0.3380 | 0.3634 | 0.3803 | 0.3972                      | (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                                                                                            | 0.5929                                                | 0.5893 | 0.5857 | 0.5691 | 0.5660 | 0.5516 | 0.5516 | 0.5489 | 0.5571 | 0.5660 | 0.5723 | 0.5789                      | (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                                                          |             |                | 11.0700       | 1.1450                | 12.6756      |                       | (27)          |
| External Wall 1                                                           | 48.3800     | 11.0700        | 37.3100       | 0.1800                | 6.7158       |                       | (29a)         |
| Corridor wall                                                             | 32.1700     | 2.4200         | 29.7500       | 0.1800                | 5.3550       |                       | (29a)         |
| External Roof 1                                                           | 72.5400     |                | 72.5400       | 0.1100                | 7.9794       |                       | (30)          |
| Total net area of external elements Aum(A, m2)                            |             |                | 153.0900      |                       |              |                       | (31)          |
| Fabric heat loss, W/K = Sum (A x U)                                       |             |                |               | (26)... (30) + (32) = | 35.1458      |                       | (33)          |
| Main dwelling                                                             |             |                |               |                       |              |                       |               |
| Party Wall 1                                                              |             |                | 16.2000       | 0.0000                | 0.0000       |                       | (32)          |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K                         |             |                |               |                       |              |                       | 149.6945 (35) |
| List of Thermal Bridges                                                   |             |                |               |                       |              |                       |               |
| K1 Element                                                                |             |                |               | Length                | Psi-value    | Total                 |               |
| E1 Steel lintel with perforated steel base plate                          |             |                |               | 6.9000                | 0.0500       | 0.3450                |               |
| E4 Jamb                                                                   |             |                |               | 18.6000               | 0.0500       | 0.9300                |               |
| E7 Party floor between dwellings (in blocks of flats)                     |             |                |               | 12.9200               | 0.0700       | 0.9044                |               |
| E7 Party floor between dwellings (in blocks of flats)                     |             |                |               | 11.4900               | 0.0700       | 0.8043                |               |
| E9 Balcony between dwellings, wall insulation continuous                  |             |                |               | 4.3600                | 0.0200       | 0.0872                |               |
| E16 Corner (normal)                                                       |             |                |               | 5.6000                | 0.0900       | 0.5040                |               |
| E16 Corner (normal)                                                       |             |                |               | 2.8000                | 0.0900       | 0.2520                |               |
| E17 Corner (inverted - internal area greater than external area)          |             |                |               | 2.8000                | -0.0900      | -0.2520               |               |
| E18 Party wall between dwellings                                          |             |                |               | 2.8000                | 0.0600       | 0.1680                |               |
| E18 Party wall between dwellings                                          |             |                |               | 2.8000                | 0.0600       | 0.1680                |               |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) |             |                |               | 5.7900                | 0.0000       | 0.0000                |               |
| E3 Sill                                                                   |             |                |               | 3.4100                | 0.0500       | 0.1705                |               |
| E14 Flat roof                                                             |             |                |               | 28.7700               | 0.0800       | 2.3016                |               |
| P4 Party wall - Roof (insulation at ceiling level)                        |             |                |               | 5.7900                | 0.1200       | 0.6948                |               |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                |             |                |               |                       |              |                       | 7.0778 (36)   |
| Point Thermal bridges                                                     |             |                |               |                       |              | (36a) =               | 0.0000        |
| Total fabric heat loss                                                    |             |                |               |                       |              | (33) + (36) + (36a) = | 42.2236 (37)  |

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

|                                                                 |          |         |         |         |         |         |         |         |         |         |         |                                                      |
|-----------------------------------------------------------------|----------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------------------------------------------------------|
| Assumed occupancy                                               |          |         |         |         |         |         |         |         |         |         |         | 2.3062 (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                                       | 27.1666  | 26.7631 | 26.1949 | 25.1474 | 24.3629 | 23.4931 | 23.0233 | 23.5875 | 24.2018 | 25.1325 | 26.2017 | 27.0747 (42b)                                        |
| Hot water usage for other uses                                  | 38.2476  | 36.8567 | 35.4659 | 34.0751 | 32.6843 | 31.2935 | 31.2935 | 32.6843 | 34.0751 | 35.4659 | 36.8567 | 38.2476 (42c)                                        |
| Average daily hot water use (litres/day)                        |          |         |         |         |         |         |         |         |         |         |         | 59.9582 (43)                                         |
|                                                                 | Jan      | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec                                                  |
| Daily hot water use                                             | 65.4141  | 63.6198 | 61.6609 | 59.2225 | 57.0472 | 54.7866 | 54.3168 | 56.2718 | 58.2769 | 60.5984 | 63.0584 | 65.3223 (44)                                         |
| Energy content (annual)                                         | 103.6000 | 90.5938 | 94.7704 | 81.0726 | 76.7965 | 67.3665 | 65.6914 | 69.6762 | 71.8612 | 82.2315 | 89.8383 | 102.2789 (45)                                        |
| Distribution loss (46)m = 0.15 x (45)m                          |          |         |         |         |         |         |         |         |         |         |         | Total = Sum(45)m = 995.7774                          |
| 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 (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 | 88.0600  | 77.0047 | 80.5549 | 68.9117 | 65.2770 | 57.2615 | 55.8377 | 59.2248 | 61.0821 | 69.8968 | 76.3625 | 86.9371 (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                                                 | 88.0600  | 77.0047 | 80.5549 | 68.9117 | 65.2770 | 57.2615 | 55.8377 | 59.2248 | 61.0821 | 69.8968 | 76.3625 | 86.9371 (64)                                         |
|                                                                 |          |         |         |         |         |         |         |         |         |         |         | Total per year (kWh/year) = Sum(64)m = 846.4107 (64) |
| 12Total per year (kWh/year)                                     |          |         |         |         |         |         |         |         |         |         |         | 846 (64)                                             |

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|                                                                                |         |         |         |         |         |         |         |         |         |         |         |                |
|--------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------------|
| Electric shower(s)                                                             | 50.3617 | 44.8727 | 48.9993 | 46.7594 | 47.6369 | 45.4409 | 46.9556 | 47.6369 | 46.7594 | 48.9993 | 48.0779 | 50.3617 (64a)  |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |         |         |         |         |         |         |         |         |         |         |         | 572.8619 (64a) |
| Heat gains from water heating, kWh/month                                       | 34.6054 | 30.4694 | 32.3885 | 28.9178 | 28.2285 | 25.6756 | 25.6983 | 26.7154 | 26.9604 | 29.7240 | 31.1101 | 34.3247 (65)   |

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

|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |          |      |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| Metabolic gains (Table 5), Watts                                                    | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |      |
| (66)m                                                                               | 115.3089 | 115.3089 | 115.3089 | 115.3089 | 115.3089 | 115.3089 | 115.3089 | 115.3089 | 115.3089 | 115.3089 | 115.3089 | 115.3089 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 107.9293 | 119.4931 | 107.9293 | 111.5269 | 107.9293 | 111.5269 | 107.9293 | 107.9293 | 111.5269 | 107.9293 | 111.5269 | 107.9293 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 203.1512 | 205.2592 | 199.9470 | 188.6378 | 174.3619 | 160.9446 | 151.9811 | 149.8730 | 155.1853 | 166.4945 | 180.7703 | 194.1876 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 34.5309  | 34.5309  | 34.5309  | 34.5309  | 34.5309  | 34.5309  | 34.5309  | 34.5309  | 34.5309  | 34.5309  | 34.5309  | 34.5309  | (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)                                 | -92.2471 | -92.2471 | -92.2471 | -92.2471 | -92.2471 | -92.2471 | -92.2471 | -92.2471 | -92.2471 | -92.2471 | -92.2471 | -92.2471 | (71) |
| Water heating gains (Table 5)                                                       | 46.5127  | 45.3413  | 43.5330  | 40.1636  | 37.9415  | 35.6606  | 34.5408  | 35.9078  | 37.4450  | 39.9516  | 43.2085  | 46.1354  | (72) |
| Total internal gains                                                                | 415.1858 | 427.6863 | 409.0019 | 397.9209 | 377.8253 | 365.7248 | 352.0438 | 351.3027 | 361.7498 | 371.9680 | 393.0984 | 405.8449 | (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    |
|-------------|----------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|----------|----------|--|---------------|
| Southwest   |          |          |          |          | 7.3300     | 36.7938                        | 0.6300                            | 0.7000                             | 0.7700                       |          |          |  | 82.4235 (79)  |
| Northwest   |          |          |          |          | 3.7400     | 11.2829                        | 0.6300                            | 0.7000                             | 0.7700                       |          |          |  | 12.8963 (81)  |
|             |          |          |          |          |            |                                |                                   |                                    |                              |          |          |  |               |
| Solar gains | 95.3198  | 166.6485 | 239.3938 | 315.6920 | 371.0089   | 375.9829                       | 359.3012                          | 316.8617                           | 265.6322                     | 187.2499 | 114.9512 |  | 81.0691 (83)  |
| Total gains | 510.5055 | 594.3348 | 648.3957 | 713.6129 | 748.8342   | 741.7077                       | 711.3449                          | 668.1644                           | 627.3820                     | 559.2179 | 508.0496 |  | 486.9140 (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                                                                         | 36.8014 | 36.9102 | 37.0176 | 37.5302 | 37.6277 | 38.0883 | 38.0883 | 38.1749 | 37.9096 | 37.6277 | 37.4310 | 37.2275 |              |
| alpha                                                                       | 3.4534  | 3.4607  | 3.4678  | 3.5020  | 3.5085  | 3.5392  | 3.5392  | 3.5450  | 3.5273  | 3.5085  | 3.4954  | 3.4818  |              |
| util living area                                                            | 0.9789  | 0.9639  | 0.9395  | 0.8802  | 0.7765  | 0.6150  | 0.4690  | 0.5134  | 0.7245  | 0.9028  | 0.9645  | 0.9819  | (86)         |
| MIT                                                                         | 19.1091 | 19.3823 | 19.7525 | 20.2463 | 20.6406 | 20.8885 | 20.9675 | 20.9551 | 20.7926 | 20.2798 | 19.6220 | 19.0718 | (87)         |
| Th 2                                                                        | 19.9765 | 19.9792 | 19.9819 | 19.9943 | 19.9967 | 20.0076 | 20.0076 | 20.0096 | 20.0034 | 19.9967 | 19.9919 | 19.9870 | (88)         |
| util rest of house                                                          | 0.9747  | 0.9568  | 0.9273  | 0.8554  | 0.7300  | 0.5393  | 0.3716  | 0.4146  | 0.6559  | 0.8774  | 0.9563  | 0.9783  | (89)         |
| MIT 2                                                                       | 18.2634 | 18.5340 | 18.8978 | 19.3788 | 19.7372 | 19.9455 | 19.9955 | 19.9917 | 19.8755 | 19.4215 | 18.7825 | 18.2341 | (90)         |
| Living area fraction                                                        | 18.6637 | 18.9354 | 19.3023 | 19.7894 | 20.1647 | 20.3918 | 20.4555 | 20.4476 | 20.3096 | 19.8277 | 19.1798 | 18.6305 | (91)         |
| MIT                                                                         | 18.6637 | 18.9354 | 19.3023 | 19.7894 | 20.1647 | 20.3918 | 20.4555 | 20.4476 | 20.3096 | 19.8277 | 19.1798 | 18.6305 | (92)         |
| Temperature adjustment                                                      | 18.6637 | 18.9354 | 19.3023 | 19.7894 | 20.1647 | 20.3918 | 20.4555 | 20.4476 | 20.3096 | 19.8277 | 19.1798 | 18.6305 | (93)         |
| adjusted MIT                                                                | 18.6637 | 18.9354 | 19.3023 | 19.7894 | 20.1647 | 20.3918 | 20.4555 | 20.4476 | 20.3096 | 19.8277 | 19.1798 | 18.6305 | (93)         |

## 8. Space heating requirement

|                                                                                |           |           |           |          |          |          |          |          |          |          |          |           |       |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-------|
| Utilisation                                                                    | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec       |       |
| Useful gains                                                                   | 493.9646  | 563.2485  | 594.8253  | 606.3553 | 552.9309 | 422.6663 | 296.4040 | 307.1332 | 425.6734 | 487.8603 | 481.6068 | 473.1883  | (94)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000  | 7.1000   | 4.2000    | (96)  |
| Heat loss rate W                                                               | 1177.2855 | 1146.9896 | 1043.1832 | 875.1902 | 678.5578 | 458.6722 | 305.3306 | 319.8163 | 494.0746 | 739.7151 | 973.4367 | 1169.2279 | (97)  |
| Space heating kWh                                                              | 508.3907  | 392.2740  | 333.5782  | 193.5612 | 93.4664  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 187.3800 | 354.1175 | 517.8534  | (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |          |          |          |          |          |          |          |          | 2580.6215 |       |
| 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                                                              | 508.3907  | 392.2740  | 333.5782  | 193.5612 | 93.4664  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 187.3800 | 354.1175 | 517.8534  | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |          |          | 2580.6215 |       |
| Space heating per m <sup>2</sup>                                               |           |           |           |          |          |          |          |          |          |          |          | 35.5752   | (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  | 744.4181 | 586.0313 | 600.5056 | 0.0000                   | 0.0000  | 0.0000 | 0.0000   | (100) |
| Utilisation                                         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.8166   | 0.8787   | 0.8536   | 0.0000                   | 0.0000  | 0.0000 | 0.0000   | (101) |
| Useful loss                                         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 607.9232 | 514.9548 | 512.5647 | 0.0000                   | 0.0000  | 0.0000 | 0.0000   | (102) |
| Total gains                                         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 822.0472 | 788.8113 | 740.4869 | 0.0000                   | 0.0000  | 0.0000 | 0.0000   | (103) |
| Space cooling kWh                                   | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 154.1693 | 203.7492 | 169.5741 | 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  | 38.5423  | 50.9373  | 42.3935  | 0.0000                   | 0.0000  | 0.0000 | 0.0000   | (107) |
| Space cooling requirement                           |        |        |        |        |         |          |          |          |                          |         |        | 131.8732 | (107) |

# Full SAP Calculation Printout



Energy for space heating  
Energy for space cooling  
Total  
Fabric Energy Efficiency (TFEE)

35.5752 (99)  
1.8179 (108)  
37.3931 (109)  
37.4 (109)