

# Summary for Input Data



|                      |          |               |                |            |
|----------------------|----------|---------------|----------------|------------|
| Plot Reference       | A 619    |               | Issued on Date | 19/03/2026 |
| Assessment Reference | Be Green | Plot Type Ref |                |            |
| Plot Address         |          |               | SAP Version    | 10.2       |

|                                    |          |               |       |      |       |
|------------------------------------|----------|---------------|-------|------|-------|
| SAP Rating                         | 83 B     | DER           | 4.89  | TER  | 14.26 |
| Environmental                      | 96 A     | % DER < TER   |       |      | 65.71 |
| CO <sub>2</sub> Emissions (t/year) | 0.36     | DFEE          | 37.05 | TFEE | 40.07 |
| Compliance Check                   | See BREL | % DFEE < TFEE |       |      | 7.54  |
| % DPER < TPER                      | 32.38    | DPER          | 51.59 | TPER | 76.29 |

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

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

|                                |                     |        |
|--------------------------------|---------------------|--------|
| Orientation                    | Southwest           |        |
| Property Tenture               | 1                   |        |
| Transaction Type               | 6                   |        |
| Terrain Type                   | Suburban            |        |
| 1.0 Property Type              | Flat, End-Terrace   |        |
| Position of Flat               | Top-floor flat      |        |
| Which Floor                    | 6                   |        |
| 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                   | 143.60              | kJ/m²K |
|                                |                     |        |
| 7.0 Electricity Tariff         | Standard            |        |
| Smart electricity meter fitted | Yes                 |        |
| Smart gas meter fitted         | Yes                 |        |

|                  |               |                     |                      |                       |
|------------------|---------------|---------------------|----------------------|-----------------------|
| 7.0 Measurements |               | Heat Loss Perimeter | Internal Floor Area  | Average Storey Height |
|                  | Ground floor: | 25.85 m             | 81.78 m <sup>2</sup> | 2.80 m                |

|                 |       |                |
|-----------------|-------|----------------|
| 8.0 Living Area | 44.26 | m <sup>2</sup> |
|-----------------|-------|----------------|

| Description     | Type        | Construction                                                                 | U-Value<br>(W/m <sup>2</sup> K) | Kappa<br>(kJ/m <sup>2</sup> K) | Gross<br>Area(m <sup>2</sup> ) | Nett Area<br>(m <sup>2</sup> ) | Shelter<br>Res | Shelter                        | Openings | Area Calculation<br>Type |
|-----------------|-------------|------------------------------------------------------------------------------|---------------------------------|--------------------------------|--------------------------------|--------------------------------|----------------|--------------------------------|----------|--------------------------|
| External Wall 1 | Cavity Wall | Cavity wall : dense plaster, AAC block, filled cavity, any outside structure | 0.15                            | 70.00                          | 53.23                          | 37.76                          | 0.00           | None                           | 15.47    | Enter Gross Area         |
| Corridor wall   | Cavity Wall | Cavity wall : dense plaster, AAC block, filled cavity, any outside structure | 0.22                            | 70.00                          | 19.14                          | 16.72                          | 0.70           | Stairwell Access<br>Corridor 3 | 2.42     | Enter Gross Area         |

| Description  | Type                               | Construction                                                                   | U-Value<br>(W/m <sup>2</sup> K) | Kappa<br>(kJ/m <sup>2</sup> K) | Area<br>(m <sup>2</sup> ) | Shelter<br>Res | Shelter |
|--------------|------------------------------------|--------------------------------------------------------------------------------|---------------------------------|--------------------------------|---------------------------|----------------|---------|
| Party Wall 1 | Filled Cavity with<br>Edge Sealing | Single plasterboard on dabs on both sides, dense blocks, cavity or cavity fill | 0.00                            | 70.00                          | 34.09                     | 0.00           | None    |

| Description     | Construction                 | Kappa<br>(kJ/m <sup>2</sup> K) | Area (m <sup>2</sup> ) |
|-----------------|------------------------------|--------------------------------|------------------------|
| Internal Wall 1 | Plasterboard on timber frame | 9.00                           | 170.72                 |

| Description     | Type                  | Construction                      | U-Value<br>(W/m <sup>2</sup> K) | Kappa<br>(kJ/m <sup>2</sup> K) | Gross<br>Area(m <sup>2</sup> ) | Nett Area<br>(m <sup>2</sup> ) | Shelter<br>Code | Shelter<br>Factor | Calculation<br>Type | Openings |
|-----------------|-----------------------|-----------------------------------|---------------------------------|--------------------------------|--------------------------------|--------------------------------|-----------------|-------------------|---------------------|----------|
| External Roof 1 | External Flat<br>Roof | Plasterboard, insulated flat roof | 0.10                            | 9.00                           | 81.78                          | 81.78                          | None            | 0.00              | Enter Gross<br>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          | 81.78     |

## 12.0 Opening Types

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

## 13.0 Openings

| Name       | Opening Type | Location        | Orientation | Area (m²) | Pitch |
|------------|--------------|-----------------|-------------|-----------|-------|
| Door       | Door         | Corridor wall   | South West  | 2.42      |       |
| NE window  | Window       | External Wall 1 | North East  | 7.13      |       |
| NW windows | Window       | External Wall 1 | North West  | 8.34      |       |

## 14.0 Conservatory

## 15.0 Draught Proofing

 %

## 16.0 Draught Lobby

## 17.0 Thermal Bridging

### 17.1 List of Bridges

| Bridge Type                                                               | Source Type            | Length | Psi  | Adjusted Reference: | Imported |
|---------------------------------------------------------------------------|------------------------|--------|------|---------------------|----------|
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | Table K1 - Default     | 12.18  | 0.00 | 0.00                | No       |
| E1 Steel lintel with perforated steel base plate                          | Independently assessed | 9.84   | 0.05 | 0.05                | No       |
| E4 Jamb                                                                   | Independently assessed | 21.60  | 0.04 | 0.04                | No       |
| E7 Party floor between dwellings (in blocks of flats)                     | Independently assessed | 14.65  | 0.05 | 0.05                | No       |
| E7 Party floor between dwellings (in blocks of flats)                     | Independently assessed | 6.84   | 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 | 2.80   | 0.05 | 0.05                | No       |
| E17 Corner (inverted – internal area greater than external area)          | Table K1 - Default     | 2.80   | 0.00 | 0.28                | No       |
| E18 Party wall between dwellings                                          | Independently assessed | 5.60   | 0.05 | 0.05                | No       |
| E18 Party wall between dwellings                                          | Independently assessed | 2.80   | 0.04 | 0.04                | No       |
| E25 Staggered party wall between dwellings                                | Independently assessed | 2.80   | 0.04 | 0.04                | No       |
| E3 Sill                                                                   | Independently assessed | 6.34   | 0.04 | 0.04                | No       |
| E14 Flat roof                                                             | Independently assessed | 25.85  | 0.05 | 0.05                | No       |
| P4 Party wall - Roof (insulation at ceiling level)                        | Independently assessed | 12.18  | 0.05 | 0.05                | No       |

Y-value  W/m²K

## 19.0 Mechanical Ventilation

### Mechanical Ventilation

|                                              |                                                                                 |
|----------------------------------------------|---------------------------------------------------------------------------------|
| Mechanical Ventilation System Present        | <input type="text" value="Yes"/>                                                |
| Approved Installation                        | <input type="text" value="Yes"/>                                                |
| Mechanical Ventilation data Type             | <input type="text" value="Database"/>                                           |
| Type                                         | <input type="text" value="Balanced mechanical ventilation with heat recovery"/> |
| MV Reference Number                          | <input type="text" value="500625"/>                                             |
| Configuration                                | <input type="text" value="1"/>                                                  |
| Manufacturer SFP                             | <input type="text" value="0.63"/>                                               |
| Duct Type                                    | <input type="text" value="Rigid"/>                                              |
| MVHR Efficiency                              | <input type="text" value="90.00"/>                                              |
| Wet Rooms                                    | <input type="text" value="1"/>                                                  |
| SFP from Installer Commissioning Certificate | <input type="text" value="No"/>                                                 |
| MVHR System Location                         | <input type="text" value="Inside heated envelope (installed exclusively)"/>     |
| Duct Installation Specification              | <input type="text" value="Level 1"/>                                            |

## 20.0 Fans, Open Fireplaces, Flues

|                                                  |                                |
|--------------------------------------------------|--------------------------------|
| Number of open chimneys                          | <input type="text" value="0"/> |
| Number of open flues                             | <input type="text" value="0"/> |
| Number of chimneys/flues attached to closed fire | <input type="text" value="0"/> |
| Number of flues attached to solid fuel boiler    | <input type="text" value="0"/> |
| Number of flues attached to other heater         | <input type="text" value="0"/> |
| Number of blocked chimneys                       | <input type="text" value="0"/> |

# 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      | 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

# Summary for Input Data



| Diverter               | <input type="text" value="No"/>   |            |             |       |                 |                    |                           |                    |  |  |  |
|------------------------|-----------------------------------|------------|-------------|-------|-----------------|--------------------|---------------------------|--------------------|--|--|--|
| Battery Capacity [kWh] | <input type="text" value="0.00"/> |            |             |       |                 |                    |                           |                    |  |  |  |
| PV Cells kWp           | Orientation                       | Elevation  | Overshading | FGHRS | MCS Certificate | Overshading Factor | MCS Certificate Reference | Panel Manufacturer |  |  |  |
| 0.39                   | South West                        | Horizontal | Modest      |       | No              | 0.80               |                           |                    |  |  |  |

| 34.0 Small-scale Hydro |     |     |     |     | <input type="text" value="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 619             |               |       |               | Issued on Date | 19/03/2026 |  |
| Assessment Reference               | Be Green          |               |       | Plot Type Ref |                |            |  |
| Plot Address                       |                   |               |       |               | SAP Version    | 10.2       |  |
|                                    |                   |               |       |               |                |            |  |
| SAP Rating                         | 83 B              | DER           | 4.89  | TER           | 14.26          |            |  |
| Environmental                      | 96 A              | % DER < TER   |       |               |                | 65.71      |  |
| CO <sub>2</sub> Emissions (t/year) | 0.36              | DFEE          | 37.05 | TFEE          | 40.07          |            |  |
| Compliance Check                   | See BREL          | % DFEE < TFEE |       |               |                | 7.54       |  |
| % DPER < TPER                      | 32.38             | DPER          | 51.59 | TPER          | 76.29          |            |  |
|                                    |                   |               |       |               |                |            |  |
| 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                                          | 81.7800 (1b)              | 2.8000 (2b)                     | 228.9840 (1b) - (3b)        |
| Ground floor                                           |                           |                                 |                             |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 81.7800                   |                                 | 228.9840 (4)                |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | 228.9840 (5)                |

## 2. Ventilation rate

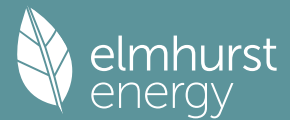
|                                                                                                  | m <sup>3</sup> per hour                 |
|--------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                          | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                             | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                               | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                    | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                         | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                       | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                              | 0 * 10 = 0.0000 (7a)                    |
| Number of passive vents                                                                          | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                     | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) | 0.0000 / (5) = 0.0000 (8)               |
| Pressure test                                                                                    | Yes                                     |
| Pressure Test Method                                                                             | Blower Door                             |
| Measured/design AP50                                                                             | 2.0000 (17)                             |
| Infiltration rate                                                                                | 0.1000 (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) = 0.0850 (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                                                                                         | 0.1084 | 0.1063 | 0.1041 | 0.0935 | 0.0914 | 0.0808 | 0.0808 | 0.0786 | 0.0850 | 0.0914 | 0.0956 | 0.0999 (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) =            |        |        |        |        |        |        |        |        |        |        |        | 81.0000 (23c) |
| Effective ac                                                                                            | 0.2034 | 0.2012 | 0.1991 | 0.1885 | 0.1864 | 0.1757 | 0.1757 | 0.1736 | 0.1800 | 0.1864 | 0.1906 | 0.1949 (25)   |

## 3. Heat losses and heat loss parameter

| Element                                                        | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K       | A x K<br>kJ/K   |
|----------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------------|-----------------|
| Main dwelling                                                  |                         |                            |                           |                               |              |                                      |                 |
| Door                                                           |                         |                            | 2.4200                    | 1.0000                        | 2.4200       |                                      | (26)            |
| Window                                                         |                         |                            | 15.4700                   | 1.1450                        | 17.7137      |                                      | (27)            |
| External Wall 1                                                | 53.2300                 | 15.4700                    | 37.7600                   | 0.1500                        | 5.6640       | 70.0000                              | 2643.2000 (29a) |
| Corridor wall                                                  | 19.1400                 | 2.4200                     | 16.7200                   | 0.1900                        | 3.1768       | 70.0000                              | 1170.4000 (29a) |
| External Roof 1                                                | 81.7800                 |                            | 81.7800                   | 0.1000                        | 8.1780       | 9.0000                               | 736.0200 (30)   |
| Total net area of external elements Aum(A, m <sup>2</sup> )    |                         |                            | 154.1500                  |                               |              |                                      | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                            |                         |                            |                           | (26)...(30) + (32) =          | 37.1525      |                                      | (33)            |
| Main dwelling                                                  |                         |                            |                           |                               |              |                                      |                 |
| Party Wall 1                                                   |                         |                            | 34.0900                   | 0.0000                        | 0.0000       | 70.0000                              | 2386.3000 (32)  |
| Party Floor 1                                                  |                         |                            | 81.7800                   |                               |              | 40.0000                              | 3271.2000 (32d) |
| Internal Wall 1                                                |                         |                            | 170.7200                  |                               |              | 9.0000                               | 1536.4800 (32c) |
| Heat capacity Cm = Sum(A x k)                                  |                         |                            |                           |                               |              | (28)...(30) + (32) + (32a)...(32e) = | 11743.5999 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K |                         |                            |                           |                               |              |                                      | 143.5999 (35)   |
| List of Thermal Bridges                                        |                         |                            |                           |                               |              |                                      |                 |

# Full SAP Calculation Printout



|                                                                           |         |                       |              |
|---------------------------------------------------------------------------|---------|-----------------------|--------------|
| K1 Element                                                                | Length  | Psi-value             | Total        |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | 12.1800 | 0.0000                | 0.0000       |
| E1 Steel lintel with perforated steel base plate                          | 9.8400  | 0.0500                | 0.4920       |
| E4 Jamb                                                                   | 21.6000 | 0.0400                | 0.8640       |
| E7 Party floor between dwellings (in blocks of flats)                     | 14.6500 | 0.0500                | 0.7325       |
| E7 Party floor between dwellings (in blocks of flats)                     | 6.8400  | 0.0390                | 0.2668       |
| E9 Balcony between dwellings, wall insulation continuous                  | 4.3600  | 0.0500                | 0.2180       |
| E16 Corner (normal)                                                       | 2.8000  | 0.0500                | 0.1400       |
| E17 Corner (inverted - internal area greater than external area)          | 2.8000  | 0.0000                | 0.0000       |
| E18 Party wall between dwellings                                          | 5.6000  | 0.0500                | 0.2800       |
| E18 Party wall between dwellings                                          | 2.8000  | 0.0390                | 0.1092       |
| E25 Staggered party wall between dwellings                                | 2.8000  | 0.0390                | 0.1092       |
| E3 Sill                                                                   | 6.3400  | 0.0400                | 0.2536       |
| E14 Flat roof                                                             | 25.8500 | 0.0500                | 1.2925       |
| P4 Party wall - Roof (insulation at ceiling level)                        | 12.1800 | 0.0500                | 0.6090       |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                |         |                       | 5.3668 (36)  |
| Point Thermal bridges                                                     |         |                       | 0.0000       |
| Total fabric heat loss                                                    |         | (33) + (36) + (36a) = | 42.5193 (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                                                               | 15.3680 | 15.2074 | 15.0468 | 14.2439 | 14.0834 | 13.2805 | 13.2805 | 13.1199 | 13.6016 | 14.0834 | 14.4045 | 14.7257 | (38) |
| Heat transfer coeff                                                 | 57.8873 | 57.7267 | 57.5661 | 56.7632 | 56.6027 | 55.7998 | 55.7998 | 55.6392 | 56.1209 | 56.6027 | 56.9238 | 57.2450 | (39) |
| Average = Sum(39)m / 12 =                                           |         |         |         |         |         |         |         |         |         |         |         | 56.7231 |      |
| HLP                                                                 | 0.7078  | 0.7059  | 0.7039  | 0.6941  | 0.6921  | 0.6823  | 0.6823  | 0.6804  | 0.6862  | 0.6921  | 0.6961  | 0.7000  | (40) |
| HLP (average)                                                       |         |         |         |         |         |         |         |         |         |         |         | 0.6936  |      |
| Days in mont                                                        | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31      |      |

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

|                                                                 |          |          |          |          |          |          |          |          |          |                                        |          |           |             |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------------------------------|----------|-----------|-------------|
| Assumed occupancy                                               |          |          |          |          |          |          |          |          |          |                                        |          |           | 2.4958 (42) |
| Hot water usage for mixer showers                               | 64.3964  | 63.4105  | 61.9575  | 59.7224  | 57.7198  | 54.9181  | 52.7022  | 55.2927  | 56.5957  | 59.3706                                | 62.2604  | 64.3383   | (42a)       |
| Hot water usage for baths                                       | 27.8975  | 27.4764  | 26.8773  | 25.9801  | 25.1715  | 24.0584  | 23.2139  | 24.2466  | 24.7885  | 25.8914                                | 27.0381  | 27.8754   | (42b)       |
| Hot water usage for other uses                                  | 40.1892  | 38.7277  | 37.2663  | 35.8049  | 34.3435  | 32.8820  | 32.8820  | 34.3435  | 35.8049  | 37.2663                                | 38.7277  | 40.1892   | (42c)       |
| Average daily hot water use (litres/day)                        |          |          |          |          |          |          |          |          |          |                                        |          | 121.7717  | (43)        |
| Daily hot water use                                             | 132.4830 | 129.6146 | 126.1011 | 121.5073 | 117.2347 | 111.8585 | 108.7981 | 113.8828 | 117.1891 | 122.5283                               | 128.0263 | 132.4028  | (44)        |
| Energy conte                                                    | 195.0379 | 171.5063 | 180.1959 | 158.7190 | 151.0688 | 129.3607 | 120.2251 | 134.0421 | 135.9335 | 157.8901                               | 173.0317 | 194.4433  | (45)        |
| Energy content (annual)                                         |          |          |          |          |          |          |          |          |          | Total = Sum(45)m =                     |          | 1901.4544 |             |
| Distribution loss (46)m = 0.15 x (45)m                          | 29.2557  | 25.7259  | 27.0294  | 23.8078  | 22.6603  | 19.4041  | 18.0338  | 20.1063  | 20.3900  | 23.6835                                | 25.9548  | 29.1665   | (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 | 250.3147 | 221.4337 | 235.4727 | 212.2126 | 206.3456 | 182.8543 | 175.5020 | 189.3189 | 189.4271 | 213.1669                               | 226.5254 | 249.7201  | (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                                                 | 250.3147 | 221.4337 | 235.4727 | 212.2126 | 206.3456 | 182.8543 | 175.5020 | 189.3189 | 189.4271 | 213.1669                               | 226.5254 | 249.7201  | (64)        |
| 12Total per year (kWh/year)                                     |          |          |          |          |          |          |          |          |          | Total per year (kWh/year) = Sum(64)m = |          | 2552.2941 | (64)        |
| Electric shower(s)                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000    | (64a)       |
|                                                                 |          |          |          |          |          |          |          |          |          |                                        |          | 0.0000    | (64a)       |
| Heat gains from water heating, kWh/month                        | 109.0715 | 96.9678  | 104.1366 | 95.5690  | 94.4518  | 85.8074  | 84.1963  | 88.7904  | 87.9928  | 96.7199                                | 100.3280 | 108.8738  | (65)        |

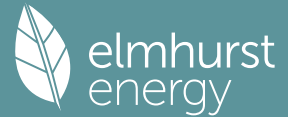
## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |          |      |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| Metabolic gains (Table 5), Watts                                                    | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |      |
| (66)m                                                                               | 124.7884 | 124.7884 | 124.7884 | 124.7884 | 124.7884 | 124.7884 | 124.7884 | 124.7884 | 124.7884 | 124.7884 | 124.7884 | 124.7884 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 114.0975 | 126.3222 | 114.0975 | 117.9008 | 114.0975 | 117.9008 | 114.0975 | 114.0975 | 117.9008 | 114.0975 | 117.9008 | 114.0975 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 223.1204 | 225.4357 | 219.6013 | 207.1804 | 191.5013 | 176.7651 | 166.9204 | 164.6051 | 170.4396 | 182.8605 | 198.5396 | 213.2758 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 35.4788  | 35.4788  | 35.4788  | 35.4788  | 35.4788  | 35.4788  | 35.4788  | 35.4788  | 35.4788  | 35.4788  | 35.4788  | 35.4788  | (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)                                 | -99.8307 | -99.8307 | -99.8307 | -99.8307 | -99.8307 | -99.8307 | -99.8307 | -99.8307 | -99.8307 | -99.8307 | -99.8307 | -99.8307 | (71) |
| Water heating gains (Table 5)                                                       | 146.6015 | 144.2973 | 139.9685 | 132.7347 | 126.9514 | 119.1769 | 113.1671 | 119.3420 | 122.2122 | 129.9999 | 139.3444 | 146.3358 | (72) |
| Total internal gains                                                                | 544.2560 | 556.4918 | 534.1038 | 518.2524 | 492.9866 | 474.2793 | 454.6215 | 458.4811 | 470.9891 | 487.3944 | 516.2213 | 534.1456 | (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 |
|-------|------------|------------------------|--------------------|---------------------|------------------|------------|

# Full SAP Calculation Printout



|                                                                                         |                                       |          |          | W/m2     |          | or Table 6b |          | or Table 6c |          | Table 6d |          |                 |
|-----------------------------------------------------------------------------------------|---------------------------------------|----------|----------|----------|----------|-------------|----------|-------------|----------|----------|----------|-----------------|
| Northeast                                                                               |                                       | 7.1300   |          | 11.2829  |          | 0.3500      |          | 0.7000      |          | 0.7700   |          | 13.6588 (75)    |
| Northwest                                                                               |                                       | 8.3400   |          | 11.2829  |          | 0.3500      |          | 0.7000      |          | 0.7700   |          | 15.9767 (81)    |
|                                                                                         |                                       |          |          |          |          |             |          |             |          |          |          |                 |
| Solar gains                                                                             | 29.6355                               | 60.3239  | 108.6844 | 178.4911 | 239.9270 | 255.7876    | 239.2841 | 190.7600    | 132.4337 | 73.7206  | 37.2891  | 24.2018 (83)    |
| Total gains                                                                             | 573.8915                              | 616.8157 | 642.7882 | 696.7434 | 732.9137 | 730.0669    | 693.9056 | 649.2412    | 603.4228 | 561.1149 | 553.5104 | 558.3474 (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                                                                                     | 56.3528                               | 56.5096  | 56.6672  | 57.4687  | 57.6317  | 58.4610     | 58.4610  | 58.6297     | 58.1264  | 57.6317  | 57.3066  | 56.9851         |
| alpha                                                                                   | 4.7569                                | 4.7673   | 4.7778   | 4.8312   | 4.8421   | 4.8974      | 4.8974   | 4.9086      | 4.8751   | 4.8421   | 4.8204   | 4.7990          |
| util living area                                                                        | 0.9642                                | 0.9474   | 0.9153   | 0.8225   | 0.6706   | 0.4815      | 0.3524   | 0.3917      | 0.6132   | 0.8481   | 0.9387   | 0.9678 (86)     |
| MIT                                                                                     | 20.0706                               | 20.2238  | 20.4454  | 20.7432  | 20.9211  | 20.9874     | 20.9978  | 20.9963     | 20.9610  | 20.7451  | 20.3869  | 20.0503 (87)    |
| Th 2                                                                                    | 20.3339                               | 20.3356  | 20.3374  | 20.3461  | 20.3478  | 20.3565     | 20.3565  | 20.3582     | 20.3530  | 20.3478  | 20.3443  | 20.3408 (88)    |
| util rest of house                                                                      | 0.9586                                | 0.9395   | 0.9025   | 0.7983   | 0.6332   | 0.4355      | 0.3015   | 0.3381      | 0.5635   | 0.8218   | 0.9282   | 0.9627 (89)     |
| MIT 2                                                                                   | 19.2433                               | 19.4362  | 19.7121  | 20.0752  | 20.2741  | 20.3470     | 20.3553  | 20.3561     | 20.3213  | 20.0850  | 19.6489  | 19.2232 (90)    |
| Living area fraction                                                                    | fLA = Living area / (4) = 0.5412 (91) |          |          |          |          |             |          |             |          |          |          |                 |
| MIT                                                                                     | 19.6911                               | 19.8625  | 20.1090  | 20.4367  | 20.6242  | 20.6936     | 20.7030  | 20.7026     | 20.6675  | 20.4423  | 20.0483  | 19.6708 (92)    |
| Temperature adjustment                                                                  | 0.0000                                |          |          |          |          |             |          |             |          |          |          |                 |
| adjusted MIT                                                                            | 19.6911                               | 19.8625  | 20.1090  | 20.4367  | 20.6242  | 20.6936     | 20.7030  | 20.7026     | 20.6675  | 20.4423  | 20.0483  | 19.6708 (93)    |
|                                                                                         |                                       |          |          |          |          |             |          |             |          |          |          |                 |
| 8. Space heating requirement                                                            |                                       |          |          |          |          |             |          |             |          |          |          |                 |
|                                                                                         |                                       |          |          |          |          |             |          |             |          |          |          |                 |
|                                                                                         | Jan                                   | Feb      | Mar      | Apr      | May      | Jun         | Jul      | Aug         | Sep      | Oct      | Nov      | Dec             |
| Utilisation                                                                             | 0.9523                                | 0.9330   | 0.8976   | 0.8019   | 0.6494   | 0.4598      | 0.3290   | 0.3670      | 0.5881   | 0.8258   | 0.9228   | 0.9566 (94)     |
| Useful gains                                                                            | 546.5123                              | 575.4656 | 576.9690 | 558.6868 | 475.9234 | 335.6667    | 228.2735 | 238.2625    | 354.8469 | 463.3904 | 510.7838 | 534.1309 (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                                                                        | 890.9474                              | 863.7330 | 783.4160 | 654.8604 | 505.1361 | 340.0202    | 228.9466 | 239.3940    | 368.5756 | 557.0988 | 737.0675 | 885.6266 (97)   |
| Space heating kWh                                                                       | 256.2597                              | 193.7157 | 153.5966 | 69.2450  | 21.7342  | 0.0000      | 0.0000   | 0.0000      | 0.0000   | 69.7190  | 162.9242 | 261.5128 (98a)  |
| Space heating requirement - total per year (kWh/year)                                   |                                       |          |          |          |          |             |          |             |          |          |          | 1188.7072       |
| 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                                                                       | 256.2597                              | 193.7157 | 153.5966 | 69.2450  | 21.7342  | 0.0000      | 0.0000   | 0.0000      | 0.0000   | 69.7190  | 162.9242 | 261.5128 (98c)  |
| Space heating requirement after solar contribution - total per year (kWh/year)          |                                       |          |          |          |          |             |          |             |          |          |          | 1188.7072       |
| Space heating per m2                                                                    | (98c) / (4) =                         |          |          |          |          |             |          |             |          |          |          | 14.5354 (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                                                               | 256.2597                              | 193.7157 | 153.5966 | 69.2450  | 21.7342  | 0.0000      | 0.0000   | 0.0000      | 0.0000   | 69.7190  | 162.9242 | 261.5128 (98)   |
| Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.50                                   |                                       |          |          |          |          |             |          |             |          |          |          |                 |
| 307a                                                                                    | 384.3895                              | 290.5735 | 230.3948 | 103.8675 | 32.6013  | 0.0000      | 0.0000   | 0.0000      | 0.0000   | 104.5785 | 244.3864 | 392.2692        |
| Space heating requirement                                                               | 384.3895                              | 290.5735 | 230.3948 | 103.8675 | 32.6013  | 0.0000      | 0.0000   | 0.0000      | 0.0000   | 104.5785 | 244.3864 | 392.2692 (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                                                        |                                       |          |          |          |          |             |          |             |          |          |          |                 |
|                                                                                         | 250.3147                              | 221.4337 | 235.4727 | 212.2126 | 206.3456 | 182.8543    | 175.5020 | 189.3189    | 189.4271 | 213.1669 | 226.5254 | 249.7201 (64)   |
| Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.50                                   |                                       |          |          |          |          |             |          |             |          |          |          |                 |
| 310a                                                                                    | 375.4721                              | 332.1506 | 353.2090 | 318.3190 | 309.5184 | 274.2815    | 263.2529 | 283.9783    | 284.1407 | 319.7504 | 339.7881 | 374.5801        |
| Water heating fuel                                                                      | 375.4721                              | 332.1506 | 353.2090 | 318.3190 | 309.5184 | 274.2815    | 263.2529 | 283.9783    | 284.1407 | 319.7504 | 339.7881 | 374.5801 (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                                                                            | 18.6846                               | 16.8764  | 18.6846  | 18.0819  | 18.6846  | 18.0819     | 18.6846  | 18.6846     | 18.0819  | 18.6846  | 18.0819  | 18.6846 (331)   |
| Lighting                                                                                | 26.8310                               | 21.5249  | 19.3807  | 14.1992  | 10.9678  | 8.9608      | 10.0052  | 13.0052     | 16.8924  | 22.1638  | 25.0340  | 27.5768 (332)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                           |                                       |          |          |          |          |             |          |             |          |          |          |                 |
| (333a)m                                                                                 | -4.2726                               | -7.5825  | -13.9827 | -19.6680 | -24.5742 | -24.2309    | -23.7259 | -20.4262    | -15.3651 | -9.8853  | -5.1300  | -3.4883 (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                                                  |                                       |          |          |          |          |             |          |             |          |          |          | 1783.0608 (307) |
| Space heating fuel - secondary                                                          |                                       |          |          |          |          |             |          |             |          |          |          | 0.0000 (309)    |
| Water heating fuel - community heating                                                  |                                       |          |          |          |          |             |          |             |          |          |          | 3828.4412 (310) |
| Efficiency of water heater                                                              |                                       |          |          |          |          |             |          |             |          |          |          | 0.0000 (311)    |
| Electricity used for heat distribution                                                  |                                       |          |          |          |          |             |          |             |          |          |          | 17.8306 (313)   |
| Space cooling fuel                                                                      |                                       |          |          |          |          |             |          |             |          |          |          | 0.0000 (321)    |
| Electricity for pumps and fans:                                                         |                                       |          |          |          |          |             |          |             |          |          |          |                 |
| (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7875)              |                                       |          |          |          |          |             |          |             |          |          |          |                 |
| mechanical ventilation fans (SFP = 0.7875)                                              |                                       |          |          |          |          |             |          |             |          |          |          | 219.9964 (330a) |

# Full SAP Calculation Printout



|                                                               |                 |
|---------------------------------------------------------------|-----------------|
| Total electricity for the above, kWh/year                     | 219.9964 (331)  |
| Electricity for lighting (calculated in Appendix L)           | 216.5419 (332)  |
| Energy saving/generation technologies (Appendices M ,N and Q) |                 |
| PV generation                                                 | -172.3316 (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                           | 5875.7086 (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                  | 2418.7509          | 0.1563                        | 120.0944 (367)           |
| Electrical energy for heat distribution (space & water) | 17.8306            | 0.0000                        | 8.1784 (372)             |
| Overall CO2 factor for heat network                     |                    |                               | 0.0643 (386)             |
| Total CO2 associated with community systems             |                    |                               | 360.6949 (373)           |
| Space and water heating                                 |                    |                               | 360.6949 (376)           |
| Pumps, fans and electric keep-hot                       | 219.9964           | 0.1387                        | 30.5162 (378)            |
| Energy for lighting                                     | 216.5419           | 0.1443                        | 31.2537 (379)            |
| Energy saving/generation technologies                   |                    |                               |                          |
| PV Unit electricity used in dwelling                    | -172.3316          | 0.1305                        | -22.4965                 |
| PV Unit electricity exported                            | 0.0000             | 0.0000                        | 0.0000                   |
| Total                                                   |                    |                               | -22.4965 (380)           |
| Total CO2, kg/year                                      |                    |                               | 399.9683 (383)           |
| EPC Dwelling Carbon Dioxide Emission Rate (DER)         |                    |                               | 4.8900 (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                  | 2418.7509          | 1.5785                              | 1213.1767 (467)            |
| Electrical energy for heat distribution (space & water) | 17.8306            | 0.0000                              | 86.3683 (472)              |
| Overall CO2 factor for heat network                     |                    |                                     | 0.6788 (486)               |
| Total CO2 associated with community systems             |                    |                                     | 3809.1418 (473)            |
| Space and water heating                                 |                    |                                     | 3809.1418 (476)            |
| Pumps, fans and electric keep-hot                       | 219.9964           | 1.5128                              | 332.8105 (478)             |
| Energy for lighting                                     | 216.5419           | 1.5338                              | 332.1391 (479)             |
| Energy saving/generation technologies                   |                    |                                     |                            |
| PV Unit electricity used in dwelling                    | -172.3316          | 1.4822                              | -255.4340                  |
| PV Unit electricity exported                            | 0.0000             | 0.0000                              | 0.0000                     |
| Total                                                   |                    |                                     | -255.4340 (480)            |
| Total Primary energy kWh/year                           |                    |                                     | 4218.6575 (483)            |
| Dwelling Primary energy Rate (DPER)                     |                    |                                     | 51.5900 (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                                          | 81.7800 (1b) | 2.8000 (2b)                     | 228.9840 (1b) - (3b) |
| Ground floor                                           |              |                                 |                      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 81.7800      |                                 | (4)                  |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | 228.9840 (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         | 30.0000 / (5) = 0.1310 (8)              |
| Pressure test                                        | Yes                                     |
| Pressure Test Method                                 | Blower Door                             |
| Measured/design AP50                                 | 5.0000 (17)                             |
| Infiltration rate                                    | 0.3810 (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) = 0.3239 (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    | 0.4129        | 0.4048        | 0.3967        | 0.3562        | 0.3482        | 0.3077        | 0.3077        | 0.2996        | 0.3239        | 0.3482        | 0.3643        | 0.3805 (22b)       |
|                 | 0.5853        | 0.5819        | 0.5787        | 0.5635        | 0.5606        | 0.5473        | 0.5473        | 0.5449        | 0.5524        | 0.5606        | 0.5664        | 0.5724 (25)        |

## 3. Heat losses and heat loss parameter

| Element                                           | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K     | A x U<br>W/K | K-value<br>kJ/m2K | A x K<br>kJ/K |
|---------------------------------------------------|-------------|----------------|---------------|----------------------|--------------|-------------------|---------------|
| Main dwelling                                     |             |                |               |                      |              |                   |               |
| TER Opaque door                                   |             |                | 2.4200        | 1.0000               | 2.4200       |                   | (26)          |
| TER Opening Type                                  |             |                | 15.4700       | 1.1450               | 17.7137      |                   | (27)          |
| External Wall 1                                   | 53.2300     | 15.4700        | 37.7600       | 0.1800               | 6.7968       |                   | (29a)         |
| Corridor wall                                     | 19.1400     | 2.4200         | 16.7200       | 0.1800               | 3.0096       |                   | (29a)         |
| External Roof 1                                   | 81.7800     |                | 81.7800       | 0.1100               | 8.9958       |                   | (30)          |
| Total net area of external elements Aum(A, m2)    |             |                | 154.1500      |                      |              |                   | (31)          |
| Fabric heat loss, W/K = Sum (A x U)               |             |                |               | (26)...(30) + (32) = | 38.9359      |                   | (33)          |
| Main dwelling                                     |             |                |               |                      |              |                   |               |
| Party Wall 1                                      |             |                | 34.0900       | 0.0000               | 0.0000       |                   | (32)          |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K |             |                |               |                      |              |                   | 143.5999 (35) |

## List of Thermal Bridges

| K1 Element                                                                | Length  | Psi-value | Total                              |
|---------------------------------------------------------------------------|---------|-----------|------------------------------------|
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | 12.1800 | 0.0000    | 0.0000                             |
| E1 Steel lintel with perforated steel base plate                          | 9.8400  | 0.0500    | 0.4920                             |
| E4 Jamb                                                                   | 21.6000 | 0.0500    | 1.0800                             |
| E7 Party floor between dwellings (in blocks of flats)                     | 14.6500 | 0.0700    | 1.0255                             |
| E7 Party floor between dwellings (in blocks of flats)                     | 6.8400  | 0.0700    | 0.4788                             |
| E9 Balcony between dwellings, wall insulation continuous                  | 4.3600  | 0.0200    | 0.0872                             |
| 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                                          | 5.6000  | 0.0600    | 0.3360                             |
| E18 Party wall between dwellings                                          | 2.8000  | 0.0600    | 0.1680                             |
| E25 Staggered party wall between dwellings                                | 2.8000  | 0.0600    | 0.1680                             |
| E3 Sill                                                                   | 6.3400  | 0.0500    | 0.3170                             |
| E14 Flat roof                                                             | 25.8500 | 0.0800    | 2.0680                             |
| P4 Party wall - Roof (insulation at ceiling level)                        | 12.1800 | 0.1200    | 1.4616                             |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                |         |           | 7.6821 (36)                        |
| Point Thermal bridges                                                     |         |           | (36a) = 0.0000                     |
| Total fabric heat loss                                                    |         |           | (33) + (36) + (36a) = 46.6180 (37) |

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

|                           |                |                |                |                |                |                |                |                |                |                |                |                     |
|---------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|---------------------|
| (38)m                     | Jan<br>44.2245 | Feb<br>43.9743 | Mar<br>43.7291 | Apr<br>42.5774 | May<br>42.3619 | Jun<br>41.3588 | Jul<br>41.3588 | Aug<br>41.1731 | Sep<br>41.7452 | Oct<br>42.3619 | Nov<br>42.7978 | Dec<br>43.2536 (38) |
| Heat transfer coeff       | 90.8425        | 90.5924        | 90.3472        | 89.1954        | 88.9800        | 87.9769        | 87.9769        | 87.7911        | 88.3632        | 88.9800        | 89.4159        | 89.8716 (39)        |
| Average = Sum(39)m / 12 = |                |                |                |                |                |                |                |                |                |                |                | 89.1944             |
| HLP                       | Jan<br>1.1108  | Feb<br>1.1078  | Mar<br>1.1048  | Apr<br>1.0907  | May<br>1.0880  | Jun<br>1.0758  | Jul<br>1.0758  | Aug<br>1.0735  | Sep<br>1.0805  | Oct<br>1.0880  | Nov<br>1.0934  | Dec<br>1.0989 (40)  |
| HLP (average)             |                |                |                |                |                |                |                |                |                |                |                | 1.0907              |
| Days in mont              | 31             | 28             | 31             | 30             | 31             | 30             | 31             | 31             | 30             | 31             | 30             | 31                  |

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

|                                                                                |          |          |          |          |          |          |          |          |          |                                        |               |                |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------------------------------|---------------|----------------|
| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |                                        |               | 2.4958 (42)    |
| Hot water usage for mixer showers                                              |          |          |          |          |          |          |          |          |          |                                        |               |                |
| 66.0655                                                                        | 65.0727  | 63.6259  | 60.8578  | 58.8150  | 56.5369  | 55.2421  | 56.6779  | 58.2518  | 60.6978  | 63.5253                                | 65.8124 (42a) |                |
| Hot water usage for baths                                                      |          |          |          |          |          |          |          |          |          |                                        |               |                |
| 28.5336                                                                        | 28.1098  | 27.5131  | 26.4128  | 25.5889  | 24.6753  | 24.1818  | 24.7744  | 25.4196  | 26.3972  | 27.5201                                | 28.4371 (42b) |                |
| Hot water usage for other uses                                                 |          |          |          |          |          |          |          |          |          |                                        |               |                |
| 40.1892                                                                        | 38.7277  | 37.2663  | 35.8049  | 34.3435  | 32.8820  | 32.8820  | 34.3435  | 35.8049  | 37.2663  | 38.7277                                | 40.1892 (42c) |                |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |                                        |               | 123.9009 (43)  |
|                                                                                | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct                                    | Nov           | Dec            |
| Daily hot water use                                                            |          |          |          |          |          |          |          |          |          |                                        |               |                |
| 134.7883                                                                       | 131.9102 | 128.4053 | 123.0755 | 118.7474 | 114.0943 | 112.3059 | 115.7957 | 119.4763 | 124.3612 | 129.7732                               | 134.4387 (44) |                |
| Energy content                                                                 | 213.4716 | 187.8384 | 197.3542 | 168.4842 | 159.8568 | 140.2922 | 135.8243 | 143.3793 | 147.3262 | 168.7570                               | 184.8857      | 210.4985 (45)  |
| Energy content (annual)                                                        |          |          |          |          |          |          |          |          |          | Total = Sum(45)m =                     |               | 2057.9684      |
| Distribution loss (46)m = 0.15 x (45)m                                         |          |          |          |          |          |          |          |          |          |                                        |               |                |
| 32.0207                                                                        | 28.1758  | 29.6031  | 25.2726  | 23.9785  | 21.0438  | 20.3736  | 21.5069  | 22.0989  | 25.3136  | 27.7329                                | 31.5748 (46)  |                |
| Water storage loss (or HIU loss):                                              |          |          |          |          |          |          |          |          |          |                                        |               |                |
| Store volume                                                                   |          |          |          |          |          |          |          |          |          |                                        |               | 180.0000 (47)  |
| a) If manufacturer declared loss factor is known (kWh/day):                    |          |          |          |          |          |          |          |          |          |                                        |               | 1.5520 (48)    |
| Temperature factor from Table 2b                                               |          |          |          |          |          |          |          |          |          |                                        |               | 0.5400 (49)    |
| Enter (49) or (54) in (55)                                                     |          |          |          |          |          |          |          |          |          |                                        |               | 0.8381 (55)    |
| Total storage loss                                                             |          |          |          |          |          |          |          |          |          |                                        |               |                |
| 25.9803                                                                        | 23.4661  | 25.9803  | 25.1422  | 25.9803  | 25.1422  | 25.9803  | 25.9803  | 25.9803  | 25.1422  | 25.9803                                | 25.1422       | 25.9803 (56)   |
| If cylinder contains dedicated solar storage                                   |          |          |          |          |          |          |          |          |          |                                        |               |                |
| 25.9803                                                                        | 23.4661  | 25.9803  | 25.1422  | 25.9803  | 25.1422  | 25.9803  | 25.9803  | 25.9803  | 25.1422  | 25.9803                                | 25.1422       | 25.9803 (57)   |
| 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                |          |          |          |          |          |          |          |          |          |                                        |               |                |
| 262.7143                                                                       | 232.3157 | 246.5968 | 216.1384 | 209.0994 | 187.9464 | 185.0670 | 192.6220 | 194.9804 | 217.9997 | 232.5399                               | 259.7411 (62) |                |
| WWHRS                                                                          | -30.2024 | -26.7113 | -27.9705 | -23.1607 | -21.5849 | -18.4704 | -17.3130 | -18.4107 | -19.1101 | -22.5288                               | -25.5223      | -29.6431 (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                                                                |          |          |          |          |          |          |          |          |          |                                        |               |                |
| 232.5119                                                                       | 205.6044 | 218.6264 | 192.9777 | 187.5145 | 169.4761 | 167.7540 | 174.2113 | 175.8703 | 195.4709 | 207.0176                               | 230.0980 (64) |                |
| 12Total per year (kWh/year)                                                    |          |          |          |          |          |          |          |          |          | Total per year (kWh/year) = Sum(64)m = |               | 2357.1330 (64) |
| Electric shower(s)                                                             |          |          |          |          |          |          |          |          |          |                                        |               | 2357 (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                                       |          |          |          |          |          |          |          |          |          |                                        |               |                |
| 110.3735                                                                       | 98.0381  | 105.0144 | 94.1443  | 92.5465  | 84.7705  | 84.5557  | 87.0678  | 87.1093  | 95.5058  | 99.5979                                | 109.3849 (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                                                                               | 124.7884 | 124.7884 | 124.7884 | 124.7884 | 124.7884 | 124.7884 | 124.7884 | 124.7884 | 124.7884 | 124.7884 | 124.7884 | 124.7884 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 114.0975 | 126.3222 | 114.0975 | 117.9008 | 114.0975 | 117.9008 | 114.0975 | 114.0975 | 117.9008 | 114.0975 | 117.9008 | 114.0975 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 223.1204 | 225.4357 | 219.6013 | 207.1804 | 191.5013 | 176.7651 | 166.9204 | 164.6051 | 170.4396 | 182.8605 | 198.5396 | 213.2758 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 35.4788  | 35.4788  | 35.4788  | 35.4788  | 35.4788  | 35.4788  | 35.4788  | 35.4788  | 35.4788  | 35.4788  | 35.4788  | 35.4788  | (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)                                 | -99.8307 | -99.8307 | -99.8307 | -99.8307 | -99.8307 | -99.8307 | -99.8307 | -99.8307 | -99.8307 | -99.8307 | -99.8307 | -99.8307 | (71) |
| Water heating gains (Table 5)                                                       | 148.3514 | 145.8900 | 141.1484 | 130.7560 | 124.3905 | 117.7368 | 113.6502 | 117.0266 | 120.9852 | 128.3681 | 138.3304 | 147.0227 | (72) |
| Total internal gains                                                                | 549.0059 | 561.0845 | 538.2837 | 519.2737 | 493.4258 | 472.8392 | 455.1046 | 456.1657 | 469.7620 | 488.7626 | 518.2072 | 537.8325 | (73) |

## 6. Solar gains

| [Jan]       |          |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c |          |          | Access<br>factor<br>Table 6d | Gains<br>W    |  |
|-------------|----------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|----------|----------|------------------------------|---------------|--|
| -----       |          |          |          |          |            |                                |                                   |                                    |          |          |                              |               |  |
| Northeast   |          |          |          |          | 7.1300     | 11.2829                        | 0.6300                            | 0.7000                             |          |          | 0.7700                       | 24.5858 (75)  |  |
| Northwest   |          |          |          |          | 8.3400     | 11.2829                        | 0.6300                            | 0.7000                             |          |          | 0.7700                       | 28.7581 (81)  |  |
| -----       |          |          |          |          |            |                                |                                   |                                    |          |          |                              |               |  |
| Solar gains | 53.3439  | 108.5830 | 195.6320 | 321.2839 | 431.8686   | 460.4177                       | 430.7113                          | 343.3680                           | 238.3806 | 132.6970 | 67.1204                      | 43.5633 (83)  |  |
| Total gains | 602.3497 | 669.6674 | 733.9157 | 840.5576 | 925.2944   | 933.2569                       | 885.8159                          | 799.5338                           | 708.1427 | 621.4596 | 585.3276                     | 581.3958 (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                                                                         | 35.9095 | 36.0087 | 36.1064 | 36.5726 | 36.6612 | 37.0792 | 37.0792 | 37.1576 | 36.9171                   | 36.6612 | 36.4825 | 36.2975 |         |      |
| alpha                                                                       | 3.3940  | 3.4006  | 3.4071  | 3.4382  | 3.4441  | 3.4719  | 3.4719  | 3.4772  | 3.4611                    | 3.4441  | 3.4322  | 3.4198  |         |      |
| util living area                                                            | 0.9733  | 0.9604  | 0.9338  | 0.8603  | 0.7299  | 0.5571  | 0.4228  | 0.4807  | 0.7146                    | 0.8995  | 0.9586  | 0.9761  | (86)    |      |
| MIT                                                                         | 19.1413 | 19.3703 | 19.7504 | 20.2848 | 20.6943 | 20.9130 | 20.9746 | 20.9606 | 20.7913                   | 20.2637 | 19.6319 | 19.1120 | (87)    |      |
| Th 2                                                                        | 19.9920 | 19.9945 | 19.9969 | 20.0085 | 20.0106 | 20.0207 | 20.0207 | 20.0225 | 20.0168                   | 20.0106 | 20.0063 | 20.0017 | (88)    |      |
| util rest of house                                                          | 0.9683  | 0.9529  | 0.9210  | 0.8337  | 0.6816  | 0.4854  | 0.3344  | 0.3879  | 0.6472                    | 0.8743  | 0.9496  | 0.9716  | (89)    |      |
| MIT 2                                                                       | 17.8337 | 18.1242 | 18.6019 | 19.2610 | 19.7301 | 19.9589 | 20.0085 | 20.0021 | 19.8500                   | 19.2524 | 18.4659 | 17.8030 | (90)    |      |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         | 0.5412  | (91)    |      |
| MIT                                                                         | 18.5414 | 18.7986 | 19.2235 | 19.8151 | 20.2519 | 20.4753 | 20.5313 | 20.5209 | 20.3594                   | 19.7997 | 19.0970 | 18.5114 | (92)    |      |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000  |         |      |
| adjusted MIT                                                                | 18.5414 | 18.7986 | 19.2235 | 19.8151 | 20.2519 | 20.4753 | 20.5313 | 20.5209 | 20.3594                   | 19.7997 | 19.0970 | 18.5114 | (93)    |      |

## 8. Space heating requirement

|                                                                                |           |           |           |          |          |          |          |          |          |          |           |           |               |  |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|-----------|-----------|---------------|--|
| Utilisation                                                                    | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov       | Dec       |               |  |
| Useful gains                                                                   | 0.9587    | 0.9417    | 0.9090    | 0.8279   | 0.6941   | 0.5197   | 0.3812   | 0.4363   | 0.6722   | 0.8679   | 0.9390    | 0.9626    | (94)          |  |
| Ext temp.                                                                      | 577.4430  | 630.6152  | 667.1487  | 695.8791 | 642.2507 | 484.9712 | 337.6923 | 348.8349 | 476.0161 | 539.3945 | 549.6395  | 559.6614  | (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                                                              | 1293.7235 | 1259.1067 | 1149.5305 | 973.5782 | 760.9475 | 516.8894 | 345.8651 | 361.7756 | 553.1023 | 818.5904 | 1072.7191 | 1286.1922 | (97)          |  |
| Space heating requirement - total per year (kWh/year)                          | 532.9127  | 422.3463  | 358.8920  | 199.9434 | 88.3104  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 207.7217 | 376.6173  | 540.5389  | (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)                         | 532.9127  | 422.3463  | 358.8920  | 199.9434 | 88.3104  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 207.7217 | 376.6173  | 540.5389  | (98c)         |  |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |          |           | 2727.2826 | (98c) / (4) = |  |
| Space heating per m2                                                           |           |           |           |          |          |          |          |          |          |          |           | 33.3490   | (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)                      | 532.9127 | 422.3463 | 358.8920 | 199.9434 | 88.3104  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 207.7217 | 376.6173 | 540.5389 | (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)                      | 577.3702 | 457.5799 | 388.8321 | 216.6234 | 95.6776  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 225.0506 | 408.0361 | 585.6326 | (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 requirement                                             | 232.5119 | 205.6044 | 218.6264 | 192.9777 | 187.5145 | 169.4761 | 167.7540 | 174.2113 | 175.8703 | 195.4709 | 207.0176 | 230.0980 | (64)    |       |
| Efficiency of water heater (217)m                                     | 85.8585  | 85.6376  | 85.1639  | 84.1394  | 82.4763  | 79.8000  | 79.8000  | 79.8000  | 79.8000  | 84.1963  | 85.3843  | 85.9071  | (216)   |       |
| Fuel for water heating, kWh/month                                     | 270.8082 | 240.0865 | 256.7124 | 229.3547 | 227.3556 | 212.3760 | 210.2180 | 218.3099 | 220.3888 | 232.1608 | 242.4540 | 267.8452 | (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                                                                                             | 23.7072  | 19.0188  | 17.1243  | 12.5460  | 9.6909   | 7.9175   | 8.8404   | 11.4910  | 14.9257  | 19.5834  | 22.1194  | 24.3661  | 24.3661   | (232)  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (233a)m                                                                                              | -15.4075 | -23.2755 | -35.8178 | -43.2037 | -49.2003 | -46.8821 | -46.3062 | -42.4025 | -36.0087 | -27.8598 | -17.4794 | -13.1454 | -13.1454  | (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                                                                                              | -4.5495  | -9.8596  | -20.1523 | -31.1075 | -41.9754 | -42.4943 | -42.0010 | -35.1765 | -25.2797 | -14.3752 | -6.1598  | -3.5769  | -3.5769   | (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                                                                   |          |          |          |          |          |          |          |          |          |          |          |          | 2954.8024 | (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                                                                              |          |          |          |          |          |          |          |          |          |          |          |          | 2828.0701 | (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)                                                  |          |          |          |          |          |          |          |          |          |          |          |          | 191.3308  | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |          |          |          |          |          |          |          |          |          |           |        |
| PV generation                                                                                        |          |          |          |          |          |          |          |          |          |          |          |          | -673.6969 | (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                                                                  |          |          |          |          |          |          |          |          |          |          |          |          | 5386.5064 | (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                 | 2954.8024          | 0.2100                        | 620.5085                 | (261) |
| Total CO2 associated with community systems   |                    |                               | 0.0000                   | (373) |
| Water heating (other fuel)                    | 2828.0701          | 0.2100                        | 593.8947                 | (264) |
| Space and water heating                       |                    |                               | 1214.4032                | (265) |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293                  | (267) |
| Energy for lighting                           | 191.3308           | 0.1443                        | 27.6149                  | (268) |
| Energy saving/generation technologies         |                    |                               |                          |       |
| PV Unit electricity used in dwelling          | -396.9890          | 0.1332                        | -52.8672                 |       |
| PV Unit electricity exported                  | -276.7079          | 0.1251                        | -34.6161                 |       |
| Total                                         |                    |                               | -87.4833                 | (269) |
| Total CO2, kg/year                            |                    |                               | 1166.4641                | (272) |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 14.2600                  | (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               | 2954.8024          | 1.1300                              | 3338.9268                  | (275) |
| Total CO2 associated with community systems |                    |                                     | 0.0000                     | (473) |
| Water heating (other fuel)                  | 2828.0701          | 1.1300                              | 3195.7192                  | (278) |
| Space and water heating                     |                    |                                     | 6534.6460                  | (279) |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008                   | (281) |
| Energy for lighting                         | 191.3308           | 1.5338                              | 293.4695                   | (282) |
| Energy saving/generation technologies       |                    |                                     |                            |       |
| PV Unit electricity used in dwelling        | -396.9890          | 1.4921                              | -592.3451                  |       |
| PV Unit electricity exported                | -276.7079          | 0.4592                              | -127.0540                  |       |
| Total                                       |                    |                                     | -719.3991                  | (283) |
| Total Primary energy kWh/year               |                    |                                     | 6238.8171                  | (286) |
| Target Primary Energy Rate (TPER)           |                    |                                     | 76.2900                    | (287) |

# Full SAP Calculation Printout



|                                    |                   |               |       |                |            |
|------------------------------------|-------------------|---------------|-------|----------------|------------|
| Plot Reference                     | A 619             |               |       | Issued on Date | 19/03/2026 |
| Assessment Reference               | Be Green          | Plot Type Ref |       |                |            |
| Plot Address                       |                   |               |       | SAP Version    | 10.2       |
|                                    |                   |               |       |                |            |
| SAP Rating                         | 83 B              | DER           | 4.89  | TER            | 14.26      |
| Environmental                      | 96 A              | % DER < TER   |       |                | 65.71      |
| CO <sub>2</sub> Emissions (t/year) | 0.36              | DFEE          | 37.05 | TFEE           | 40.07      |
| Compliance Check                   | See BREL          | % DFEE < TFEE |       |                | 7.54       |
| % DPER < TPER                      | 32.38             | DPER          | 51.59 | TPER           | 76.29      |
|                                    |                   |               |       |                |            |
| 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                                          | 81.7800                   | 2.8000               | 228.9840                    |
| Ground floor                                           |                           |                      |                             |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 81.7800                   |                      |                             |
| 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) = 0.1310 (8)              |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 2.0000 (17)                             |
| Infiltration rate                                                                                  | 0.2310 (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) = 0.1964 (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                                                                                         | 0.2504 | 0.2455 | 0.2405 | 0.2160 | 0.2111 | 0.1865 | 0.1865 | 0.1816 | 0.1964 | 0.2111 | 0.2209 | 0.2307 (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                                                                                            | 0.5313 | 0.5301 | 0.5289 | 0.5233 | 0.5223 | 0.5174 | 0.5174 | 0.5165 | 0.5193 | 0.5223 | 0.5244 | 0.5266 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                                                    | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K                 | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K                                        |
|----------------------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|------------------------------|--------------------------------|------------------------------------------------------|
| Main dwelling                                                              |                         |                            |                           |                               |                              |                                |                                                      |
| Door                                                                       |                         |                            | 2.4200                    | 1.0000                        | 2.4200                       |                                | (26)                                                 |
| Window                                                                     |                         |                            | 15.4700                   | 1.1450                        | 17.7137                      |                                | (27)                                                 |
| External Wall 1                                                            | 53.2300                 | 15.4700                    | 37.7600                   | 0.1500                        | 5.6640                       | 70.0000                        | 2643.2000 (29a)                                      |
| Corridor wall                                                              | 19.1400                 | 2.4200                     | 16.7200                   | 0.1900                        | 3.1768                       | 70.0000                        | 1170.4000 (29a)                                      |
| External Roof 1                                                            | 81.7800                 |                            | 81.7800                   | 0.1000                        | 8.1780                       | 9.0000                         | 736.0200 (30)                                        |
| Total net area of external elements A <sub>um</sub> (A, m <sup>2</sup> )   |                         |                            | 154.1500                  |                               |                              |                                | (31)                                                 |
| Fabric heat loss, W/K = Sum (A x U)                                        |                         |                            |                           |                               | (26)...(30) + (32) = 37.1525 |                                | (33)                                                 |
| Main dwelling                                                              |                         |                            |                           |                               |                              |                                |                                                      |
| Party Wall 1                                                               |                         |                            | 34.0900                   | 0.0000                        | 0.0000                       | 70.0000                        | 2386.3000 (32)                                       |
| Party Floor 1                                                              |                         |                            | 81.7800                   |                               |                              | 40.0000                        | 3271.2000 (32a)                                      |
| Internal Wall 1                                                            |                         |                            | 170.7200                  |                               |                              | 9.0000                         | 1536.4800 (32c)                                      |
| Heat capacity C <sub>m</sub> = Sum(A x k)                                  |                         |                            |                           |                               |                              |                                | (28)...(30) + (32) + (32a)...(32e) = 11743.5999 (34) |
| Thermal mass parameter (TMP = C <sub>m</sub> / TFA) in kJ/m <sup>2</sup> K |                         |                            |                           |                               |                              |                                | 143.5999 (35)                                        |
| List of Thermal Bridges                                                    |                         |                            |                           |                               |                              |                                |                                                      |
| K1 Element                                                                 |                         |                            |                           |                               | Length                       | Psi-value                      | Total                                                |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats)  |                         |                            |                           |                               | 12.1800                      | 0.0000                         | 0.0000                                               |
| E1 Steel lintel with perforated steel base plate                           |                         |                            |                           |                               | 9.8400                       | 0.0500                         | 0.4920                                               |



|                                                                     |         |         |         |         |         |         |         |         |         |         |         |              |
|---------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| 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          |
|                                                                     | 40.1506 | 40.0586 | 39.9685 | 39.5451 | 39.4659 | 39.0971 | 39.0971 | 39.0288 | 39.2392 | 39.4659 | 39.6261 | 39.7937 (38) |
| Heat transfer coeff                                                 | 82.6699 | 82.5779 | 82.4878 | 82.0644 | 81.9852 | 81.6164 | 81.6164 | 81.5481 | 81.7585 | 81.9852 | 82.1454 | 82.3130 (39) |
| Average = Sum(39)m / 12 =                                           |         |         |         |         |         |         |         |         |         |         |         | 82.0640      |
| HLP                                                                 | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
|                                                                     | 1.0109  | 1.0098  | 1.0087  | 1.0035  | 1.0025  | 0.9980  | 0.9980  | 0.9972  | 0.9997  | 1.0025  | 1.0045  | 1.0065 (40)  |
| HLP (average)                                                       |         |         |         |         |         |         |         |         |         |         |         | 1.0035       |
| Days in mont                                                        | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31           |

|                                                                 |          |         |         |         |         |         |         |         |                                        |                    |         |                |
|-----------------------------------------------------------------|----------|---------|---------|---------|---------|---------|---------|---------|----------------------------------------|--------------------|---------|----------------|
| 4. Water heating energy requirements (kWh/year)                 |          |         |         |         |         |         |         |         |                                        |                    |         |                |
| Assumed occupancy                                               |          |         |         |         |         |         |         |         |                                        |                    |         |                |
| Hot water usage for mixer showers                               |          |         |         |         |         |         |         |         |                                        |                    |         | 2.4958 (42)    |
|                                                                 | 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                                       | 27.8975  | 27.4764 | 26.8773 | 25.9801 | 25.1715 | 24.0584 | 23.2139 | 24.2466 | 24.7885                                | 25.8914            | 27.0381 | 27.8754 (42b)  |
| Hot water usage for other uses                                  | 40.1892  | 38.7277 | 37.2663 | 35.8049 | 34.3435 | 32.8820 | 32.8820 | 34.3435 | 35.8049                                | 37.2663            | 38.7277 | 40.1892 (42c)  |
| Average daily hot water use (litres/day)                        |          |         |         |         |         |         |         |         |                                        |                    |         | 62.4032 (43)   |
|                                                                 | Jan      | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep                                    | Oct                | Nov     | Dec            |
| Daily hot water use                                             | 68.0866  | 66.2041 | 64.1436 | 61.7849 | 59.5149 | 56.9404 | 56.0960 | 58.5900 | 60.5934                                | 63.1577            | 65.7658 | 68.0645 (44)   |
| Energy content (annual)                                         | 100.2353 | 87.6014 | 91.6598 | 80.7066 | 76.6910 | 65.8497 | 61.9877 | 68.9615 | 70.2853                                | 81.3851            | 88.8847 | 99.9577 (45)   |
| Distribution loss (46)m = 0.15 x (45)m                          |          |         |         |         |         |         |         |         |                                        | Total = Sum(45)m = |         | 974.2059       |
| Water storage loss (or HIU loss):                               | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000             | 0.0000  | 0.0000 (46)    |
| Total storage loss                                              |          |         |         |         |         |         |         |         |                                        |                    |         |                |
| 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 (56)    |
| Primary loss                                                    | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000             | 0.0000  | 0.0000 (57)    |
| Combi loss                                                      | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000             | 0.0000  | 0.0000 (59)    |
| Total heat required for water heating calculated for each month | 85.2000  | 74.4612 | 77.9109 | 68.6006 | 65.1874 | 55.9723 | 52.6895 | 58.6173 | 59.7425                                | 69.1773            | 75.5520 | 84.9641 (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                                                 | 85.2000  | 74.4612 | 77.9109 | 68.6006 | 65.1874 | 55.9723 | 52.6895 | 58.6173 | 59.7425                                | 69.1773            | 75.5520 | 84.9641 (64)   |
| 12Total per year (kWh/year)                                     |          |         |         |         |         |         |         |         | Total per year (kWh/year) = Sum(64)m = |                    |         | 828.0750 (64)  |
| Electric shower(s)                                              | 52.9075  | 47.1410 | 51.4762 | 49.1231 | 50.0449 | 47.7379 | 49.3292 | 50.0449 | 49.1231                                | 51.4762            | 50.5082 | 52.9075 (64a)  |
|                                                                 |          |         |         |         |         |         |         |         |                                        |                    |         | 601.8195 (64a) |
| Heat gains from water heating, kWh/month                        | 34.5269  | 30.4005 | 32.3468 | 29.4309 | 28.8081 | 25.9275 | 25.5047 | 27.1655 | 27.2164                                | 30.1634            | 31.5151 | 34.4679 (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                                                                               | 124.7884 | 124.7884 | 124.7884 | 124.7884 | 124.7884 | 124.7884 | 124.7884 | 124.7884 | 124.7884 | 124.7884 | 124.7884 | 124.7884 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 114.0975 | 126.3222 | 114.0975 | 117.9008 | 114.0975 | 117.9008 | 114.0975 | 114.0975 | 117.9008 | 114.0975 | 117.9008 | 114.0975 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 223.1204 | 225.4357 | 219.6013 | 207.1804 | 191.5013 | 176.7651 | 166.9204 | 164.6051 | 170.4396 | 182.8605 | 198.5396 | 213.2758 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 35.4788  | 35.4788  | 35.4788  | 35.4788  | 35.4788  | 35.4788  | 35.4788  | 35.4788  | 35.4788  | 35.4788  | 35.4788  | 35.4788  | (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)                                 | -99.8307 | -99.8307 | -99.8307 | -99.8307 | -99.8307 | -99.8307 | -99.8307 | -99.8307 | -99.8307 | -99.8307 | -99.8307 | -99.8307 | (71) |
| Water heating gains (Table 5)                                                       | 46.4071  | 45.2389  | 43.4768  | 40.8763  | 38.7205  | 36.0105  | 34.2805  | 36.5128  | 37.8006  | 40.5422  | 43.7709  | 46.3278  | (72) |
| Total internal gains                                                                | 444.0615 | 457.4334 | 437.6121 | 426.3939 | 404.7558 | 391.1128 | 375.7349 | 375.6520 | 386.5774 | 397.9367 | 420.6478 | 434.1376 | (73) |

| 6. Solar gains |  |          |          |            |          |               |          |               |          |          |          |              |               |
|----------------|--|----------|----------|------------|----------|---------------|----------|---------------|----------|----------|----------|--------------|---------------|
|                |  |          |          |            |          |               |          |               |          |          |          |              |               |
| [Jan]          |  | Area     |          | Solar flux |          | g             |          | FF            |          | Access   |          | Gains        |               |
|                |  | m2       |          | Table 6a   |          | Specific data |          | Specific data |          | factor   |          | W            |               |
|                |  |          |          | W/m2       |          | or Table 6b   |          | or Table 6c   |          | Table 6d |          |              |               |
| Northeast      |  | 7.1300   |          | 11.2829    |          | 0.3500        |          | 0.7000        |          | 0.7700   |          | 13.6588 (75) |               |
| Northwest      |  | 8.3400   |          | 11.2829    |          | 0.3500        |          | 0.7000        |          | 0.7700   |          | 15.9767 (81) |               |
|                |  |          |          |            |          |               |          |               |          |          |          |              |               |
| Solar gains    |  | 29.6355  | 60.3239  | 108.6844   | 178.4911 | 239.9270      | 255.7876 | 239.2841      | 190.7600 | 132.4337 | 73.7206  | 37.2891      | 24.2018 (83)  |
| Total gains    |  | 473.6970 | 517.7573 | 546.2965   | 604.8850 | 644.6828      | 646.9004 | 615.0190      | 566.4120 | 519.0111 | 471.6572 | 457.9369     | 458.3394 (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                                                                         | 39.4595                   | 39.5034 | 39.5466 | 39.7506 | 39.7890 | 39.9688 | 39.9688 | 40.0023 | 39.8994 | 39.7890 | 39.7114      |
| alpha                                                                       | 3.6306                    | 3.6336  | 3.6364  | 3.6500  | 3.6526  | 3.6646  | 3.6646  | 3.6668  | 3.6600  | 3.6526  | 3.6474       |
| util living area                                                            | 0.9864                    | 0.9799  | 0.9677  | 0.9289  | 0.8456  | 0.6950  | 0.5471  | 0.6045  | 0.8169  | 0.9451  | 0.9783       |
| MIT                                                                         | 19.1241                   | 19.3109 | 19.6283 | 20.1127 | 20.5525 | 20.8500 | 20.9533 | 20.9325 | 20.7112 | 20.1623 | 19.5724      |
| Th 2                                                                        | 20.0743                   | 20.0752 | 20.0761 | 20.0804 | 20.0812 | 20.0850 | 20.0850 | 20.0857 | 20.0836 | 20.0812 | 20.0796      |
| util rest of house                                                          | 0.9837                    | 0.9760  | 0.9609  | 0.9130  | 0.8094  | 0.6246  | 0.4473  | 0.5049  | 0.7616  | 0.9297  | 0.9733       |
| MIT 2                                                                       | 18.3530                   | 18.5388 | 18.8535 | 19.3287 | 19.7408 | 19.9951 | 20.0658 | 20.0557 | 19.8900 | 19.3837 | 18.8029      |
| Living area fraction                                                        | fLA = Living area / (4) = |         |         |         |         |         |         |         |         |         |              |
| MIT                                                                         | 18.7703                   | 18.9566 | 19.2728 | 19.7530 | 20.1801 | 20.4578 | 20.5461 | 20.5302 | 20.3344 | 19.8051 | 19.2193      |
| Temperature adjustment                                                      | 0.0000                    |         |         |         |         |         |         |         |         |         |              |
| adjusted MIT                                                                | 18.7703                   | 18.9566 | 19.2728 | 19.7530 | 20.1801 | 20.4578 | 20.5461 | 20.5302 | 20.3344 | 19.8051 | 19.2193      |
|                                                                             |                           |         |         |         |         |         |         |         |         |         | 18.7350 (93) |

|                                                                                |               |           |           |          |          |          |          |          |          |          |              |
|--------------------------------------------------------------------------------|---------------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|--------------|
| 8. Space heating requirement                                                   |               |           |           |          |          |          |          |          |          |          |              |
|                                                                                | Jan           | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov          |
| Utilisation                                                                    | 0.9788        | 0.9698    | 0.9536    | 0.9063   | 0.8137   | 0.6548   | 0.4992   | 0.5553   | 0.7783   | 0.9241   | 0.9673       |
| Useful gains                                                                   | 463.6543      | 502.1245  | 520.9508  | 548.2360 | 524.5573 | 423.6036 | 306.9992 | 314.5436 | 403.9230 | 435.8666 | 442.9740     |
| 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                                                               | 1196.2607     | 1160.7675 | 1053.6038 | 890.6431 | 695.2445 | 478.0913 | 322.0691 | 336.8100 | 509.7186 | 754.6816 | 995.5468     |
| Space heating kWh                                                              | 545.0591      | 442.6081  | 396.2938  | 246.5331 | 126.9913 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 237.1984 | 397.8525     |
| 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                                                              | 545.0591      | 442.6081  | 396.2938  | 246.5331 | 126.9913 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 237.1984 | 397.8525     |
| Space heating requirement after solar contribution - total per year (kWh/year) |               |           |           |          |          |          |          |          |          |          |              |
| Space heating per m2                                                           | (98c) / (4) = |           |           |          |          |          |          |          |          |          |              |
|                                                                                |               |           |           |          |          |          |          |          |          |          | 36.0495 (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  | 767.1944 | 603.9616 | 619.7659 | 0.0000  | 0.0000  | 0.0000     |
| Utilisation                                         | 0.0000                   | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.7549   | 0.8277   | 0.7869   | 0.0000  | 0.0000  | 0.0000     |
| Useful loss                                         | 0.0000                   | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 579.1480 | 499.8695 | 487.6683 | 0.0000  | 0.0000  | 0.0000     |
| Total gains                                         | 0.0000                   | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 711.1803 | 676.2709 | 621.5656 | 0.0000  | 0.0000  | 0.0000     |
| Space cooling kWh                                   | 0.0000                   | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 95.0633  | 131.2427 | 99.6196  | 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  | 23.7658  | 32.8107  | 24.9049  | 0.0000  | 0.0000  | 0.0000     |
| Space cooling requirement                           |                          |        |        |        |         |          |          |          |         |         |            |
| Energy for space heating                            |                          |        |        |        |         |          |          |          |         |         |            |
| Energy for space cooling                            |                          |        |        |        |         |          |          |          |         |         |            |
| Total                                               |                          |        |        |        |         |          |          |          |         |         |            |
| Fabric Energy Efficiency (DFEE)                     |                          |        |        |        |         |          |          |          |         |         |            |
|                                                     |                          |        |        |        |         |          |          |          |         |         | 37.0 (109) |

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

|                                                        |  |  |  |  |  |              |                                           |             |   |                      |  |
|--------------------------------------------------------|--|--|--|--|--|--------------|-------------------------------------------|-------------|---|----------------------|--|
| 1. Overall dwelling characteristics                    |  |  |  |  |  |              |                                           |             |   |                      |  |
| Main dwelling                                          |  |  |  |  |  | Area (m2)    | Storey height (m)                         | Volume (m3) |   |                      |  |
| Ground floor                                           |  |  |  |  |  | 81.7800 (1b) | x                                         | 2.8000 (2b) | = | 228.9840 (1b) - (3b) |  |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) |  |  |  |  |  | 81.7800      |                                           |             |   | (4)                  |  |
| Dwelling volume                                        |  |  |  |  |  |              | (3a) + (3b) + (3c) + (3d) + (3e) ... (3n) | =           |   | 228.9840 (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 (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) =             | 0.1310 (8)  |
| Pressure Test Method                                                                                    |                                                       |        |        |        |        |        |        |        |        |        |        | Yes                         |             |
| Measured/design AP50                                                                                    |                                                       |        |        |        |        |        |        |        |        |        |        | Blower Door                 |             |
| Infiltration rate                                                                                       |                                                       |        |        |        |        |        |        |        |        |        |        | 5.0000                      | (17)        |
| Number of sides sheltered                                                                               |                                                       |        |        |        |        |        |        |        |        |        |        | 0.3810                      | (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) =        | 0.3239 (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)       |
|                                                                                                         | 0.4129                                                | 0.4048 | 0.3967 | 0.3562 | 0.3482 | 0.3077 | 0.3077 | 0.2996 | 0.3239 | 0.3482 | 0.3643 | 0.3805                      | (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                                                                                            | 0.5853                                                | 0.5819 | 0.5787 | 0.5635 | 0.5606 | 0.5473 | 0.5473 | 0.5449 | 0.5524 | 0.5606 | 0.5664 | 0.5724                      | (25)        |

## 3. Heat losses and heat loss parameter

|                                                                           |         |          |          |                       |           |                       |               |
|---------------------------------------------------------------------------|---------|----------|----------|-----------------------|-----------|-----------------------|---------------|
| Element                                                                   | Gross   | Openings | NetArea  | U-value               | A x U     | K-value               | A x K         |
| Main dwelling                                                             | m2      | m2       | m2       | W/m2K                 | W/K       | kJ/m2K                | kJ/K          |
| TER Opaque door                                                           |         |          | 2.4200   | 1.0000                | 2.4200    |                       | (26)          |
| TER Opening Type                                                          |         |          | 15.4700  | 1.1450                | 17.7137   |                       | (27)          |
| External Wall 1                                                           | 53.2300 | 15.4700  | 37.7600  | 0.1800                | 6.7968    |                       | (29a)         |
| Corridor wall                                                             | 19.1400 | 2.4200   | 16.7200  | 0.1800                | 3.0096    |                       | (29a)         |
| External Roof 1                                                           | 81.7800 |          | 81.7800  | 0.1100                | 8.9958    |                       | (30)          |
| Total net area of external elements Aum(A, m2)                            |         |          | 154.1500 |                       |           |                       | (31)          |
| Fabric heat loss, W/K = Sum (A x U)                                       |         |          |          | (26)... (30) + (32) = | 38.9359   |                       | (33)          |
| Main dwelling                                                             |         |          |          |                       |           |                       |               |
| Party Wall 1                                                              |         |          | 34.0900  | 0.0000                | 0.0000    |                       | (32)          |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K                         |         |          |          |                       |           |                       | 143.5999 (35) |
| List of Thermal Bridges                                                   |         |          |          |                       |           |                       |               |
| K1 Element                                                                |         |          |          | Length                | Psi-value |                       | Total         |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) |         |          |          | 12.1800               | 0.0000    |                       | 0.0000        |
| E1 Steel lintel with perforated steel base plate                          |         |          |          | 9.8400                | 0.0500    |                       | 0.4920        |
| E4 Jamb                                                                   |         |          |          | 21.6000               | 0.0500    |                       | 1.0800        |
| E7 Party floor between dwellings (in blocks of flats)                     |         |          |          | 14.6500               | 0.0700    |                       | 1.0255        |
| E7 Party floor between dwellings (in blocks of flats)                     |         |          |          | 6.8400                | 0.0700    |                       | 0.4788        |
| E9 Balcony between dwellings, wall insulation continuous                  |         |          |          | 4.3600                | 0.0200    |                       | 0.0872        |
| 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                                          |         |          |          | 5.6000                | 0.0600    |                       | 0.3360        |
| E18 Party wall between dwellings                                          |         |          |          | 2.8000                | 0.0600    |                       | 0.1680        |
| E25 Staggered party wall between dwellings                                |         |          |          | 2.8000                | 0.0600    |                       | 0.1680        |
| E3 Sill                                                                   |         |          |          | 6.3400                | 0.0500    |                       | 0.3170        |
| E14 Flat roof                                                             |         |          |          | 25.8500               | 0.0800    |                       | 2.0680        |
| P4 Party wall - Roof (insulation at ceiling level)                        |         |          |          | 12.1800               | 0.1200    |                       | 1.4616        |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                |         |          |          |                       |           |                       | 7.6821 (36)   |
| Point Thermal bridges                                                     |         |          |          |                       |           | (36a) =               | 0.0000        |
| Total fabric heat loss                                                    |         |          |          |                       |           | (33) + (36) + (36a) = | 46.6180 (37)  |

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

|                                                                 |                                        |         |         |         |         |         |         |         |         |         |         |               |  |
|-----------------------------------------------------------------|----------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------------|--|
| Assumed occupancy                                               |                                        |         |         |         |         |         |         |         |         |         |         | 2.4958 (42)   |  |
| Hot water usage for mixer showers                               |                                        |         |         |         |         |         |         |         |         |         |         | 0.0000 (42a)  |  |
| Hot water usage for baths                                       | 0.0000                                 | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (42b)  |  |
| Hot water usage for other uses                                  | 28.5336                                | 28.1098 | 27.5131 | 26.4128 | 25.5889 | 24.6753 | 24.1818 | 24.7744 | 25.4196 | 26.3972 | 27.5201 | 28.4371 (42b) |  |
| Average daily hot water use (litres/day)                        | 40.1892                                | 38.7277 | 37.2663 | 35.8049 | 34.3435 | 32.8820 | 32.8820 | 34.3435 | 35.8049 | 37.2663 | 38.7277 | 40.1892 (42c) |  |
|                                                                 |                                        |         |         |         |         |         |         |         |         |         |         | 62.9907 (43)  |  |
| Daily hot water use                                             | Jan                                    | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec           |  |
| Energy content (annual)                                         | 68.7227                                | 66.8375 | 64.7794 | 62.2176 | 59.9323 | 57.5573 | 57.0639 | 59.1179 | 61.2245 | 63.6635 | 66.2479 | 68.6263 (44)  |  |
| Distribution loss (46)m = 0.15 x (45)m                          | 108.8400                               | 95.1758 | 99.5635 | 85.1728 | 80.6804 | 70.7735 | 69.0138 | 73.2003 | 75.4959 | 86.3907 | 94.3822 | 107.4521 (45) |  |
| Total storage loss                                              | Total = Sum(45)m =                     |         |         |         |         |         |         |         |         |         |         | 1046.1411     |  |
| Water storage loss (or HIU loss):                               | 0.0000                                 | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (46)   |  |
| 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 (56)   |  |
| Primary loss                                                    | 0.0000                                 | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (57)   |  |
| Combi loss                                                      | 0.0000                                 | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (59)   |  |
| Total heat required for water heating calculated for each month | 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                                                           | 92.5140                                | 80.8994 | 84.6289 | 72.3969 | 68.5784 | 60.1574 | 58.6617 | 62.2202 | 64.1716 | 73.4321 | 80.2249 | 91.3343 (62)  |  |
| PV diverter                                                     | 0.0000                                 | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (63a)  |  |
| Solar input                                                     | 0.0000                                 | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (63b)  |  |
| FGHRS                                                           | 0.0000                                 | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (63c)  |  |
| Output from w/h                                                 | 0.0000                                 | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (63d)  |  |
|                                                                 | 92.5140                                | 80.8994 | 84.6289 | 72.3969 | 68.5784 | 60.1574 | 58.6617 | 62.2202 | 64.1716 | 73.4321 | 80.2249 | 91.3343 (64)  |  |
| 12Total per year (kWh/year)                                     | Total per year (kWh/year) = Sum(64)m = |         |         |         |         |         |         |         |         |         |         | 889.2199 (64) |  |
|                                                                 |                                        |         |         |         |         |         |         |         |         |         |         | 889 (64)      |  |

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|                                                                                |         |         |         |         |         |         |         |         |         |         |         |                |
|--------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------------|
| Electric shower(s)                                                             | 52.9075 | 47.1410 | 51.4762 | 49.1231 | 50.0449 | 47.7379 | 49.3292 | 50.0449 | 49.1231 | 51.4762 | 50.5082 | 52.9075 (64a)  |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |         |         |         |         |         |         |         |         |         |         |         | 601.8195 (64a) |
| Heat gains from water heating, kWh/month                                       | 36.3554 | 32.0101 | 34.0263 | 30.3800 | 29.6558 | 26.9738 | 26.9977 | 28.0663 | 28.3237 | 31.2271 | 32.6833 | 36.0604 (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                                                                               | 124.7884 | 124.7884 | 124.7884 | 124.7884 | 124.7884 | 124.7884 | 124.7884 | 124.7884 | 124.7884 | 124.7884 | 124.7884 | 124.7884 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 114.0975 | 126.3222 | 114.0975 | 117.9008 | 114.0975 | 117.9008 | 114.0975 | 114.0975 | 117.9008 | 114.0975 | 117.9008 | 114.0975 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 223.1204 | 225.4357 | 219.6013 | 207.1804 | 191.5013 | 176.7651 | 166.9204 | 164.6051 | 170.4396 | 182.8605 | 198.5396 | 213.2758 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 35.4788  | 35.4788  | 35.4788  | 35.4788  | 35.4788  | 35.4788  | 35.4788  | 35.4788  | 35.4788  | 35.4788  | 35.4788  | 35.4788  | (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)                                 | -99.8307 | -99.8307 | -99.8307 | -99.8307 | -99.8307 | -99.8307 | -99.8307 | -99.8307 | -99.8307 | -99.8307 | -99.8307 | -99.8307 | (71) |
| Water heating gains (Table 5)                                                       | 48.8647  | 47.6341  | 45.7342  | 42.1944  | 39.8600  | 37.4637  | 36.2873  | 37.7235  | 39.3384  | 41.9719  | 45.3934  | 48.4683  | (72) |
| Total internal gains                                                                | 446.5192 | 459.8286 | 439.8695 | 427.7121 | 405.8952 | 392.5660 | 377.7417 | 376.8626 | 388.1153 | 399.3664 | 422.2703 | 436.2781 | (73) |

## 6. Solar gains

| [Jan]       |          |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c |          |          | Access<br>factor<br>Table 6d |          |      | Gains<br>W   |
|-------------|----------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|----------|----------|------------------------------|----------|------|--------------|
| Northeast   |          |          |          |          | 7.1300     | 11.2829                        | 0.6300                            | 0.7000                             |          |          | 0.7700                       |          |      | 24.5858 (75) |
| Northwest   |          |          |          |          | 8.3400     | 11.2829                        | 0.6300                            | 0.7000                             |          |          | 0.7700                       |          |      | 28.7581 (81) |
|             |          |          |          |          |            |                                |                                   |                                    |          |          |                              |          |      |              |
| Solar gains | 53.3439  | 108.5830 | 195.6320 | 321.2839 | 431.8686   | 460.4177                       | 430.7113                          | 343.3680                           | 238.3806 | 132.6970 | 67.1204                      |          |      | 43.5633 (83) |
| Total gains | 499.8631 | 568.4115 | 635.5015 | 748.9960 | 837.7639   | 852.9837                       | 808.4530                          | 720.2307                           | 626.4959 | 532.0634 | 489.3907                     | 479.8414 | (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                                                                         | 35.9095 | 36.0087 | 36.1064 | 36.5726 | 36.6612 | 37.0792 | 37.0792 | 37.1576 | 36.9171                   | 36.6612 | 36.4825 | 36.2975 |              |
| alpha                                                                       | 3.3940  | 3.4006  | 3.4071  | 3.4382  | 3.4441  | 3.4719  | 3.4719  | 3.4772  | 3.4611                    | 3.4441  | 3.4322  | 3.4198  |              |
| util living area                                                            | 0.9844  | 0.9748  | 0.9543  | 0.8914  | 0.7702  | 0.5972  | 0.4587  | 0.5251  | 0.7652                    | 0.9309  | 0.9749  | 0.9864  | (86)         |
| MIT                                                                         | 18.9531 | 19.1924 | 19.5927 | 20.1734 | 20.6337 | 20.8919 | 20.9672 | 20.9482 | 20.7376                   | 20.1357 | 19.4633 | 18.9233 | (87)         |
| Th 2                                                                        | 19.9920 | 19.9945 | 19.9969 | 20.0085 | 20.0106 | 20.0207 | 20.0207 | 20.0225 | 20.0168                   | 20.0106 | 20.0063 | 20.0017 | (88)         |
| util rest of house                                                          | 0.9813  | 0.9698  | 0.9449  | 0.8689  | 0.7244  | 0.5237  | 0.3646  | 0.4268  | 0.7012                    | 0.9118  | 0.9690  | 0.9837  | (89)         |
| MIT 2                                                                       | 18.1249 | 18.3633 | 18.7589 | 19.3256 | 19.7441 | 19.9598 | 20.0082 | 20.0011 | 19.8486                   | 19.3027 | 18.6421 | 18.1021 | (90)         |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | FLA = Living area / (4) = |         |         | 0.5412  | (91)         |
| MIT                                                                         | 18.5732 | 18.8120 | 19.2102 | 19.7844 | 20.2256 | 20.4643 | 20.5272 | 20.5137 | 20.3297                   | 19.7535 | 19.0866 | 18.5465 | (92)         |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000  |              |
| adjusted MIT                                                                | 18.5732 | 18.8120 | 19.2102 | 19.7844 | 20.2256 | 20.4643 | 20.5272 | 20.5137 | 20.3297                   | 19.7535 | 19.0866 | 18.5465 | (93)         |

## 8. Space heating requirement

|                                                                                |           |           |           |          |          |          |          |          |          |               |           |           |       |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|---------------|-----------|-----------|-------|
| Utilisation                                                                    | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec       |       |
|                                                                                | 0.9754    | 0.9623    | 0.9358    | 0.8630   | 0.7351   | 0.5582   | 0.4143   | 0.4777   | 0.7233   | 0.9058        | 0.9620    | 0.9784    | (94)  |
| Useful gains                                                                   | 487.5875  | 546.9574  | 594.6855  | 646.4130 | 615.8251 | 476.1389 | 334.9302 | 344.0377 | 453.1203 | 481.9379      | 470.7724  | 469.4554  | (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                                                               | 1296.6088 | 1260.3209 | 1148.3270 | 970.8409 | 758.6049 | 515.9198 | 345.5057 | 361.1458 | 550.4765 | 814.4818      | 1071.7894 | 1289.3463 | (97)  |
| Space heating kWh                                                              | 601.9119  | 479.3803  | 411.9093  | 233.5881 | 106.2282 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 247.4127      | 432.7322  | 609.9988  | (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |          |          |          |          |          |          |               |           | 3123.1614 |       |
| 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                                                              | 601.9119  | 479.3803  | 411.9093  | 233.5881 | 106.2282 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 247.4127      | 432.7322  | 609.9988  | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |               |           | 3123.1614 |       |
| Space heating per m <sup>2</sup>                                               |           |           |           |          |          |          |          |          |          | (98c) / (4) = |           | 38.1898   | (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  | 826.9826 | 651.0289 | 667.2125 | 0.0000                   | 0.0000  | 0.0000 | 0.0000   | (100) |
| Utilisation                                         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.8275   | 0.8831   | 0.8417   | 0.0000                   | 0.0000  | 0.0000 | 0.0000   | (101) |
| Useful loss                                         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 684.3432 | 574.9329 | 561.6125 | 0.0000                   | 0.0000  | 0.0000 | 0.0000   | (102) |
| Total gains                                         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 951.8115 | 902.0238 | 801.1492 | 0.0000                   | 0.0000  | 0.0000 | 0.0000   | (103) |
| Space cooling kWh                                   | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 192.5772 | 243.3556 | 178.2153 | 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  | 48.1443  | 60.8389  | 44.5538  | 0.0000                   | 0.0000  | 0.0000 | 0.0000   | (107) |
| Space cooling requirement                           |        |        |        |        |         |          |          |          |                          |         |        | 153.5370 | (107) |

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

38.1898 (99)  
1.8774 (108)  
40.0672 (109)  
40.1 (109)