

# Summary for Input Data

|                      |          |               |                |            |
|----------------------|----------|---------------|----------------|------------|
| Plot Reference       | A 108    |               | Issued on Date | 19/03/2026 |
| Assessment Reference | Be Green | Plot Type Ref |                |            |
| Plot Address         |          |               | SAP Version    | 10.2       |

|                                    |          |               |       |      |       |
|------------------------------------|----------|---------------|-------|------|-------|
| SAP Rating                         | 82 B     | DER           | 5.81  | TER  | 17.78 |
| Environmental                      | 96 A     | % DER < TER   |       |      | 67.32 |
| CO <sub>2</sub> Emissions (t/year) | 0.27     | DFEE          | 38.15 | TFEE | 46.73 |
| Compliance Check                   | See BREL | % DFEE < TFEE |       |      | 18.36 |
| % DPER < TPER                      | 35.53    | DPER          | 61.59 | TPER | 95.53 |

|                  |                   |             |           |
|------------------|-------------------|-------------|-----------|
| 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, Mid-Terrace   |        |
| Position of Flat               | Mid-floor flat      |        |
| Which Floor                    | 1                   |        |
| 2.0 Number of Storeys          | 1                   |        |
| 3.0 Date Built                 | 2026                |        |
| 4.0 Sheltered Sides            | 3                   |        |
| 5.0 Sunlight/Shade             | Average or unknown  |        |
| 6.0 Thermal Mass Parameter     | Precise calculation |        |
| Thermal Mass                   | 258.36              | kJ/m²K |
|                                |                     |        |
| 7.0 Electricity Tariff         | Standard            |        |
| Smart electricity meter fitted | Yes                 |        |
| Smart gas meter fitted         | Yes                 |        |

| 7.0 Measurements | Ground floor: | Heat Loss Perimeter | Internal Floor Area  | Average Storey Height |
|------------------|---------------|---------------------|----------------------|-----------------------|
|                  |               | 19.81 m             | 52.45 m <sup>2</sup> | 2.80 m                |

|                 |       |                |
|-----------------|-------|----------------|
| 8.0 Living Area | 30.10 | m <sup>2</sup> |
|-----------------|-------|----------------|

| 9.0 External Walls | Description     | Type        | Construction                                                                 | U-Value (W/m <sup>2</sup> K) | Kappa (kJ/m <sup>2</sup> K) | Gross Area(m <sup>2</sup> ) | Nett Area (m <sup>2</sup> ) | Shelter Res | Shelter                     | Openings | Area Calculation Type |
|--------------------|-----------------|-------------|------------------------------------------------------------------------------|------------------------------|-----------------------------|-----------------------------|-----------------------------|-------------|-----------------------------|----------|-----------------------|
|                    | External Wall 1 | Cavity Wall | Cavity wall : dense plaster, AAC block, filled cavity, any outside structure | 0.15                         | 70.00                       | 16.44                       | 10.73                       | 0.00        | None                        | 5.71     | Enter Gross Area      |
|                    | Corridor wall   | Cavity Wall | Cavity wall : dense plaster, AAC block, filled cavity, any outside structure | 0.22                         | 70.00                       | 39.03                       | 36.61                       | 0.70        | Stairwell Access Corridor 3 | 2.42     | Enter Gross Area      |

| 9.1 Party Walls | Description  | Type                            | Construction                                                                   | U-Value (W/m <sup>2</sup> K) | Kappa (kJ/m <sup>2</sup> K) | Area (m <sup>2</sup> ) | Shelter Res | Shelter |
|-----------------|--------------|---------------------------------|--------------------------------------------------------------------------------|------------------------------|-----------------------------|------------------------|-------------|---------|
|                 | Party Wall 1 | Filled Cavity with Edge Sealing | Single plasterboard on dabs on both sides, dense blocks, cavity or cavity fill | 0.00                         | 70.00                       | 28.06                  | 0.00        | None    |

| 9.2 Internal Walls | Description     | Construction                 | Kappa (kJ/m <sup>2</sup> K) | Area (m <sup>2</sup> ) |
|--------------------|-----------------|------------------------------|-----------------------------|------------------------|
|                    | Internal Wall 1 | Plasterboard on timber frame | 9.00                        | 103.32                 |

| 10.1 Party Ceilings | Description     | Construction                                    | Kappa (kJ/m <sup>2</sup> K) | Area (m <sup>2</sup> ) |
|---------------------|-----------------|-------------------------------------------------|-----------------------------|------------------------|
|                     | Party Ceiling 1 | Precast concrete planks floor, screed, carpeted | 30.00                       | 52.45                  |

| 11.0 Heat Loss Floors | Description      | Type                  | Storey Index    | Construction | U-Value (W/m <sup>2</sup> K) | Shelter Code | Shelter Factor | Kappa (kJ/m <sup>2</sup> K) | Area (m <sup>2</sup> ) |
|-----------------------|------------------|-----------------------|-----------------|--------------|------------------------------|--------------|----------------|-----------------------------|------------------------|
|                       | Heatloss Floor 1 | Exposed Floor - Solid | Lowest occupied | Other        | 0.10                         | None         | 0.00           | 110.00                      | 52.45                  |

# Summary for Input Data

## 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      |       |
| Windows | Window       | External Wall 1 | North East  | 5.71      |       |

## 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 |
|---------------------------------------------------------------------------|------------------------|--------|------|---------------------|----------|
| E1 Steel lintel with perforated steel base plate                          | Independently assessed | 3.73   | 0.05 | 0.05                | No       |
| E3 Sill                                                                   | Independently assessed | 0.91   | 0.04 | 0.04                | No       |
| E4 Jamb                                                                   | Independently assessed | 12.60  | 0.04 | 0.04                | No       |
| E7 Party floor between dwellings (in blocks of flats)                     | Independently assessed | 2.51   | 0.05 | 0.05                | No       |
| E7 Party floor between dwellings (in blocks of flats)                     | Independently assessed | 6.52   | 0.04 | 0.04                | No       |
| E9 Balcony between dwellings, wall insulation continuous                  | Independently assessed | 3.36   | 0.05 | 0.05                | No       |
| E16 Corner (normal)                                                       | Independently assessed | 2.80   | 0.05 | 0.05                | No       |
| E16 Corner (normal)                                                       | Independently assessed | 5.60   | 0.04 | 0.04                | No       |
| E17 Corner (inverted – internal area greater than external area)          | Table K1 - Default     | 2.80   | 0.00 | 0.00                | No       |
| E18 Party wall between dwellings                                          | Independently assessed | 2.80   | 0.05 | 0.05                | No       |
| E20 Exposed floor (normal)                                                | Independently assessed | 5.87   | 0.10 | 0.10                | No       |
| E21 Exposed floor (inverted)                                              | Independently assessed | 13.94  | 0.10 | 0.10                | No       |
| E25 Staggered party wall between dwellings                                | Independently assessed | 2.80   | 0.04 | 0.04                | No       |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | Table K1 - Default     | 10.02  | 0.00 | 0.00                | No       |
| P7 Party Wall - Exposed floor (normal)                                    | Independently assessed | 10.02  | 0.08 | 0.08                | No       |
| P8 Party Wall - Exposed floor (inverted)                                  | Independently assessed | 7.42   | 0.16 | 0.16                | 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"/> |
| Number of intermittent extract fans              | <input type="text" value="0"/> |
| Number of passive vents                          | <input type="text" value="0"/> |
| Number of flueless gas fires                     | <input type="text" value="0"/> |

# Summary for Input Data



|                                                  |                                               |                                                                 |                           |
|--------------------------------------------------|-----------------------------------------------|-----------------------------------------------------------------|---------------------------|
| <b>21.0 Fixed Cooling System</b>                 |                                               | <input type="text" value="No"/>                                 |                           |
| <b>22.0 Pressure Testing</b>                     |                                               | <input type="text" value="Yes"/>                                |                           |
| Designed AP <sub>50</sub>                        | <input type="text" value="3.00"/>             | m³/(h.m²) @ 50 Pa                                               |                           |
| Test Method                                      | <input type="text" value="Blower Door"/>      |                                                                 |                           |
| <b>22.0 Lighting</b>                             |                                               | <input type="text" value="No"/>                                 |                           |
| No Fixed Lighting                                | <input type="text" value="No"/>               |                                                                 |                           |
|                                                  | <b>Name</b>                                   | <b>Efficacy</b>                                                 | <b>Power</b>              |
|                                                  | Lighting 1                                    | 75.00                                                           | 15.00                     |
|                                                  |                                               |                                                                 | <b>Capacity</b>           |
|                                                  |                                               |                                                                 | 1125.00                   |
|                                                  |                                               |                                                                 | <b>Count</b>              |
|                                                  |                                               |                                                                 | 5                         |
| <b>24.0 Main Heating 1</b>                       |                                               | <input type="text" value="None"/>                               |                           |
| <b>25.0 Main Heating 2</b>                       |                                               | <input type="text" value="None"/>                               |                           |
| <b>26.0 Heat Networks</b>                        |                                               | <input type="text" value="Space and Water Combined"/>           |                           |
| <b>Space Community Heating</b>                   |                                               |                                                                 |                           |
| Distribution Loss                                | <input type="text" value="Calculated"/>       |                                                                 |                           |
| Distribution Loss Value                          | <input type="text" value="1.50"/>             |                                                                 |                           |
| SAP Code                                         | <input type="text" value="2306"/>             |                                                                 |                           |
|                                                  | <b>Heat Source</b>                            | <b>Fuel Type</b>                                                | <b>Heating Use</b>        |
|                                                  | Heat source 1                                 | Heat pump                                                       | Electricity               |
|                                                  | Heat source 2                                 | None                                                            | Space and Water           |
|                                                  | Heat source 3                                 | None                                                            |                           |
|                                                  | Heat source 4                                 | None                                                            |                           |
|                                                  | Heat source 5                                 | None                                                            |                           |
|                                                  |                                               |                                                                 | <b>Efficiency</b>         |
|                                                  |                                               |                                                                 | 232.00                    |
|                                                  |                                               |                                                                 | <b>Percentage Of Heat</b> |
|                                                  |                                               |                                                                 | 100.00                    |
|                                                  |                                               |                                                                 | <b>Heat</b>               |
|                                                  |                                               |                                                                 |                           |
|                                                  |                                               |                                                                 | <b>Heat Power Ratio</b>   |
|                                                  |                                               |                                                                 |                           |
|                                                  |                                               |                                                                 | <b>Electrical</b>         |
|                                                  |                                               |                                                                 |                           |
|                                                  |                                               |                                                                 | <b>Fuel Factor</b>        |
|                                                  |                                               |                                                                 |                           |
|                                                  |                                               |                                                                 | <b>Efficiency type</b>    |
|                                                  |                                               |                                                                 |                           |
| <b>27.0 Secondary Heating</b>                    |                                               | <input type="text" value="None"/>                               |                           |
| <b>28.0 Water Heating</b>                        |                                               | <input type="text" value="Community Heating"/>                  |                           |
| Water Heating                                    |                                               |                                                                 |                           |
| SAP Code                                         | <input type="text" value="901"/>              |                                                                 |                           |
| Flue Gas Heat Recovery System                    | <input type="text" value="No"/>               |                                                                 |                           |
| Waste Water Heat Recovery Instantaneous System 1 | <input type="text" value="No"/>               |                                                                 |                           |
| Waste Water Heat Recovery Instantaneous System 2 | <input type="text" value="No"/>               |                                                                 |                           |
| Waste Water Heat Recovery Storage System         | <input type="text" value="No"/>               |                                                                 |                           |
| Solar Panel                                      | <input type="text" value="No"/>               |                                                                 |                           |
| Water use <= 125 litres/person/day               | <input type="text" value="Yes"/>              |                                                                 |                           |
| Cold Water Source                                | <input type="text" value="From header tank"/> |                                                                 |                           |
| Bath Count                                       | <input type="text" value="1"/>                |                                                                 |                           |
| <b>28.1 Showers</b>                              |                                               |                                                                 |                           |
| <b>Description</b>                               | <b>Shower Type</b>                            | <b>Flow Rate [l/min]</b>                                        | <b>Rated Power [kW]</b>   |
| Shower                                           | Combi boiler or unvented hot water system     | 8.00                                                            |                           |
|                                                  |                                               |                                                                 | <b>Connected</b>          |
|                                                  |                                               |                                                                 | No                        |
|                                                  |                                               |                                                                 | <b>Connected To</b>       |
|                                                  |                                               |                                                                 |                           |
| <b>28.3 Waste Water Heat Recovery System</b>     |                                               |                                                                 |                           |
| <b>29.0 Hot Water Cylinder</b>                   |                                               | <input type="text" value="Internal Store"/>                     |                           |
| Insulation Type                                  | <input type="text" value="Measured Loss"/>    |                                                                 |                           |
| Cylinder Volume                                  | <input type="text" value="180.00"/>           |                                                                 |                           |
| Loss                                             | <input type="text" value="1.20"/>             |                                                                 |                           |
|                                                  |                                               |                                                                 | L                         |
|                                                  |                                               |                                                                 | kWh/day                   |
| <b>32.0 Photovoltaic Unit</b>                    |                                               | <input type="text" value="Multiple Dwellings – Not Connected"/> |                           |
| Export Capable Meter?                            | <input type="text" value="No"/>               |                                                                 |                           |
| Connected To Dwelling                            | <input type="text" value="Yes"/>              |                                                                 |                           |
| Diverter                                         | <input type="text" value="No"/>               |                                                                 |                           |
| Battery Capacity [kWh]                           | <input type="text" value="0.00"/>             |                                                                 |                           |
| <b>PV Cells kWp</b>                              | <b>Orientation</b>                            | <b>Elevation</b>                                                | <b>Overshading FGHRs</b>  |
|                                                  |                                               |                                                                 | <b>MCS Certificate</b>    |
|                                                  |                                               |                                                                 | <b>Overshading Factor</b> |
|                                                  |                                               |                                                                 | <b>MCS Certificate</b>    |
|                                                  |                                               |                                                                 | <b>Panel Manufacturer</b> |

# Summary for Input Data



|                        |     |            |            |        |     |     |      |     |           |     |     |
|------------------------|-----|------------|------------|--------|-----|-----|------|-----|-----------|-----|-----|
| 0.25                   |     | North East | Horizontal | Modest | No  |     | 0.80 |     | Reference |     |     |
| 34.0 Small-scale Hydro |     |            |            | None   |     |     |      |     |           |     |     |
| Jan                    | Feb | Mar        | Apr        | May    | Jun | Jul | Aug  | Sep | Oct       | Nov | Dec |

## Recommendations

### Lower cost measures

None

### Further measures to achieve even higher standards

None

# Full SAP Calculation Printout



|                                    |                   |  |               |               |                |            |       |
|------------------------------------|-------------------|--|---------------|---------------|----------------|------------|-------|
| Plot Reference                     | A 108             |  |               |               | Issued on Date | 19/03/2026 |       |
| Assessment Reference               | Be Green          |  |               | Plot Type Ref |                |            |       |
| Plot Address                       |                   |  |               |               | SAP Version    | 10.2       |       |
|                                    |                   |  |               |               |                |            |       |
| SAP Rating                         | 82 B              |  | DER           | 5.81          |                | TER        | 17.78 |
| Environmental                      | 96 A              |  | % DER < TER   |               |                |            | 67.32 |
| CO <sub>2</sub> Emissions (t/year) | 0.27              |  | DFEE          | 38.15         |                | TFEE       | 46.73 |
| Compliance Check                   | See BREL          |  | % DFEE < TFEE |               |                |            | 18.36 |
| % DPER < TPER                      | 35.53             |  | DPER          | 61.59         |                | TPER       | 95.53 |
|                                    |                   |  |               |               |                |            |       |
| Assessor Details                   | Mr. Robert Tanner |  |               |               | Assessor ID    | W344-0001  |       |
| Client                             |                   |  |               |               |                |            |       |

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

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                 |                             |
| Ground floor                                           | 52.4500 (1b)              | 2.8000 (2b)                     | 146.8600 (1b) - (3b)        |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 52.4500                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | 146.8600 (5)                |

## 2. Ventilation rate

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

|                                                                                                    |                |            |
|----------------------------------------------------------------------------------------------------|----------------|------------|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 / (5) = | 0.0000 (8) |
| Pressure test                                                                                      | Yes            |            |
| Pressure Test Method                                                                               | Blower Door    |            |
| Measured/design AP50                                                                               | 3.0000         | (17)       |
| Infiltration rate                                                                                  | 0.1500         | (18)       |
| Number of sides sheltered                                                                          | 3              | (19)       |

|                                                      |                             |             |
|------------------------------------------------------|-----------------------------|-------------|
| Shelter factor                                       | (20) = 1 - [0.075 x (19)] = | 0.7750 (20) |
| Infiltration rate adjusted to include shelter factor | (21) = (18) x (20) =        | 0.1162 (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                                                                                         | 0.1482 | 0.1453 | 0.1424 | 0.1279 | 0.1250 | 0.1104 | 0.1104 | 0.1075 | 0.1162 | 0.1250 | 0.1308 | 0.1366 (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                                                                                            | 0.2432 | 0.2403 | 0.2374 | 0.2229 | 0.2200 | 0.2054 | 0.2054 | 0.2025 | 0.2112 | 0.2200 | 0.2258 | 0.2316 (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                                                         |                         |                            | 5.7100                    | 1.1450                        | 6.5382                               |                                | (27)            |
| Heatloss Floor 1                                               |                         |                            | 52.4500                   | 0.1000                        | 5.2450                               | 110.0000                       | 5769.5000 (28b) |
| External Wall 1                                                | 16.4400                 | 5.7100                     | 10.7300                   | 0.1500                        | 1.6095                               | 70.0000                        | 751.1000 (29a)  |
| Corridor wall                                                  | 39.0300                 | 2.4200                     | 36.6100                   | 0.1900                        | 6.9559                               | 70.0000                        | 2562.6999 (29a) |
| Total net area of external elements Aum(A, m <sup>2</sup> )    |                         |                            | 107.9200                  |                               |                                      |                                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                            |                         |                            | (26)...(30) + (32) =      |                               | 22.7686                              |                                | (33)            |
| Main dwelling                                                  |                         |                            |                           |                               |                                      |                                |                 |
| Party Wall 1                                                   |                         |                            | 28.0600                   | 0.0000                        | 0.0000                               | 70.0000                        | 1964.2000 (32)  |
| Party Ceiling 1                                                |                         |                            | 52.4500                   |                               |                                      | 30.0000                        | 1573.5000 (32b) |
| Internal Wall 1                                                |                         |                            | 103.3200                  |                               |                                      | 9.0000                         | 929.8800 (32c)  |
| Heat capacity Cm = Sum(A x k)                                  |                         |                            |                           |                               | (28)...(30) + (32) + (32a)...(32e) = |                                | 13550.8799 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K |                         |                            |                           |                               |                                      |                                | 258.3580 (35)   |
| List of Thermal Bridges                                        |                         |                            |                           |                               |                                      |                                |                 |

# Full SAP Calculation Printout



|                                                                           |         |                       |              |
|---------------------------------------------------------------------------|---------|-----------------------|--------------|
| K1 Element                                                                | Length  | Psi-value             | Total        |
| E1 Steel lintel with perforated steel base plate                          | 3.7300  | 0.0500                | 0.1865       |
| E3 Sill                                                                   | 0.9100  | 0.0400                | 0.0364       |
| E4 Jamb                                                                   | 12.6000 | 0.0400                | 0.5040       |
| E7 Party floor between dwellings (in blocks of flats)                     | 2.5100  | 0.0500                | 0.1255       |
| E7 Party floor between dwellings (in blocks of flats)                     | 6.5200  | 0.0390                | 0.2543       |
| E9 Balcony between dwellings, wall insulation continuous                  | 3.3600  | 0.0500                | 0.1680       |
| E16 Corner (normal)                                                       | 2.8000  | 0.0500                | 0.1400       |
| E16 Corner (normal)                                                       | 5.6000  | 0.0390                | 0.2184       |
| E17 Corner (inverted - internal area greater than external area)          | 2.8000  | 0.0000                | 0.0000       |
| E18 Party wall between dwellings                                          | 2.8000  | 0.0500                | 0.1400       |
| E20 Exposed floor (normal)                                                | 5.8700  | 0.1000                | 0.5870       |
| E21 Exposed floor (inverted)                                              | 13.9400 | 0.1000                | 1.3940       |
| E25 Staggered party wall between dwellings                                | 2.8000  | 0.0390                | 0.1092       |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | 10.0200 | 0.0000                | 0.0000       |
| P7 Party Wall - Exposed floor (normal)                                    | 10.0200 | 0.0800                | 0.8016       |
| P8 Party Wall - Exposed floor (inverted)                                  | 7.4200  | 0.1600                | 1.1872       |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                |         |                       | 5.8521 (36)  |
| Point Thermal bridges                                                     |         |                       | 0.0000       |
| Total fabric heat loss                                                    |         | (33) + (36) + (36a) = | 28.6206 (37) |

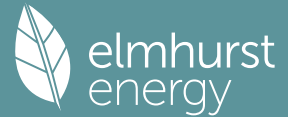
|                                                                     |         |         |         |         |         |         |         |         |         |         |         |         |      |
|---------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| 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                                                               | 11.7873 | 11.6465 | 11.5056 | 10.8014 | 10.6605 | 9.9563  | 9.9563  | 9.8154  | 10.2380 | 10.6605 | 10.9422 | 11.2239 | (38) |
| Heat transfer coeff                                                 | 40.4080 | 40.2671 | 40.1263 | 39.4220 | 39.2812 | 38.5769 | 38.5769 | 38.4361 | 38.8586 | 39.2812 | 39.5629 | 39.8446 | (39) |
| Average = Sum(39)m / 12 =                                           |         |         |         |         |         |         |         |         |         |         |         | 39.3868 |      |
| HLP                                                                 | 0.7704  | 0.7677  | 0.7650  | 0.7516  | 0.7489  | 0.7355  | 0.7355  | 0.7328  | 0.7409  | 0.7489  | 0.7543  | 0.7597  | (40) |
| HLP (average)                                                       |         |         |         |         |         |         |         |         |         |         |         | 0.7509  |      |
| Days in mont                                                        | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31      |      |

|                                                                                |          |          |          |          |          |          |          |          |          |                    |          |                |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------------|----------|----------------|
| 4. Water heating energy requirements (kWh/year)                                |          |          |          |          |          |          |          |          |          |                    |          |                |
| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |                    |          | 1.7623 (42)    |
| Hot water usage for mixer showers                                              |          |          |          |          |          |          |          |          |          |                    |          |                |
| 52.4098                                                                        | 51.6074  | 50.4249  | 48.6058  | 46.9759  | 44.6958  | 42.8923  | 45.0007  | 46.0611  | 48.3195  | 50.6714            | 52.3625  | (42a)          |
| Hot water usage for baths                                                      |          |          |          |          |          |          |          |          |          |                    |          |                |
| 22.7271                                                                        | 22.3841  | 21.8960  | 21.1651  | 20.5064  | 19.5996  | 18.9116  | 19.7529  | 20.1944  | 21.0929  | 22.0270            | 22.7091  | (42b)          |
| Hot water usage for other uses                                                 |          |          |          |          |          |          |          |          |          |                    |          |                |
| 32.6782                                                                        | 31.4899  | 30.3016  | 29.1133  | 27.9250  | 26.7367  | 26.7367  | 27.9250  | 29.1133  | 30.3016  | 31.4899            | 32.6782  | (42c)          |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |                    |          | 99.0986 (43)   |
| Daily hot water use                                                            |          |          |          |          |          |          |          |          |          |                    |          |                |
| 107.8151                                                                       | 105.4813 | 102.6225 | 98.8842  | 95.4073  | 91.0320  | 88.5406  | 92.6785  | 95.3687  | 99.7139  | 104.1883           | 107.7498 | (44)           |
| Energy conte                                                                   | 158.7225 | 139.5731 | 146.6454 | 129.1674 | 122.9419 | 105.2755 | 97.8400  | 109.0843 | 110.6229 | 128.4915           | 140.8140 | 158.2385 (45)  |
| Energy content (annual)                                                        |          |          |          |          |          |          |          |          |          | Total = Sum(45)m = |          | 1547.4171      |
| Distribution loss (46)m = 0.15 x (45)m                                         |          |          |          |          |          |          |          |          |          |                    |          |                |
| 23.8084                                                                        | 20.9360  | 21.9968  | 19.3751  | 18.4413  | 15.7913  | 14.6760  | 16.3626  | 16.5934  | 19.2737  | 21.1221            | 23.7358  | (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  | 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   | (61)           |
| Total heat required for water heating calculated for each month                |          |          |          |          |          |          |          |          |          |                    |          |                |
| 213.9993                                                                       | 189.5006 | 201.9222 | 182.6611 | 178.2187 | 158.7692 | 153.1168 | 164.3611 | 164.1166 | 183.7683 | 194.3077           | 213.5153 | (62)           |
| WWHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | (63a)          |
| PV diverter                                                                    | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000            | -0.0000  | (63b)          |
| Solar input                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | (63c)          |
| FGHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | (63d)          |
| Output from w/h                                                                |          |          |          |          |          |          |          |          |          |                    |          |                |
| 213.9993                                                                       | 189.5006 | 201.9222 | 182.6611 | 178.2187 | 158.7692 | 153.1168 | 164.3611 | 164.1166 | 183.7683 | 194.3077           | 213.5153 | (64)           |
| 12Total per year (kWh/year)                                                    |          |          |          |          |          |          |          |          |          |                    |          | 2198.2568 (64) |
| Electric shower(s)                                                             |          |          |          |          |          |          |          |          |          |                    |          | 2198 (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                                       |          |          |          |          |          |          |          |          |          |                    |          |                |
| 96.9967                                                                        | 86.3500  | 92.9810  | 85.7431  | 85.0996  | 77.7990  | 76.7532  | 80.4920  | 79.5771  | 86.9449  | 89.6156            | 96.8357  | (65)           |

|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |      |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| 5. Internal gains (see Table 5 and 5a)                                              |          |          |          |          |          |          |          |          |          |          |          |      |
| Metabolic gains (Table 5), Watts                                                    |          |          |          |          |          |          |          |          |          |          |          |      |
| (66)m                                                                               | 88.1173  | 88.1173  | 88.1173  | 88.1173  | 88.1173  | 88.1173  | 88.1173  | 88.1173  | 88.1173  | 88.1173  | 88.1173  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     |          |          |          |          |          |          |          |          |          |          |          |      |
| 87.8465                                                                             | 97.2587  | 87.8465  | 90.7748  | 87.8465  | 90.7748  | 87.8465  | 87.8465  | 90.7748  | 87.8465  | 90.7748  | 87.8465  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 |          |          |          |          |          |          |          |          |          |          |          |      |
| 153.5928                                                                            | 155.1866 | 151.1702 | 142.6199 | 131.8266 | 121.6824 | 114.9055 | 113.3117 | 117.3281 | 125.8784 | 136.6717 | 146.8159 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    |          |          |          |          |          |          |          |          |          |          |          |      |
| 31.8117                                                                             | 31.8117  | 31.8117  | 31.8117  | 31.8117  | 31.8117  | 31.8117  | 31.8117  | 31.8117  | 31.8117  | 31.8117  | 31.8117  | (69) |
| Pumps, fans                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 |          |          |          |          |          |          |          |          |          |          |          |      |
| -70.4938                                                                            | -70.4938 | -70.4938 | -70.4938 | -70.4938 | -70.4938 | -70.4938 | -70.4938 | -70.4938 | -70.4938 | -70.4938 | -70.4938 | (71) |
| Water heating gains (Table 5)                                                       |          |          |          |          |          |          |          |          |          |          |          |      |
| 130.3719                                                                            | 128.4971 | 124.9745 | 119.0877 | 114.3812 | 108.0542 | 103.1629 | 108.1881 | 110.5237 | 116.8614 | 124.4661 | 130.1556 | (72) |
| Total internal gains                                                                |          |          |          |          |          |          |          |          |          |          |          |      |
| 421.2463                                                                            | 430.3775 | 413.4265 | 401.9175 | 383.4896 | 369.9466 | 355.3502 | 358.7816 | 368.0617 | 380.0215 | 401.3477 | 414.2531 | (73) |

## 6. Solar gains

# Full SAP Calculation Printout



| [Jan]                                                                                                         | Area<br>m2 |          |          |          | Solar flux<br>Table 6a<br>W/m2 | Specific data<br>or Table 6b |          | g        | Specific data<br>or Table 6c | FF            | Access<br>factor<br>Table 6d |              | Gains<br>W |               |
|---------------------------------------------------------------------------------------------------------------|------------|----------|----------|----------|--------------------------------|------------------------------|----------|----------|------------------------------|---------------|------------------------------|--------------|------------|---------------|
| Northeast                                                                                                     | 5.7100     |          |          |          | 11.2829                        | 0.3500                       |          |          | 0.7000                       |               | 0.7700                       | 10.9385 (75) |            |               |
| Solar gains                                                                                                   | 10.9385    | 22.2656  | 40.1156  | 65.8813  | 88.5574                        | 94.4116                      | 88.3201  | 70.4098  | 48.8815                      | 27.2104       | 13.7635                      | 8.9329       | (83)       |               |
| Total gains                                                                                                   | 432.1848   | 452.6431 | 453.5420 | 467.7988 | 472.0470                       | 464.3582                     | 443.6703 | 429.1914 | 416.9432                     | 407.2319      | 415.1112                     | 423.1861     | (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                                                                                                           | 93.1533    | 93.4791  | 93.8072  | 95.4830  | 95.8254                        | 97.5747                      | 97.5747  | 97.9323  | 96.8674                      | 95.8254       | 95.1431                      | 94.4704      |            |               |
| alpha                                                                                                         | 7.2102     | 7.2319   | 7.2538   | 7.3655   | 7.3884                         | 7.5050                       | 7.5050   | 7.5288   | 7.4578                       | 7.3884        | 7.3429                       | 7.2980       |            |               |
| util living area                                                                                              | 0.9851     | 0.9763   | 0.9585   | 0.8889   | 0.7441                         | 0.5295                       | 0.3824   | 0.4116   | 0.6343                       | 0.8822        | 0.9656                       | 0.9868       | (86)       |               |
| MIT                                                                                                           | 20.4683    | 20.5592  | 20.6856  | 20.8689  | 20.9698                        | 20.9978                      | 20.9998  | 20.9997  | 20.9922                      | 20.8944       | 20.6807                      | 20.4613      | (87)       |               |
| Th 2                                                                                                          | 20.2791    | 20.2814  | 20.2837  | 20.2955  | 20.2978                        | 20.3096                      | 20.3096  | 20.3119  | 20.3049                      | 20.2978       | 20.2931                      | 20.2884      | (88)       |               |
| util rest of house                                                                                            | 0.9810     | 0.9698   | 0.9470   | 0.8619   | 0.6972                         | 0.4734                       | 0.3225   | 0.3502   | 0.5741                       | 0.8494        | 0.9553                       | 0.9831       | (89)       |               |
| MIT 2                                                                                                         | 19.6717    | 19.7870  | 19.9449  | 20.1689  | 20.2741                        | 20.3084                      | 20.3095  | 20.3118  | 20.3001                      | 20.2014       | 19.9485                      | 19.6707      | (90)       |               |
| Living area fraction                                                                                          |            |          |          |          |                                |                              |          |          | fLA = Living area / (4) =    |               |                              | 0.5739       | (91)       |               |
| MIT                                                                                                           | 20.1288    | 20.2301  | 20.3700  | 20.5706  | 20.6734                        | 20.7040                      | 20.7057  | 20.7066  | 20.6973                      | 20.5991       | 20.3687                      | 20.1244      | (92)       |               |
| Temperature adjustment                                                                                        |            |          |          |          |                                |                              |          |          |                              |               |                              | 0.0000       |            |               |
| adjusted MIT                                                                                                  | 20.1288    | 20.2301  | 20.3700  | 20.5706  | 20.6734                        | 20.7040                      | 20.7057  | 20.7066  | 20.6973                      | 20.5991       | 20.3687                      | 20.1244      | (93)       |               |
| 8. Space heating requirement                                                                                  |            |          |          |          |                                |                              |          |          |                              |               |                              |              |            |               |
|                                                                                                               | Jan        | Feb      | Mar      | Apr      | May                            | Jun                          | Jul      | Aug      | Sep                          | Oct           | Nov                          | Dec          |            |               |
| Utilisation                                                                                                   | 0.9800     | 0.9693   | 0.9486   | 0.8730   | 0.7228                         | 0.5056                       | 0.3569   | 0.3855   | 0.6085                       | 0.8643        | 0.9565                       | 0.9820       | (94)       |               |
| Useful gains                                                                                                  | 423.5383   | 438.7574 | 430.2142 | 408.3920 | 341.1928                       | 234.7627                     | 158.3398 | 165.4508 | 253.6920                     | 351.9589      | 397.0721                     | 415.5891     | (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                                                                                              | 639.6108   | 617.2999 | 556.5492 | 460.0783 | 352.4846                       | 235.4752                     | 158.3845 | 165.5288 | 256.3610                     | 392.7762      | 524.9486                     | 634.5009     | (97)       |               |
| Space heating kWh                                                                                             | 160.7579   | 119.9805 | 93.9933  | 37.2142  | 8.4012                         | 0.0000                       | 0.0000   | 0.0000   | 0.0000                       | 30.3680       | 92.0711                      | 162.8704     | (98a)      |               |
| Space heating requirement - total per year (kWh/year)                                                         |            |          |          |          |                                |                              |          |          |                              |               |                              | 705.6565     |            |               |
| 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                                                                                             | 160.7579   | 119.9805 | 93.9933  | 37.2142  | 8.4012                         | 0.0000                       | 0.0000   | 0.0000   | 0.0000                       | 30.3680       | 92.0711                      | 162.8704     | (98c)      |               |
| Space heating requirement after solar contribution - total per year (kWh/year)                                |            |          |          |          |                                |                              |          |          |                              |               |                              | 705.6565     |            |               |
| Space heating per m2                                                                                          |            |          |          |          |                                |                              |          |          |                              | (98c) / (4) = |                              | 13.4539      | (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                                                                                     |            |          |          |          |                                |                              |          |          |                              |               |                              |              |            |               |
|                                                                                                               | 160.7579   | 119.9805 | 93.9933  | 37.2142  | 8.4012                         | 0.0000                       | 0.0000   | 0.0000   | 0.0000                       | 30.3680       | 92.0711                      | 162.8704     | (98)       |               |
| Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.50                                                         |            |          |          |          |                                |                              |          |          |                              |               |                              |              |            |               |
| 307a                                                                                                          | 241.1369   | 179.9708 | 140.9899 | 55.8212  | 12.6017                        | 0.0000                       | 0.0000   | 0.0000   | 0.0000                       | 45.5520       | 138.1067                     | 244.3056     |            |               |
| Space heating requirement                                                                                     | 241.1369   | 179.9708 | 140.9899 | 55.8212  | 12.6017                        | 0.0000                       | 0.0000   | 0.0000   | 0.0000                       | 45.5520       | 138.1067                     | 244.3056     | (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                                                                              |            |          |          |          |                                |                              |          |          |                              |               |                              |              |            |               |
|                                                                                                               | 213.9993   | 189.5006 | 201.9222 | 182.6611 | 178.2187                       | 158.7692                     | 153.1168 | 164.3611 | 164.1166                     | 183.7683      | 194.3077                     | 213.5153     | (64)       |               |
| Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.50                                                         |            |          |          |          |                                |                              |          |          |                              |               |                              |              |            |               |
| 310a                                                                                                          | 320.9989   | 284.2509 | 302.8833 | 273.9917 | 267.3281                       | 238.1538                     | 229.6752 | 246.5417 | 246.1749                     | 275.6524      | 291.4615                     | 320.2730     |            |               |
| Water heating fuel                                                                                            | 320.9989   | 284.2509 | 302.8833 | 273.9917 | 267.3281                       | 238.1538                     | 229.6752 | 246.5417 | 246.1749                     | 275.6524      | 291.4615                     | 320.2730     | (310)      |               |
| Cooling System Energy Efficiency Ratio                                                                        | 0.0000     | 0.0000   | 0.0000   | 0.0000   | 0.0000                         | 0.0000                       | 0.0000   | 0.0000   | 0.0000                       | 0.0000        | 0.0000                       | 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                                                                                                  | 11.9835    | 10.8238  | 11.9835  | 11.5969  | 11.9835                        | 11.5969                      | 11.9835  | 11.9835  | 11.5969                      | 11.9835       | 11.5969                      | 11.9835      | (331)      |               |
| Lighting                                                                                                      | 18.8745    | 15.1418  | 13.6335  | 9.9885   | 7.7154                         | 6.3035                       | 7.0382   | 9.1486   | 11.8831                      | 15.5913       | 17.6103                      | 19.3990      | (332)      |               |
| Electricity generated by PVs (Appendix M) (negative quantity)                                                 | -2.7534    | -4.8980  | -9.0580  | -12.7820 | -16.0130                       | -15.8081                     | -15.4793 | -13.3056 | -9.9813                      | -6.3976       | -3.3095                      | -2.2469      | (333a)     |               |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                                       | 0.0000     | 0.0000   | 0.0000   | 0.0000   | 0.0000                         | 0.0000                       | 0.0000   | 0.0000   | 0.0000                       | 0.0000        | 0.0000                       | 0.0000       | (334a)     |               |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                           | 0.0000     | 0.0000   | 0.0000   | 0.0000   | 0.0000                         | 0.0000                       | 0.0000   | 0.0000   | 0.0000                       | 0.0000        | 0.0000                       | 0.0000       | (335a)     |               |
| Electricity generated by PVs (Appendix M) (negative quantity)                                                 | 0.0000     | 0.0000   | 0.0000   | 0.0000   | 0.0000                         | 0.0000                       | 0.0000   | 0.0000   | 0.0000                       | 0.0000        | 0.0000                       | 0.0000       | (333b)     |               |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                                       | 0.0000     | 0.0000   | 0.0000   | 0.0000   | 0.0000                         | 0.0000                       | 0.0000   | 0.0000   | 0.0000                       | 0.0000        | 0.0000                       | 0.0000       | (334b)     |               |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                           | 0.0000     | 0.0000   | 0.0000   | 0.0000   | 0.0000                         | 0.0000                       | 0.0000   | 0.0000   | 0.0000                       | 0.0000        | 0.0000                       | 0.0000       | (335b)     |               |
| Annual totals kWh/year                                                                                        |            |          |          |          |                                |                              |          |          |                              |               |                              |              |            |               |
| Space heating fuel - community heating                                                                        |            |          |          |          |                                |                              |          |          |                              |               |                              | 1058.4848    | (307)      |               |
| Space heating fuel - secondary                                                                                |            |          |          |          |                                |                              |          |          |                              |               |                              | 0.0000       | (309)      |               |
| Water heating fuel - community heating                                                                        |            |          |          |          |                                |                              |          |          |                              |               |                              | 3297.3852    | (310)      |               |
| Efficiency of water heater                                                                                    |            |          |          |          |                                |                              |          |          |                              |               |                              | 0.0000       | (311)      |               |
| Electricity used for heat distribution                                                                        |            |          |          |          |                                |                              |          |          |                              |               |                              | 10.5848      | (313)      |               |
| Space cooling fuel                                                                                            |            |          |          |          |                                |                              |          |          |                              |               |                              | 0.0000       | (321)      |               |
| Electricity for pumps and fans:<br>(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7875) |            |          |          |          |                                |                              |          |          |                              |               |                              |              |            |               |

# Full SAP Calculation Printout



mechanical ventilation fans (SFP = 0.7875) 141.0957 (330a)  
 Total electricity for the above, kWh/year 141.0957 (331)  
 Electricity for lighting (calculated in Appendix L) 152.3278 (332)

Energy saving/generation technologies (Appendices M ,N and Q)  
 PV generation -112.0326 (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 4537.2609 (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                  | 1877.5302          | 0.1570                        | 71.6332 (367)            |
| Electrical energy for heat distribution (space & water) | 10.5848            | 0.0000                        | 6.3022 (372)             |
| Overall CO2 factor for heat network                     |                    |                               | 0.0638 (386)             |
| Total CO2 associated with community systems             |                    |                               | 277.9503 (373)           |
| Space and water heating                                 |                    |                               | 277.9503 (376)           |
| Pumps, fans and electric keep-hot                       | 141.0957           | 0.1387                        | 19.5717 (378)            |
| Energy for lighting                                     | 152.3278           | 0.1443                        | 21.9856 (379)            |
| Energy saving/generation technologies                   |                    |                               |                          |
| PV Unit electricity used in dwelling                    | -112.0326          | 0.1305                        | -14.6191                 |
| PV Unit electricity exported                            | 0.0000             | 0.0000                        | 0.0000                   |
| Total                                                   |                    |                               | -14.6191 (380)           |
| Total CO2, kg/year                                      |                    |                               | 304.8885 (383)           |
| EPC Dwelling Carbon Dioxide Emission Rate (DER)         |                    |                               | 5.8100 (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                  | 1877.5302          | 1.5813                              | 721.4477 (467)             |
| Electrical energy for heat distribution (space & water) | 10.5848            | 0.0000                              | 66.8694 (472)              |
| Overall CO2 factor for heat network                     |                    |                                     | 0.6771 (486)               |
| Total CO2 associated with community systems             |                    |                                     | 2949.1730 (473)            |
| Space and water heating                                 |                    |                                     | 2949.1730 (476)            |
| Pumps, fans and electric keep-hot                       | 141.0957           | 1.5128                              | 213.4496 (478)             |
| Energy for lighting                                     | 152.3278           | 1.5338                              | 233.6454 (479)             |
| Energy saving/generation technologies                   |                    |                                     |                            |
| PV Unit electricity used in dwelling                    | -112.0326          | 1.4820                              | -166.0353                  |
| PV Unit electricity exported                            | 0.0000             | 0.0000                              | 0.0000                     |
| Total                                                   |                    |                                     | -166.0353 (480)            |
| Total Primary energy kWh/year                           |                    |                                     | 3230.2327 (483)            |
| Dwelling Primary energy Rate (DPER)                     |                    |                                     | 61.5900 (484)              |

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

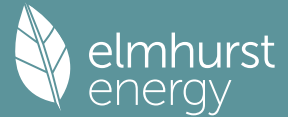
## 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m) | Volume<br>(m3)                                 |
|--------------------------------------------------------|--------------|----------------------|------------------------------------------------|
| Main dwelling                                          |              |                      |                                                |
| Ground floor                                           | 52.4500 (1b) | 2.8000 (2b)          | 146.8600 (1b) - (3b)                           |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 52.4500      |                      | (4)                                            |
| Dwelling volume                                        |              |                      | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 146.8600 (5) |

## 2. Ventilation rate

|                                                                                                    | m3 per hour                             |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 2 * 10 = 20.0000 (7a)                   |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 20.0000 / (5) = 0.1362 (8)              |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 5.0000 (17)                             |
| Infiltration rate                                                                                  | 0.3862 (18)                             |
| Number of sides sheltered                                                                          | 3 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.7750 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.2993 (21)        |

# Full SAP Calculation Printout



|                 |        |        |        |        |        |        |        |        |        |        |        |        |       |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| Wind speed      | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |       |
| Wind factor     | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 | (22)  |
| Adj infilt rate | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 | (22a) |
| Effective ac    | 0.3816 | 0.3741 | 0.3666 | 0.3292 | 0.3217 | 0.2843 | 0.2843 | 0.2768 | 0.2993 | 0.3217 | 0.3367 | 0.3517 | (22b) |
|                 | 0.5728 | 0.5700 | 0.5672 | 0.5542 | 0.5518 | 0.5404 | 0.5404 | 0.5383 | 0.5448 | 0.5518 | 0.5567 | 0.5618 | (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                                  |             |                | 5.7100        | 1.1450           | 6.5382               |                   |               | (27)  |
| Heatloss Floor 1                                  |             |                | 52.4500       | 0.1300           | 6.8185               |                   |               | (28b) |
| External Wall 1                                   | 16.4400     | 5.7100         | 10.7300       | 0.1800           | 1.9314               |                   |               | (29a) |
| Corridor wall                                     | 39.0300     | 2.4200         | 36.6100       | 0.1800           | 6.5898               |                   |               | (29a) |
| Total net area of external elements Aum(A, m2)    |             |                | 107.9200      |                  |                      |                   |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)               |             |                |               |                  | (26)...(30) + (32) = | 24.2979           |               | (33)  |
| Main dwelling                                     |             |                |               |                  |                      |                   |               |       |
| Party Wall 1                                      |             |                | 28.0600       | 0.0000           | 0.0000               |                   |               | (32)  |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K |             |                |               |                  |                      |                   | 258.3580      | (35)  |

## List of Thermal Bridges

| K1 Element                                                                | Length  | Psi-value | Total   |                                    |
|---------------------------------------------------------------------------|---------|-----------|---------|------------------------------------|
| E1 Steel lintel with perforated steel base plate                          | 3.7300  | 0.0500    | 0.1865  |                                    |
| E3 Sill                                                                   | 0.9100  | 0.0500    | 0.0455  |                                    |
| E4 Jamb                                                                   | 12.6000 | 0.0500    | 0.6300  |                                    |
| E7 Party floor between dwellings (in blocks of flats)                     | 2.5100  | 0.0700    | 0.1757  |                                    |
| E7 Party floor between dwellings (in blocks of flats)                     | 6.5200  | 0.0700    | 0.4564  |                                    |
| E9 Balcony between dwellings, wall insulation continuous                  | 3.3600  | 0.0200    | 0.0672  |                                    |
| E16 Corner (normal)                                                       | 2.8000  | 0.0900    | 0.2520  |                                    |
| E16 Corner (normal)                                                       | 5.6000  | 0.0900    | 0.5040  |                                    |
| E17 Corner (inverted - internal area greater than external area)          | 2.8000  | -0.0900   | -0.2520 |                                    |
| E18 Party wall between dwellings                                          | 2.8000  | 0.0600    | 0.1680  |                                    |
| E20 Exposed floor (normal)                                                | 5.8700  | 0.3200    | 1.8784  |                                    |
| E21 Exposed floor (inverted)                                              | 13.9400 | 0.3200    | 4.4608  |                                    |
| E25 Staggered party wall between dwellings                                | 2.8000  | 0.0600    | 0.1680  |                                    |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | 10.0200 | 0.0000    | 0.0000  |                                    |
| P7 Party Wall - Exposed floor (normal)                                    | 10.0200 | 0.1600    | 1.6032  |                                    |
| P8 Party Wall - Exposed floor (inverted)                                  | 7.4200  | 0.2400    | 1.7808  |                                    |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                |         |           |         | 12.1245 (36)                       |
| Point Thermal Bridges                                                     |         |           |         | (36a) = 0.0000                     |
| Total fabric heat loss                                                    |         |           |         | (33) + (36) + (36a) = 36.4224 (37) |

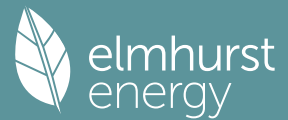
## Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

| (38)m                     | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |      |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| Heat transfer coeff       | 27.7605 | 27.6235 | 27.4892 | 26.8583 | 26.7403 | 26.1909 | 26.1909 | 26.0891 | 26.4025 | 26.7403 | 26.9791 | 27.2287 | (38) |
| Average = Sum(39)m / 12 = | 64.1828 | 64.0458 | 63.9115 | 63.2807 | 63.1627 | 62.6132 | 62.6132 | 62.5115 | 62.8249 | 63.1627 | 63.4014 | 63.6511 | (39) |
|                           |         |         |         |         |         |         |         |         |         |         |         | 63.2801 |      |
| HLP                       | 1.2237  | 1.2211  | 1.2185  | 1.2065  | 1.2042  | 1.1938  | 1.1938  | 1.1918  | 1.1978  | 1.2042  | 1.2088  | 1.2136  | (40) |
| HLP (average)             |         |         |         |         |         |         |         |         |         |         |         | 1.2065  |      |
| Days in mont              | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31      |      |

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

|                                                                                |          |          |          |          |          |          |          |          |          |                                        |          |           |               |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------------------------------|----------|-----------|---------------|
| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |                                        |          |           | 1.7623 (42)   |
| Hot water usage for mixer showers                                              | 53.7682  | 52.9602  | 51.7827  | 49.5299  | 47.8673  | 46.0133  | 44.9594  | 46.1280  | 47.4089  | 49.3996                                | 51.7009  | 53.5622   | (42a)         |
| Hot water usage for baths                                                      | 23.2453  | 22.9001  | 22.4140  | 21.5176  | 20.8464  | 20.1021  | 19.7001  | 20.1829  | 20.7085  | 21.5049                                | 22.4197  | 23.1667   | (42b)         |
| Hot water usage for other uses                                                 | 32.6782  | 31.4899  | 30.3016  | 29.1133  | 27.9250  | 26.7367  | 26.7367  | 27.9250  | 29.1133  | 30.3016                                | 31.4899  | 32.6782   | (42c)         |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |                                        |          |           | 100.8320 (43) |
| Daily hot water use                                                            | 109.6917 | 107.3502 | 104.4983 | 100.1608 | 96.6387  | 92.8521  | 91.3962  | 94.2358  | 97.2307  | 101.2061                               | 105.6105 | 109.4072  | (44)          |
| Energy conte                                                                   | 173.7249 | 152.8652 | 160.6100 | 137.1151 | 130.0943 | 114.1725 | 110.5358 | 116.6837 | 119.8952 | 137.3357                               | 150.4615 | 171.3052  | (45)          |
| Energy content (annual)                                                        |          |          |          |          |          |          |          |          |          | Total = Sum(45)m =                     |          | 1674.7990 |               |
| Distribution loss (46)m = 0.15 x (45)m                                         | 26.0587  | 22.9298  | 24.0915  | 20.5673  | 19.5141  | 17.1259  | 16.5804  | 17.5025  | 17.9843  | 20.6004                                | 22.5692  | 25.6958   | (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  | 25.1422  | 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  | 25.1422  | 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                | 222.9676 | 197.3425 | 209.8526 | 184.7693 | 179.3369 | 161.8267 | 159.7785 | 165.9263 | 167.5494 | 186.5784                               | 198.1157 | 220.5478  | (62)          |
| WWHRS                                                                          | -24.5806 | -21.7393 | -22.7641 | -18.8496 | -17.5671 | -15.0323 | -14.0904 | -14.9837 | -15.5530 | -18.3353                               | -20.7717 | -24.1254  | (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                                                                | 198.3870 | 175.6032 | 187.0885 | 165.9197 | 161.7698 | 146.7944 | 145.6881 | 150.9426 | 151.9964 | 168.2431                               | 177.3440 | 196.4224  | (64)          |
| Total per year (kWh/year)                                                      |          |          |          |          |          |          |          |          |          | Total per year (kWh/year) = Sum(64)m = |          | 2026.1991 | (64)          |
| Electric shower(s)                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000    | (64a)         |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |                                        |          | 0.0000    | (64a)         |
| Heat gains from water heating, kWh/month                                       | 97.1577  | 86.4095  | 92.7970  | 83.7141  | 82.6505  | 76.0857  | 76.1473  | 78.1915  | 77.9885  | 85.0583                                | 88.1518  | 96.3531   | (65)          |

# Full SAP Calculation Printout



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

| Metabolic gains (Table 5), Watts                                                    |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
|                                                                                     | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
| (66)m                                                                               | 88.1173  | 88.1173  | 88.1173  | 88.1173  | 88.1173  | 88.1173  | 88.1173  | 88.1173  | 88.1173  | 88.1173  | 88.1173  | 88.1173 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 87.8465  | 97.2587  | 87.8465  | 90.7748  | 87.8465  | 90.7748  | 87.8465  | 87.8465  | 90.7748  | 87.8465  | 90.7748  | 87.8465 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 153.5928 | 155.1866 | 151.1702 | 142.6199 | 131.8266 | 121.6824 | 114.9055 | 113.3117 | 117.3281 | 125.8784 | 136.6717 | 146.8159 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 31.8117  | 31.8117  | 31.8117  | 31.8117  | 31.8117  | 31.8117  | 31.8117  | 31.8117  | 31.8117  | 31.8117  | 31.8117  | 31.8117 (69)  |
| Pumps, fans                                                                         | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 3.0000   | 3.0000 (70)   |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -70.4938 | -70.4938 | -70.4938 | -70.4938 | -70.4938 | -70.4938 | -70.4938 | -70.4938 | -70.4938 | -70.4938 | -70.4938 | -70.4938 (71) |
| Water heating gains (Table 5)                                                       | 130.5883 | 128.5856 | 124.7271 | 116.2696 | 111.0894 | 105.6746 | 102.3485 | 105.0960 | 108.3174 | 114.3256 | 122.4330 | 129.5069 (72) |
| Total internal gains                                                                | 424.4628 | 433.4660 | 416.1790 | 402.0994 | 383.1977 | 367.5670 | 354.5358 | 355.6895 | 365.8554 | 380.4857 | 402.3147 | 416.6044 (73) |

## 6. Solar gains

| [Jan]       | Area<br>m <sup>2</sup> |          | Solar flux<br>Table 6a<br>W/m <sup>2</sup> |          | Specific data<br>or Table 6b |          | Specific data<br>or Table 6c |          | Access<br>factor<br>Table 6d |          | Gains<br>W   |               |
|-------------|------------------------|----------|--------------------------------------------|----------|------------------------------|----------|------------------------------|----------|------------------------------|----------|--------------|---------------|
| Northeast   | 5.7100                 |          | 11.2829                                    |          | 0.6300                       |          | 0.7000                       |          | 0.7700                       |          | 19.6893 (75) |               |
| Solar gains | 19.6893                | 40.0781  | 72.2081                                    | 118.5864 | 159.4034                     | 169.9408 | 158.9762                     | 126.7377 | 87.9866                      | 48.9787  | 24.7742      | 16.0793 (83)  |
| Total gains | 444.1521               | 473.5441 | 488.3871                                   | 520.6858 | 542.6010                     | 537.5078 | 513.5119                     | 482.4271 | 453.8420                     | 429.4644 | 427.0889     | 432.6837 (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                                                                         | 58.6470                   | 58.7725 | 58.8960 | 59.4831 | 59.5943 | 60.1172 | 60.1172 | 60.2151 | 59.9147 | 59.5943 | 59.3698 | 59.1370      |
| alpha                                                                       | 4.9098                    | 4.9182  | 4.9264  | 4.9655  | 4.9730  | 5.0078  | 5.0078  | 5.0143  | 4.9943  | 4.9730  | 4.9580  | 4.9425       |
| util living area                                                            | 0.9922                    | 0.9881  | 0.9794  | 0.9476  | 0.8638  | 0.6929  | 0.5252  | 0.5772  | 0.8135  | 0.9546  | 0.9856  | 0.9932 (86)  |
| MIT                                                                         | 19.7595                   | 19.8925 | 20.1179 | 20.4632 | 20.7659 | 20.9441 | 20.9886 | 20.9821 | 20.8731 | 20.5130 | 20.0929 | 19.7406 (87) |
| Th 2                                                                        | 19.9011                   | 19.9032 | 19.9052 | 19.9148 | 19.9166 | 19.9250 | 19.9250 | 19.9265 | 19.9218 | 19.9166 | 19.9130 | 19.9092 (88) |
| util rest of house                                                          | 0.9896                    | 0.9841  | 0.9720  | 0.9279  | 0.8135  | 0.5975  | 0.4028  | 0.4520  | 0.7325  | 0.9334  | 0.9800  | 0.9909 (89)  |
| MIT 2                                                                       | 18.4843                   | 18.6545 | 18.9409 | 19.3738 | 19.7203 | 19.8939 | 19.9216 | 19.9205 | 19.8374 | 19.4419 | 18.9171 | 18.4661 (90) |
| Living area fraction                                                        | fLA = Living area / (4) = |         |         |         |         |         |         |         |         |         |         |              |
| MIT                                                                         | 19.2161                   | 19.3650 | 19.6163 | 19.9990 | 20.3203 | 20.4966 | 20.5339 | 20.5297 | 20.4317 | 20.0566 | 19.5919 | 19.1975 (92) |
| Temperature adjustment                                                      | 0.0000                    |         |         |         |         |         |         |         |         |         |         |              |
| adjusted MIT                                                                | 19.2161                   | 19.3650 | 19.6163 | 19.9990 | 20.3203 | 20.4966 | 20.5339 | 20.5297 | 20.4317 | 20.0566 | 19.5919 | 19.1975 (93) |

## 8. Space heating requirement

|                                                                                |                            |          |          |          |          |          |          |          |          |          |          |                |
|--------------------------------------------------------------------------------|----------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
|                                                                                | Jan                        | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec            |
| Utilisation                                                                    | 0.9875                     | 0.9816   | 0.9696   | 0.9297   | 0.8340   | 0.6503   | 0.4733   | 0.5240   | 0.7739   | 0.9367   | 0.9779   | 0.9890 (94)    |
| Useful gains                                                                   | 438.6085                   | 464.8464 | 473.5453 | 484.0744 | 452.5386 | 349.5188 | 243.0385 | 252.8111 | 351.2294 | 402.2774 | 417.6416 | 427.9039 (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                                                               | 957.3565                   | 926.4213 | 838.2845 | 702.3502 | 544.4837 | 369.2044 | 246.3139 | 258.1542 | 397.7910 | 597.3028 | 792.0018 | 954.6088 (97)  |
| Space heating kWh                                                              | 385.9485                   | 310.1783 | 271.3660 | 157.1586 | 68.4071  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 145.0990 | 269.5394 | 391.8684 (98a) |
| Space heating requirement - total per year (kWh/year)                          | 1999.5654                  |          |          |          |          |          |          |          |          |          |          |                |
| 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                                                              | 385.9485                   | 310.1783 | 271.3660 | 157.1586 | 68.4071  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 145.0990 | 269.5394 | 391.8684 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) | 1999.5654                  |          |          |          |          |          |          |          |          |          |          |                |
| Space heating per m <sup>2</sup>                                               | (98c) / (4) = 38.1233 (99) |          |          |          |          |          |          |          |          |          |          |                |

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

|                                                                       |               |          |          |          |          |          |          |          |          |          |          |                |
|-----------------------------------------------------------------------|---------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Fraction of space heat from secondary/supplementary system (Table 11) |               |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)   |
| Fraction of space heat from main system(s)                            |               |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)   |
| Efficiency of main space heating system 1 (in %)                      |               |          |          |          |          |          |          |          |          |          |          | 92.3000 (206)  |
| Efficiency of main space heating system 2 (in %)                      |               |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)   |
| Efficiency of secondary/supplementary heating system, %               |               |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)   |
|                                                                       | Jan           | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec            |
| Space heating requirement                                             | 385.9485      | 310.1783 | 271.3660 | 157.1586 | 68.4071  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 145.0990 | 269.5394 | 391.8684 (98)  |
| Space heating efficiency (main heating system 1)                      | 92.3000       | 92.3000  | 92.3000  | 92.3000  | 92.3000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 92.3000  | 92.3000  | 92.3000 (210)  |
| Space heating fuel (main heating system)                              | 418.1458      | 336.0545 | 294.0043 | 170.2693 | 74.1139  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 157.2036 | 292.0253 | 424.5595 (211) |
| Space heating efficiency (main heating system 2)                      | 0.0000        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)   |
| Space heating fuel (main heating system 2)                            | 0.0000        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)   |
| Space heating fuel (secondary)                                        | 0.0000        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)   |
| Water heating                                                         |               |          |          |          |          |          |          |          |          |          |          |                |
| Water heating requirement                                             | 198.3870      | 175.6032 | 187.0885 | 165.9197 | 161.7698 | 146.7944 | 145.6881 | 150.9426 | 151.9964 | 168.2431 | 177.3440 | 196.4224 (64)  |
| Efficiency of water heater                                            | 79.8000 (216) |          |          |          |          |          |          |          |          |          |          |                |
| (217)m                                                                | 85.5252       | 85.3215  | 84.8928  | 83.9383  | 82.2783  | 79.8000  | 79.8000  | 79.8000  | 79.8000  | 83.7297  | 84.9958  | 85.5775 (217)  |

# Full SAP Calculation Printout



|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |           |        |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|--------|
| Fuel for water heating, kWh/month                                                                    | 231.9632 | 205.8135 | 220.3820 | 197.6687 | 196.6130 | 183.9528 | 182.5665 | 189.1511 | 190.4716 | 200.9361 | 208.6502 | 229.5259  | (219)  |
| Space cooling fuel requirement                                                                       |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (221)  |
| Pumps and Fa                                                                                         | 7.3041   | 6.5973   | 7.3041   | 7.0685   | 7.3041   | 7.0685   | 7.3041   | 7.3041   | 7.0685   | 7.3041   | 7.0685   | 7.3041    | (231)  |
| Lighting                                                                                             | 18.2528  | 14.6431  | 13.1844  | 9.6595   | 7.4613   | 6.0959   | 6.8064   | 8.8472   | 11.4917  | 15.0777  | 17.0303  | 18.7601   | (232)  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (233a)m                                                                                              | -11.7415 | -17.6704 | -27.0929 | -32.5644 | -36.9974 | -35.2437 | -34.8371 | -31.9607 | -27.2087 | -21.1296 | -13.3062 | -10.0267  | (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (234a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (234a) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (235a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235a) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (235c)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235c) |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (233b)m                                                                                              | -3.6179  | -7.8313  | -15.9831 | -24.6274 | -33.1738 | -33.5427 | -33.1264 | -27.7461 | -19.9605 | -11.3755 | -4.8872  | -2.8433   | (233b) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (234b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (234b) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (235b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235b) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (235d)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235d) |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |           |        |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 2166.3764 | (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                                                                              |          |          |          |          |          |          |          |          |          |          |          | 2437.6946 | (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)                                                  |          |          |          |          |          |          |          |          |          |          |          | 147.3104  | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |          |          |          |          |          |          |          |          |           |        |
| PV generation                                                                                        |          |          |          |          |          |          |          |          |          |          |          | -518.4945 | (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                                                                  |          |          |          |          |          |          |          |          |          |          |          | 4318.8867 | (238)  |

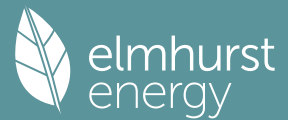
## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                               | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |       |
|-----------------------------------------------|--------------------|-------------------------------|--------------------------|-------|
| Space heating - main system 1                 | 2166.3764          | 0.2100                        | 454.9390                 | (261) |
| Total CO2 associated with community systems   |                    |                               | 0.0000                   | (373) |
| Water heating (other fuel)                    | 2437.6946          | 0.2100                        | 511.9159                 | (264) |
| Space and water heating                       |                    |                               | 966.8549                 | (265) |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293                  | (267) |
| Energy for lighting                           | 147.3104           | 0.1443                        | 21.2614                  | (268) |
| Energy saving/generation technologies         |                    |                               |                          |       |
| PV Unit electricity used in dwelling          | -299.7793          | 0.1332                        | -39.9391                 |       |
| PV Unit electricity exported                  | -218.7152          | 0.1252                        | -27.3766                 |       |
| Total                                         |                    |                               | -67.3157                 | (269) |
| Total CO2, kg/year                            |                    |                               | 932.7298                 | (272) |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 17.7800                  | (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               | 2166.3764          | 1.1300                              | 2448.0053                  | (275) |
| Total CO2 associated with community systems |                    |                                     | 0.0000                     | (473) |
| Water heating (other fuel)                  | 2437.6946          | 1.1300                              | 2754.5949                  | (278) |
| Space and water heating                     |                    |                                     | 5202.6001                  | (279) |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008                   | (281) |
| Energy for lighting                         | 147.3104           | 1.5338                              | 225.9495                   | (282) |
| Energy saving/generation technologies       |                    |                                     |                            |       |
| PV Unit electricity used in dwelling        | -299.7793          | 1.4923                              | -447.3643                  |       |
| PV Unit electricity exported                | -218.7152          | 0.4594                              | -100.4835                  |       |
| Total                                       |                    |                                     | -547.8478                  | (283) |
| Total Primary energy kWh/year               |                    |                                     | 5010.8027                  | (286) |
| Target Primary Energy Rate (TPER)           |                    |                                     | 95.5300                    | (287) |

# Full SAP Calculation Printout



|                                    |                   |               |       |               |                |            |  |
|------------------------------------|-------------------|---------------|-------|---------------|----------------|------------|--|
| Plot Reference                     | A 108             |               |       |               | Issued on Date | 19/03/2026 |  |
| Assessment Reference               | Be Green          |               |       | Plot Type Ref |                |            |  |
| Plot Address                       |                   |               |       |               | SAP Version    | 10.2       |  |
|                                    |                   |               |       |               |                |            |  |
| SAP Rating                         | 82 B              | DER           | 5.81  | TER           | 17.78          |            |  |
| Environmental                      | 96 A              | % DER < TER   |       |               |                | 67.32      |  |
| CO <sub>2</sub> Emissions (t/year) | 0.27              | DFEE          | 38.15 | TFEE          | 46.73          |            |  |
| Compliance Check                   | See BREL          | % DFEE < TFEE |       |               |                | 18.36      |  |
| % DPER < TPER                      | 35.53             | DPER          | 61.59 | TPER          | 95.53          |            |  |
|                                    |                   |               |       |               |                |            |  |
| Assessor Details                   | Mr. Robert Tanner |               |       |               | Assessor ID    | W344-0001  |  |
| Client                             |                   |               |       |               |                |            |  |

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

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                 |                             |
| Ground floor                                           | 52.4500 (1b)              | 2.8000 (2b)                     | 146.8600 (1b) - (3b)        |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 52.4500                   |                                 | 146.8600 (4)                |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | 146.8600 (5)                |

## 2. Ventilation rate

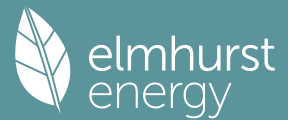
|                                                                                                  | m <sup>3</sup> per hour                 |
|--------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open 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                                                              | 2 * 10 = 20.0000 (7a)                   |
| Number of passive vents                                                                          | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                     | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) | 20.0000 / (5) = 0.1362 (8)              |
| Pressure test                                                                                    | Yes                                     |
| Pressure Test Method                                                                             | Blower Door                             |
| Measured/design AP50                                                                             | 3.0000 (17)                             |
| Infiltration rate                                                                                | 0.2862 (18)                             |
| Number of sides sheltered                                                                        | 3 (19)                                  |
| Shelter factor                                                                                   | (20) = 1 - [0.075 x (19)] = 0.7750 (20) |
| Infiltration rate adjusted to include shelter factor                                             | (21) = (18) x (20) = 0.2218 (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                                                                                         | 0.2828 | 0.2772 | 0.2717 | 0.2440 | 0.2384 | 0.2107 | 0.2107 | 0.2052 | 0.2218 | 0.2384 | 0.2495 | 0.2606 (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                                                                                            | 0.5400 | 0.5384 | 0.5369 | 0.5298 | 0.5284 | 0.5222 | 0.5222 | 0.5210 | 0.5246 | 0.5284 | 0.5311 | 0.5340 (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                                                         |                         |                            | 5.7100                    | 1.1450                        | 6.5382       |                                      | (27)            |
| Heatloss Floor 1                                               |                         |                            | 52.4500                   | 0.1000                        | 5.2450       | 110.0000                             | 5769.5000 (28b) |
| External Wall 1                                                | 16.4400                 | 5.7100                     | 10.7300                   | 0.1500                        | 1.6095       | 70.0000                              | 751.1000 (29a)  |
| Corridor wall                                                  | 39.0300                 | 2.4200                     | 36.6100                   | 0.1900                        | 6.9559       | 70.0000                              | 2562.6999 (29a) |
| Total net area of external elements Aum(A, m <sup>2</sup> )    |                         |                            | 107.9200                  |                               |              |                                      | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                            |                         |                            |                           | (26)...(30) + (32) =          | 22.7686      |                                      | (33)            |
| Main dwelling                                                  |                         |                            |                           |                               |              |                                      |                 |
| Party Wall 1                                                   |                         |                            | 28.0600                   | 0.0000                        | 0.0000       | 70.0000                              | 1964.2000 (32)  |
| Party Ceiling 1                                                |                         |                            | 52.4500                   |                               |              | 30.0000                              | 1573.5000 (32b) |
| Internal Wall 1                                                |                         |                            | 103.3200                  |                               |              | 9.0000                               | 929.8800 (32c)  |
| Heat capacity Cm = Sum(A x k)                                  |                         |                            |                           |                               |              | (28)...(30) + (32) + (32a)...(32e) = | 13550.8799 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K |                         |                            |                           |                               |              |                                      | 258.3580 (35)   |
| List of Thermal Bridges                                        |                         |                            |                           |                               |              |                                      |                 |
| K1 Element                                                     |                         |                            |                           |                               | Length       | Psi-value                            | Total           |
| E1 Steel lintel with perforated steel base plate               |                         |                            |                           |                               | 3.7300       | 0.0500                               | 0.1865          |
| E3 Sill                                                        |                         |                            |                           |                               | 0.9100       | 0.0400                               | 0.0364          |

# Full SAP Calculation Printout



|                                                                           |         |                       |              |
|---------------------------------------------------------------------------|---------|-----------------------|--------------|
| E4 Jamb                                                                   | 12.6000 | 0.0400                | 0.5040       |
| E7 Party floor between dwellings (in blocks of flats)                     | 2.5100  | 0.0500                | 0.1255       |
| E7 Party floor between dwellings (in blocks of flats)                     | 6.5200  | 0.0390                | 0.2543       |
| E9 Balcony between dwellings, wall insulation continuous                  | 3.3600  | 0.0500                | 0.1680       |
| E16 Corner (normal)                                                       | 2.8000  | 0.0500                | 0.1400       |
| E16 Corner (normal)                                                       | 5.6000  | 0.0390                | 0.2184       |
| E17 Corner (inverted - internal area greater than external area)          | 2.8000  | 0.0000                | 0.0000       |
| E18 Party wall between dwellings                                          | 2.8000  | 0.0500                | 0.1400       |
| E20 Exposed floor (normal)                                                | 5.8700  | 0.1000                | 0.5870       |
| E21 Exposed floor (inverted)                                              | 13.9400 | 0.1000                | 1.3940       |
| E25 Staggered party wall between dwellings                                | 2.8000  | 0.0390                | 0.1092       |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | 10.0200 | 0.0000                | 0.0000       |
| P7 Party Wall - Exposed floor (normal)                                    | 10.0200 | 0.0800                | 0.8016       |
| P8 Party Wall - Exposed floor (inverted)                                  | 7.4200  | 0.1600                | 1.1872       |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                |         |                       | 5.8521 (36)  |
| Point Thermal bridges                                                     |         | (36a) =               | 0.0000       |
| Total fabric heat loss                                                    |         | (33) + (36) + (36a) = | 28.6206 (37) |

|                                                                     |         |         |         |         |         |         |         |         |         |         |         |              |
|---------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) |         |         |         |         |         |         |         |         |         |         |         |              |
| (38)m                                                               | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| Heat transfer coeff                                                 | 26.1697 | 26.0944 | 26.0207 | 25.6742 | 25.6094 | 25.3077 | 25.3077 | 25.2518 | 25.4239 | 25.6094 | 25.7405 | 25.8776 (38) |
| Average = Sum(39)m / 12 =                                           | 54.7903 | 54.7151 | 54.6413 | 54.2949 | 54.2301 | 53.9283 | 53.9283 | 53.8725 | 54.0446 | 54.2301 | 54.3612 | 54.4983 (39) |
|                                                                     | 54.2946 |         |         |         |         |         |         |         |         |         |         | 54.2946      |
| HLP                                                                 | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| HLP (average)                                                       | 1.0446  | 1.0432  | 1.0418  | 1.0352  | 1.0339  | 1.0282  | 1.0282  | 1.0271  | 1.0304  | 1.0339  | 1.0364  | 1.0391 (40)  |
| Days in mont                                                        | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31           |

|                                                                                |         |         |         |         |         |         |         |         |         |         |         |                |
|--------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------------|
| 4. Water heating energy requirements (kWh/year)                                |         |         |         |         |         |         |         |         |         |         |         |                |
| Assumed occupancy                                                              |         |         |         |         |         |         |         |         |         |         |         | 1.7623 (42)    |
| Hot water usage for mixer showers                                              | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (42a)   |
| Hot water usage for baths                                                      | 22.7271 | 22.3841 | 21.8960 | 21.1651 | 20.5064 | 19.5996 | 18.9116 | 19.7529 | 20.1944 | 21.0929 | 22.0270 | 22.7091 (42b)  |
| Hot water usage for other uses                                                 | 32.6782 | 31.4899 | 30.3016 | 29.1133 | 27.9250 | 26.7367 | 26.7367 | 27.9250 | 29.1133 | 30.3016 | 31.4899 | 32.6782 (42c)  |
| Average daily hot water use (litres/day)                                       |         |         |         |         |         |         |         |         |         |         |         | 50.7809 (43)   |
| Daily hot water use                                                            | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec            |
| Energy conte                                                                   | 55.4053 | 53.8739 | 52.1976 | 50.2784 | 48.4313 | 46.3363 | 45.6483 | 47.6778 | 49.3076 | 51.3944 | 53.5169 | 55.3873 (44)   |
| Energy content (annual)                                                        | 81.5662 | 71.2861 | 74.5893 | 65.6761 | 62.4087 | 53.5863 | 50.4427 | 56.1177 | 57.1944 | 66.2269 | 72.3299 | 81.3403 (45)   |
| Distribution loss (46)m = 0.15 x (45)m                                         | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (46)    |
| Water storage loss (or HIU loss):                                              |         |         |         |         |         |         |         |         |         |         |         |                |
| Total storage loss                                                             | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (56)    |
| If cylinder contains dedicated solar storage                                   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (57)    |
| Primary loss                                                                   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (59)    |
| Combi loss                                                                     | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (61)    |
| Total heat required for water heating calculated for each month                | 69.3313 | 60.5932 | 63.4009 | 55.8247 | 53.0474 | 45.5484 | 42.8763 | 47.7000 | 48.6152 | 56.2929 | 61.4804 | 69.1392 (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                                                                | 69.3313 | 60.5932 | 63.4009 | 55.8247 | 53.0474 | 45.5484 | 42.8763 | 47.7000 | 48.6152 | 56.2929 | 61.4804 | 69.1392 (64)   |
| 12Total per year (kWh/year)                                                    |         |         |         |         |         |         |         |         |         |         |         | 673.8499 (64)  |
| Electric shower(s)                                                             | 43.0594 | 38.3663 | 41.8945 | 39.9794 | 40.7296 | 38.8521 | 40.1472 | 40.7296 | 39.9794 | 41.8945 | 41.1067 | 43.0594 (64a)  |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |         |         |         |         |         |         |         |         |         |         |         | 489.7981 (64a) |
| Heat gains from water heating, kWh/month                                       | 28.0977 | 24.7399 | 26.3238 | 23.9510 | 23.4442 | 21.1001 | 20.7559 | 22.1074 | 22.1487 | 24.5468 | 25.6468 | 28.0497 (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                                                                               | 88.1173  | 88.1173  | 88.1173  | 88.1173  | 88.1173  | 88.1173  | 88.1173  | 88.1173  | 88.1173  | 88.1173  | 88.1173  | 88.1173 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 87.8465  | 97.2587  | 87.8465  | 90.7748  | 87.8465  | 90.7748  | 87.8465  | 87.8465  | 90.7748  | 87.8465  | 90.7748  | 87.8465 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 153.5928 | 155.1866 | 151.1702 | 142.6199 | 131.8266 | 121.6824 | 114.9055 | 113.3117 | 117.3281 | 125.8784 | 136.6717 | 146.8159 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 31.8117  | 31.8117  | 31.8117  | 31.8117  | 31.8117  | 31.8117  | 31.8117  | 31.8117  | 31.8117  | 31.8117  | 31.8117  | 31.8117 (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)                                 | -70.4938 | -70.4938 | -70.4938 | -70.4938 | -70.4938 | -70.4938 | -70.4938 | -70.4938 | -70.4938 | -70.4938 | -70.4938 | -70.4938 (71) |
| Water heating gains (Table 5)                                                       | 37.7657  | 36.8153  | 35.3815  | 33.2653  | 31.5111  | 29.3057  | 27.8977  | 29.7143  | 30.7620  | 32.9931  | 35.6205  | 37.7012 (72)  |
| Total internal gains                                                                | 328.6402 | 338.6957 | 323.8335 | 316.0951 | 300.6194 | 291.1981 | 280.0849 | 280.3077 | 288.3000 | 296.1532 | 312.5022 | 321.7987 (73) |

|                |          |            |          |               |          |              |          |          |          |          |          |               |
|----------------|----------|------------|----------|---------------|----------|--------------|----------|----------|----------|----------|----------|---------------|
| 6. Solar gains |          |            |          |               |          |              |          |          |          |          |          |               |
| [Jan]          | Area     | Solar flux | g        | FF            | Access   | Gains        |          |          |          |          |          |               |
|                | m2       | Table 6a   | W/m2     | Specific data | factor   | W            |          |          |          |          |          |               |
|                |          |            |          | or Table 6b   | Table 6c |              |          |          |          |          |          |               |
| Northeast      | 5.7100   | 11.2829    | 0.3500   | 0.7000        | 0.7700   | 10.9385 (75) |          |          |          |          |          |               |
| Solar gains    | 10.9385  | 22.2656    | 40.1156  | 65.8813       | 88.5574  | 94.4116      | 88.3201  | 70.4098  | 48.8815  | 27.2104  | 13.7635  | 8.9329 (83)   |
| Total gains    | 339.5787 | 360.9613   | 363.9490 | 381.9764      | 389.1768 | 385.6097     | 368.4050 | 350.7175 | 337.1815 | 323.3636 | 326.2656 | 330.7317 (84) |

# Full SAP Calculation Printout



## 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                                                                         | 68.7007                   | 68.7952 | 68.8880 | 69.3276 | 69.4104 | 69.7988 | 69.7988 | 69.8712 | 69.6487 | 69.4104 | 69.2430 | 69.0689      |
| alpha                                                                       | 5.5800                    | 5.5863  | 5.5925  | 5.6218  | 5.6274  | 5.6533  | 5.6533  | 5.6581  | 5.6432  | 5.6274  | 5.6162  | 5.6046       |
| util living area                                                            | 0.9975                    | 0.9959  | 0.9930  | 0.9796  | 0.9353  | 0.7989  | 0.6239  | 0.6743  | 0.8887  | 0.9809  | 0.9949  | 0.9979 (86)  |
| MIT                                                                         | 19.8307                   | 19.9417 | 20.1252 | 20.4252 | 20.7147 | 20.9245 | 20.9849 | 20.9770 | 20.8510 | 20.4982 | 20.1241 | 19.8107 (87) |
| Th 2                                                                        | 20.0463                   | 20.0475 | 20.0487 | 20.0541 | 20.0551 | 20.0599 | 20.0599 | 20.0608 | 20.0581 | 20.0551 | 20.0531 | 20.0509 (88) |
| util rest of house                                                          | 0.9967                    | 0.9945  | 0.9903  | 0.9710  | 0.9056  | 0.7165  | 0.5011  | 0.5526  | 0.8292  | 0.9710  | 0.9928  | 0.9972 (89)  |
| MIT 2                                                                       | 18.9824                   | 19.0940 | 19.2774 | 19.5770 | 19.8505 | 20.0229 | 20.0559 | 20.0539 | 19.9718 | 19.6511 | 19.2804 | 18.9662 (90) |
| Living area fraction                                                        | fLA = Living area / (4) = |         |         |         |         |         |         |         |         |         |         | 0.5739 (91)  |
| MIT                                                                         | 19.4692                   | 19.5805 | 19.7639 | 20.0638 | 20.3464 | 20.5403 | 20.5890 | 20.5836 | 20.4764 | 20.1372 | 19.7646 | 19.4508 (92) |
| Temperature adjustment                                                      |                           |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 19.4692                   | 19.5805 | 19.7639 | 20.0638 | 20.3464 | 20.5403 | 20.5890 | 20.5836 | 20.4764 | 20.1372 | 19.7646 | 19.4508 (93) |

## 8. Space heating requirement

|                                                                                |          |          |          |          |          |          |          |          |          |          |          |                            |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------------------|
|                                                                                | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec                        |
| Utilisation                                                                    | 0.9960   | 0.9937   | 0.9893   | 0.9711   | 0.9160   | 0.7612   | 0.5720   | 0.6228   | 0.8586   | 0.9721   | 0.9920   | 0.9966 (94)                |
| Useful gains                                                                   | 338.2143 | 358.6708 | 360.0608 | 370.9213 | 356.4829 | 293.5345 | 210.7226 | 218.4167 | 289.4927 | 314.3392 | 323.6573 | 329.5910 (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                                                               | 831.1273 | 803.2432 | 724.7595 | 606.1359 | 468.8963 | 320.3522 | 215.1211 | 225.3823 | 344.6079 | 517.2048 | 688.4628 | 831.1427 (97)              |
| Space heating kWh                                                              | 366.7272 | 298.7526 | 271.3359 | 169.3545 | 83.6355  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 150.9320 | 262.6600 | 373.1545 (98a)             |
| Space heating requirement - total per year (kWh/year)                          |          |          |          |          |          |          |          |          |          |          |          | 1976.5523                  |
| 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                                                              | 366.7272 | 298.7526 | 271.3359 | 169.3545 | 83.6355  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 150.9320 | 262.6600 | 373.1545 (98c)             |
| Space heating requirement after solar contribution - total per year (kWh/year) |          |          |          |          |          |          |          |          |          |          |          | 1976.5523                  |
| Space heating per m2                                                           |          |          |          |          |          |          |          |          |          |          |          | (98c) / (4) = 37.6845 (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  | 506.9264 | 399.0697 | 409.4307 | 0.0000  | 0.0000  | 0.0000 | 0.0000 (100)  |
| Utilisation                                         | 0.0000                   | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.7492   | 0.8437   | 0.8095   | 0.0000  | 0.0000  | 0.0000 | 0.0000 (101)  |
| Useful loss                                         | 0.0000                   | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 379.7730 | 336.6879 | 331.4218 | 0.0000  | 0.0000  | 0.0000 | 0.0000 (102)  |
| Total gains                                         | 0.0000                   | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 411.5421 | 393.5183 | 374.5122 | 0.0000  | 0.0000  | 0.0000 | 0.0000 (103)  |
| Space cooling kWh                                   |                          |        |        |        |         |          |          |          |         |         |        |               |
|                                                     | 0.0000                   | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 22.8737  | 42.2818  | 32.0592  | 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  | 5.7184   | 10.5704  | 8.0148   | 0.0000  | 0.0000  | 0.0000 | 0.0000 (107)  |
| Space cooling requirement                           |                          |        |        |        |         |          |          |          |         |         |        | 24.3037 (107) |
| Energy for space heating                            |                          |        |        |        |         |          |          |          |         |         |        | 37.6845 (99)  |
| Energy for space cooling                            |                          |        |        |        |         |          |          |          |         |         |        | 0.4634 (108)  |
| Total                                               |                          |        |        |        |         |          |          |          |         |         |        | 38.1479 (109) |
| Fabric Energy Efficiency (DFEE)                     |                          |        |        |        |         |          |          |          |         |         |        | 38.1 (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                                           | 52.4500 (1b) | x 2.8000 (2b)                   | = 146.8600 (1b) - (3b) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 52.4500      |                                 | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 146.8600 (5)         |

## 2. Ventilation rate

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

# Full SAP Calculation Printout



Number of flueless gas fires

0 \* 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =

Air changes per hour  
20.0000 / (5) = 0.1362 (8)

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

Yes  
Blower Door  
5.0000 (17)  
0.3862 (18)  
3 (19)

Shelter factor

(20) = 1 - [0.075 x (19)] = 0.7750 (20)

Infiltration rate adjusted to include shelter factor

(21) = (18) x (20) = 0.2993 (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                                                                                         | 0.3816 | 0.3741 | 0.3666 | 0.3292 | 0.3217 | 0.2843 | 0.2843 | 0.2768 | 0.2993 | 0.3217 | 0.3367 | 0.3517 (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                                                                                            | 0.5728 | 0.5700 | 0.5672 | 0.5542 | 0.5518 | 0.5404 | 0.5404 | 0.5383 | 0.5448 | 0.5518 | 0.5567 | 0.5618 (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                               |             |                | 5.7100        | 1.1450           | 6.5382       |                   | (27)          |
| Heatloss Floor 1                               |             |                | 52.4500       | 0.1300           | 6.8185       |                   | (28b)         |
| External Wall 1                                | 16.4400     | 5.7100         | 10.7300       | 0.1800           | 1.9314       |                   | (29a)         |
| Corridor wall                                  | 39.0300     | 2.4200         | 36.6100       | 0.1800           | 6.5898       |                   | (29a)         |
| Total net area of external elements Aum(A, m2) |             |                | 107.9200      |                  |              |                   | (31)          |
| Fabric heat loss, W/K = Sum (A x U)            |             |                |               |                  | 24.2979      |                   | (33)          |
| Main dwelling                                  |             |                |               |                  |              |                   |               |
| Party Wall 1                                   |             |                | 28.0600       | 0.0000           | 0.0000       |                   | (32)          |

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

258.3580 (35)

List of Thermal Bridges

| K1 Element                                                                | Length  | Psi-value | Total   |
|---------------------------------------------------------------------------|---------|-----------|---------|
| E1 Steel lintel with perforated steel base plate                          | 3.7300  | 0.0500    | 0.1865  |
| E3 Sill                                                                   | 0.9100  | 0.0500    | 0.0455  |
| E4 Jamb                                                                   | 12.6000 | 0.0500    | 0.6300  |
| E7 Party floor between dwellings (in blocks of flats)                     | 2.5100  | 0.0700    | 0.1757  |
| E7 Party floor between dwellings (in blocks of flats)                     | 6.5200  | 0.0700    | 0.4564  |
| E9 Balcony between dwellings, wall insulation continuous                  | 3.3600  | 0.0200    | 0.0672  |
| E16 Corner (normal)                                                       | 2.8000  | 0.0900    | 0.2520  |
| E16 Corner (normal)                                                       | 5.6000  | 0.0900    | 0.5040  |
| E17 Corner (inverted - internal area greater than external area)          | 2.8000  | -0.0900   | -0.2520 |
| E18 Party wall between dwellings                                          | 2.8000  | 0.0600    | 0.1680  |
| E20 Exposed floor (normal)                                                | 5.8700  | 0.3200    | 1.8784  |
| E21 Exposed floor (inverted)                                              | 13.9400 | 0.3200    | 4.4608  |
| E25 Staggered party wall between dwellings                                | 2.8000  | 0.0600    | 0.1680  |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | 10.0200 | 0.0000    | 0.0000  |
| P7 Party Wall - Exposed floor (normal)                                    | 10.0200 | 0.1600    | 1.6032  |
| P8 Party Wall - Exposed floor (inverted)                                  | 7.4200  | 0.2400    | 1.7808  |

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

12.1245 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 36.4224 (37)

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

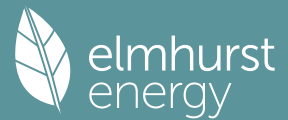
|                           | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| (38)m                     | 27.7605 | 27.6235 | 27.4892 | 26.8583 | 26.7403 | 26.1909 | 26.1909 | 26.0891 | 26.4025 | 26.7403 | 26.9791 | 27.2287 (38) |
| Heat transfer coeff       | 64.1828 | 64.0458 | 63.9115 | 63.2807 | 63.1627 | 62.6132 | 62.6132 | 62.5115 | 62.8249 | 63.1627 | 63.4014 | 63.6511 (39) |
| Average = Sum(39)m / 12 = |         |         |         |         |         |         |         |         |         |         |         | 63.2801      |

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec         |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
| HLP           | 1.2237 | 1.2211 | 1.2185 | 1.2065 | 1.2042 | 1.1938 | 1.1938 | 1.1918 | 1.1978 | 1.2042 | 1.2088 | 1.2136 (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 1.2065      |
| Days in month | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31          |

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

|                                                                 |         |         |         |         |         |         |         |         |         |                    |         |               |
|-----------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------------|---------|---------------|
| Assumed occupancy                                               |         |         |         |         |         |         |         |         |         |                    |         | 1.7623 (42)   |
| Hot water usage for mixer showers                               | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000             | 0.0000  | 0.0000 (42a)  |
| Hot water usage for baths                                       | 23.2453 | 22.9001 | 22.4140 | 21.5176 | 20.8464 | 20.1021 | 19.7001 | 20.1829 | 20.7085 | 21.5049            | 22.4197 | 23.1667 (42b) |
| Hot water usage for other uses                                  | 32.6782 | 31.4899 | 30.3016 | 29.1133 | 27.9250 | 26.7367 | 26.7367 | 27.9250 | 29.1133 | 30.3016            | 31.4899 | 32.6782 (42c) |
| Average daily hot water use (litres/day)                        |         |         |         |         |         |         |         |         |         |                    |         | 51.2595 (43)  |
| Daily hot water use                                             | 55.9235 | 54.3900 | 52.7155 | 50.6309 | 48.7714 | 46.8388 | 46.4368 | 48.1079 | 49.8218 | 51.8065            | 53.9096 | 55.8449 (44)  |
| Energy conte                                                    | 88.5692 | 77.4506 | 81.0218 | 69.3111 | 65.6556 | 57.5938 | 56.1613 | 59.5676 | 61.4353 | 70.3009            | 76.8041 | 87.4397 (45)  |
| Energy content (annual)                                         |         |         |         |         |         |         |         |         |         | Total = Sum(45)m = |         | 851.3110      |
| Distribution loss (46)m = 0.15 x (45)m                          | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000             | 0.0000  | 0.0000 (46)   |
| Water storage loss (or HIU loss):                               |         |         |         |         |         |         |         |         |         |                    |         |               |
| Total storage loss                                              | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000             | 0.0000  | 0.0000 (56)   |
| If cylinder contains dedicated solar storage                    |         |         |         |         |         |         |         |         |         |                    |         |               |
| Primary loss                                                    | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000             | 0.0000  | 0.0000 (57)   |
| Combi loss                                                      | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000             | 0.0000  | 0.0000 (59)   |
| Total heat required for water heating calculated for each month | 75.2838 | 65.8330 | 68.8685 | 58.9145 | 55.8073 | 48.9547 | 47.7371 | 50.6325 | 52.2200 | 59.7557            | 65.2835 | 74.3237 (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                                                 |         |         |         |         |         |         |         |         |         |                    |         |               |

# Full SAP Calculation Printout



|                                                                                |         |         |         |         |         |         |         |         |         |         |                |
|--------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------------|
| 75.2838                                                                        | 65.8330 | 68.8685 | 58.9145 | 55.8073 | 48.9547 | 47.7371 | 50.6325 | 52.2200 | 59.7557 | 65.2835 | 74.3237 (64)   |
| Total per year (kWh/year)                                                      |         |         |         |         |         |         |         |         |         |         | 723.6143 (64)  |
| Electric shower(s)                                                             |         |         |         |         |         |         |         |         |         |         | 724 (64)       |
| 43.0594                                                                        | 38.3663 | 41.8945 | 39.9794 | 40.7296 | 38.8521 | 40.1472 | 40.7296 | 39.9794 | 41.8945 | 41.1067 | 43.0594 (64a)  |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |         |         |         |         |         |         |         |         |         |         | 489.7981 (64a) |
| Heat gains from water heating, kWh/month                                       |         |         |         |         |         |         |         |         |         |         |                |
| 29.5858                                                                        | 26.0498 | 27.6908 | 24.7235 | 24.1342 | 21.9517 | 21.9711 | 22.8405 | 23.0498 | 25.4126 | 26.5976 | 29.3458 (65)   |

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

|                                                                                     |          |          |          |          |          |          |          |          |          |          |               |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Metabolic gains (Table 5), Watts                                                    |          |          |          |          |          |          |          |          |          |          |               |
| (66)m                                                                               | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov           |
|                                                                                     | 88.1173  | 88.1173  | 88.1173  | 88.1173  | 88.1173  | 88.1173  | 88.1173  | 88.1173  | 88.1173  | 88.1173  | 88.1173 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                     | 87.8465  | 97.2587  | 87.8465  | 90.7748  | 87.8465  | 90.7748  | 87.8465  | 87.8465  | 90.7748  | 87.8465  | 90.7748 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                     | 153.5928 | 155.1866 | 151.1702 | 142.6199 | 131.8266 | 121.6824 | 114.9055 | 113.3117 | 117.3281 | 125.8784 | 136.6717 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                     | 31.8117  | 31.8117  | 31.8117  | 31.8117  | 31.8117  | 31.8117  | 31.8117  | 31.8117  | 31.8117  | 31.8117  | 31.8117 (69)  |
| Pumps, fans                                                                         |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (70)   |
| Losses e.g. evaporation (negative values) (Table 5)                                 |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                     | -70.4938 | -70.4938 | -70.4938 | -70.4938 | -70.4938 | -70.4938 | -70.4938 | -70.4938 | -70.4938 | -70.4938 | -70.4938 (71) |
| Water heating gains (Table 5)                                                       |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                     | 39.7659  | 38.7646  | 37.2188  | 34.3381  | 32.4385  | 30.4885  | 29.5310  | 30.6996  | 32.0137  | 34.1567  | 36.9410 (72)  |
| Total internal gains                                                                |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                     | 330.6403 | 340.6450 | 325.6707 | 317.1680 | 301.5468 | 292.3809 | 281.7183 | 281.2931 | 289.5517 | 297.3168 | 313.8227 (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   | 5.7100   |          | 11.2829    |          | 0.6300        |          | 0.7000        |          | 0.7700   |          | 19.6893 (75)  |
| Solar gains | 19.6893  | 40.0781  | 72.2081    | 118.5864 | 159.4034      | 169.9408 | 158.9762      | 126.7377 | 87.9866  | 48.9787  | 24.7742 (83)  |
| Total gains | 350.3296 | 380.7232 | 397.8788   | 435.7543 | 460.9502      | 462.3217 | 440.6944      | 408.0307 | 377.5383 | 346.2955 | 338.5969 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |                           |         |         |         |         |         |         |         |         |         |         |
|-----------------------------------------------------------------------------|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |                           |         |         |         |         |         |         |         |         |         |         |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |                           |         |         |         |         |         |         |         |         |         |         |
|                                                                             | Jan                       | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     |
| tau                                                                         | 58.6470                   | 58.7725 | 58.8960 | 59.4831 | 59.5943 | 60.1172 | 60.1172 | 60.2151 | 59.9147 | 59.5943 | 59.3698 |
| alpha                                                                       | 4.9098                    | 4.9182  | 4.9264  | 4.9655  | 4.9730  | 5.0078  | 5.0078  | 5.0143  | 4.9943  | 4.9730  | 4.9580  |
| util living area                                                            | 0.9972                    | 0.9953  | 0.9911  | 0.9728  | 0.9157  | 0.7689  | 0.6014  | 0.6637  | 0.8851  | 0.9800  | 0.9946  |
| MIT                                                                         | 19.5800                   | 19.7175 | 19.9527 | 20.3262 | 20.6740 | 20.9106 | 20.9794 | 20.9669 | 20.8039 | 20.3738 | 19.9270 |
| Th 2                                                                        | 19.9011                   | 19.9032 | 19.9052 | 19.9148 | 19.9166 | 19.9250 | 19.9250 | 19.9265 | 19.9218 | 19.9166 | 19.9130 |
| util rest of house                                                          | 0.9962                    | 0.9936  | 0.9876  | 0.9613  | 0.8778  | 0.6757  | 0.4665  | 0.5287  | 0.8197  | 0.9692  | 0.9923  |
| MIT 2                                                                       | 18.6190                   | 18.7576 | 18.9928 | 19.3665 | 19.6911 | 19.8834 | 19.9199 | 19.9172 | 19.8106 | 19.4180 | 18.9743 |
| Living area fraction                                                        | FLA = Living area / (4) = |         |         |         |         |         |         |         |         |         |         |
| MIT                                                                         | 19.1705                   | 19.3085 | 19.5437 | 19.9172 | 20.2551 | 20.4729 | 20.5279 | 20.5196 | 20.3806 | 19.9665 | 19.5210 |
| Temperature adjustment                                                      | 0.0000                    |         |         |         |         |         |         |         |         |         |         |
| adjusted MIT                                                                | 19.1705                   | 19.3085 | 19.5437 | 19.9172 | 20.2551 | 20.4729 | 20.5279 | 20.5196 | 20.3806 | 19.9665 | 19.5210 |

## 8. Space heating requirement

|                                                                                |          |          |          |          |          |          |          |          |          |          |          |                            |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------------------|
| Utilisation                                                                    | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec                        |
|                                                                                | 0.9954   | 0.9924   | 0.9862   | 0.9613   | 0.8913   | 0.7262   | 0.5444   | 0.6064   | 0.8510   | 0.9699   | 0.9913   | 0.9960                     |
| Useful gains                                                                   | 348.7081 | 377.8336 | 392.3709 | 418.8923 | 410.8222 | 335.7248 | 239.8995 | 247.4401 | 321.2897 | 335.8586 | 335.6391 | 338.2771                   |
| 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                                                               | 954.4293 | 922.8021 | 833.6397 | 697.1789 | 540.3656 | 367.7198 | 245.9375 | 257.5233 | 394.5793 | 591.6130 | 787.5100 | 951.8907                   |
| Space heating kWh                                                              | 450.6566 | 366.2189 | 328.3040 | 200.3664 | 96.3803  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 190.2812 | 325.3471 | 456.5286                   |
| Space heating requirement - total per year (kWh/year)                          |          |          |          |          |          |          |          |          |          |          |          | 2414.0830                  |
| Solar heating kWh                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                     |
| Solar heating contribution - total per year (kWh/year)                         |          |          |          |          |          |          |          |          |          |          |          | 0.0000                     |
| Space heating kWh                                                              | 450.6566 | 366.2189 | 328.3040 | 200.3664 | 96.3803  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 190.2812 | 325.3471 | 456.5286                   |
| Space heating requirement after solar contribution - total per year (kWh/year) |          |          |          |          |          |          |          |          |          |          |          | 2414.0830                  |
| Space heating per m2                                                           |          |          |          |          |          |          |          |          |          |          |          | (98c) / (4) = 46.0264 (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  | 588.5644 | 463.3379 | 475.0873 | 0.0000  | 0.0000  | 0.0000 |
| Utilisation                                         | 0.0000                   | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.7601   | 0.8460   | 0.8016   | 0.0000  | 0.0000  | 0.0000 |
| Useful loss                                         | 0.0000                   | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 447.3483 | 392.0020 | 380.8167 | 0.0000  | 0.0000  | 0.0000 |
| Total gains                                         | 0.0000                   | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 501.0058 | 477.7367 | 441.3353 | 0.0000  | 0.0000  | 0.0000 |
| Space cooling kWh                                   | 0.0000                   | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 38.6334  | 63.7866  | 45.0258  | 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  | 0.0000   | 0.0000   | 0.0000   | 0.0000  | 0.0000  | 0.0000 |

# Full SAP Calculation Printout



|                                 |        |        |        |        |        |        |         |         |        |        |        |        |               |
|---------------------------------|--------|--------|--------|--------|--------|--------|---------|---------|--------|--------|--------|--------|---------------|
|                                 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 9.6583 | 15.9466 | 11.2565 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (107)         |
| Space cooling requirement       |        |        |        |        |        |        |         |         |        |        |        |        | 36.8614 (107) |
| Energy for space heating        |        |        |        |        |        |        |         |         |        |        |        |        | 46.0264 (99)  |
| Energy for space cooling        |        |        |        |        |        |        |         |         |        |        |        |        | 0.7028 (108)  |
| Total                           |        |        |        |        |        |        |         |         |        |        |        |        | 46.7292 (109) |
| Fabric Energy Efficiency (TFEE) |        |        |        |        |        |        |         |         |        |        |        |        | 46.7 (109)    |