

# Building Regulations England Part L (BREL) Compliance Report

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

Date: Fri 15 Nov 2024 10:34:45

| Project Information |                   |                 |                    |
|---------------------|-------------------|-----------------|--------------------|
| Assessed By         | Victoria Gartside | Building Type   | House, Mid-terrace |
| OCDEA Registration  | EES/026678        | Assessment Date | 2024-11-15         |

| Dwelling Details |                |                  |                   |
|------------------|----------------|------------------|-------------------|
| Assessment Type  | As designed    | Total Floor Area | 72 m <sup>2</sup> |
| Site Reference   | SAP VG 21-0282 | Plot Reference   | Plot 37           |
| Address          |                |                  |                   |

| Client Details |                                                     |
|----------------|-----------------------------------------------------|
| Name           | Newett Homes                                        |
| Company        | Newett Homes                                        |
| Address        | Thorp Arch Grange , Thorp Arch, Wetherby , Wetherby |

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

| 1a Target emission rate and dwelling emission rate                       |                                         |  |    |
|--------------------------------------------------------------------------|-----------------------------------------|--|----|
| Fuel for main heating system                                             | Mains gas                               |  |    |
| Target carbon dioxide emission rate                                      | 11.07 kgCO <sub>2</sub> /m <sup>2</sup> |  |    |
| Dwelling carbon dioxide emission rate                                    | 10.93 kgCO <sub>2</sub> /m <sup>2</sup> |  | OK |
| 1b Target primary energy rate and dwelling primary energy                |                                         |  |    |
| Target primary energy                                                    | 57.78 kWh <sub>PE</sub> /m <sup>2</sup> |  |    |
| Dwelling primary energy                                                  | 57.45 kWh <sub>PE</sub> /m <sup>2</sup> |  | OK |
| 1c Target fabric energy efficiency and dwelling fabric energy efficiency |                                         |  |    |
| Target fabric energy efficiency                                          | 30.4 kWh/m <sup>2</sup>                 |  |    |
| Dwelling fabric energy efficiency                                        | 27.3 kWh/m <sup>2</sup>                 |  | OK |

| 2a Fabric U-values               |                                                        |                                               |                                         |     |
|----------------------------------|--------------------------------------------------------|-----------------------------------------------|-----------------------------------------|-----|
| Element                          | Maximum permitted average U-Value [W/m <sup>2</sup> K] | Dwelling average U-Value [W/m <sup>2</sup> K] | Element with highest individual U-Value |     |
| External walls                   | 0.26                                                   | 0.19                                          | Walls (1) (0.19)                        | OK  |
| Party walls                      | 0.2                                                    | 0                                             | Party Wall (1) (0)                      | N/A |
| Curtain walls                    | 1.6                                                    | 0                                             | N/A                                     | N/A |
| Floors                           | 0.18                                                   | 0.13                                          | Heatloss Floor 1 (0.13)                 | OK  |
| Roofs                            | 0.16                                                   | 0.09                                          | Roof (1) (0.09)                         | OK  |
| Windows, doors, and roof windows | 1.6                                                    | 1.27                                          | Front Windows (1.3)                     | OK  |
| Rooflights                       | 2.2                                                    | N/A                                           | N/A                                     | N/A |

| 2b Envelope elements (better than typically expected values are flagged with a subsequent (!)) |                            |                              |  |
|------------------------------------------------------------------------------------------------|----------------------------|------------------------------|--|
| Name                                                                                           | Net area [m <sup>2</sup> ] | U-Value [W/m <sup>2</sup> K] |  |
| Exposed wall: Walls (1)                                                                        | 31.25                      | 0.19                         |  |
| Party wall: Party Wall (1)                                                                     | 82.79                      | 0 (!)                        |  |
| Ground floor: Heatloss Floor 1, Heatloss Floor 1                                               | 35.97                      | 0.13                         |  |
| Exposed roof: Roof (1)                                                                         | 35.97                      | 0.09 (!)                     |  |

| 2c Openings (better than typically expected values are flagged with a subsequent (!)) |                        |             |              |                              |
|---------------------------------------------------------------------------------------|------------------------|-------------|--------------|------------------------------|
| Name                                                                                  | Area [m <sup>2</sup> ] | Orientation | Frame factor | U-Value [W/m <sup>2</sup> K] |
| Front door, Front door                                                                | 2.14                   | South       | N/A          | 1.1 (!)                      |
| Front Windows, Windows                                                                | 4.56                   | South       | 0.7          | 1.3                          |
| Rear Windows, Windows                                                                 | 6.01                   | North       | 0.7          | 1.3                          |

| 2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))                     |                                                   |                                              |                  |                     |
|-------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|----------------------------------------------|------------------|---------------------|
| Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction |                                                   |                                              |                  |                     |
| Main element                                                                                                      | Junction detail                                   | Source                                       | Psi value [W/mK] | Drawing / reference |
| External wall                                                                                                     | E2: Other lintels (including other steel lintels) | Calculated by person with suitable expertise | 0.024 (!)        | MFF-150-E2-02       |
| External wall                                                                                                     | E3: Sill                                          | Calculated by person with suitable expertise | 0.022 (!)        | RCD E3.01           |

| Main element  | Junction detail                          | Source                                       | Psi value [W/mK] | Drawing / reference      |
|---------------|------------------------------------------|----------------------------------------------|------------------|--------------------------|
| External wall | E4: Jamb                                 | Calculated by person with suitable expertise | 0.017 (!)        |                          |
| External wall | E5: Ground floor (normal)                | Calculated by person with suitable expertise | 0.092            | Manufacturer Declaration |
| External wall | E6: Intermediate floor within a dwelling | Calculated by person with suitable expertise | 0.001 (!)        | RCD E6.01                |
| External wall | E18: Party wall between dwellings        | Calculated by person with suitable expertise | 0.04             | SMRF-P05-0.16            |
| Party wall    | P1: Ground floor                         | Calculated by person with suitable expertise | 0.069            | Manufacturer Declaration |
| Party wall    | P2: Intermediate floor within a dwelling | SAP table default                            | 0 (!)            |                          |
| Party wall    | P4: Roof (insulation at ceiling level)   | Calculated by person with suitable expertise | 0.101            | MPW-P4-01                |
| External wall | E10: Eaves (insulation at ceiling level) | Calculated by person with suitable expertise | 0.06             | RCD E10.01               |

### 3 Air permeability (better than typically expected values are flagged with a subsequent (!))

|                                             |                                                  |    |
|---------------------------------------------|--------------------------------------------------|----|
| Maximum permitted air permeability at 50Pa  | 8 m <sup>3</sup> /hm <sup>2</sup>                |    |
| Dwelling air permeability at 50Pa           | 4 m <sup>3</sup> /hm <sup>2</sup> , Design value | OK |
| Air permeability test certificate reference |                                                  |    |

### 4 Space heating

|                                                                                       |                    |  |
|---------------------------------------------------------------------------------------|--------------------|--|
| <b>Main heating system 1:</b> Boiler with radiators or underfloor heating - Mains gas |                    |  |
| Efficiency                                                                            | 88.7%              |  |
| Emitter type                                                                          | Radiators          |  |
| Flow temperature                                                                      |                    |  |
| System type                                                                           | Combi boiler       |  |
| Manufacturer                                                                          | Vaillant           |  |
| Model                                                                                 | ecoFIT sustain 835 |  |
| Commissioning                                                                         |                    |  |
| <b>Secondary heating system:</b> N/A                                                  |                    |  |
| Fuel                                                                                  | N/A                |  |
| Efficiency                                                                            | N/A                |  |
| Commissioning                                                                         |                    |  |

### 5 Hot water

|                                                       |     |  |
|-------------------------------------------------------|-----|--|
| <b>Cylinder/store</b> - type: N/A                     |     |  |
| Capacity                                              | N/A |  |
| Declared heat loss                                    | N/A |  |
| Primary pipework insulated                            | N/A |  |
| Manufacturer                                          |     |  |
| Model                                                 |     |  |
| Commissioning                                         |     |  |
| <b>Waste water heat recovery system 1</b> - type: N/A |     |  |
| Efficiency                                            |     |  |
| Manufacturer                                          |     |  |
| Model                                                 |     |  |

### 6 Controls

|                                                                                                                    |  |  |
|--------------------------------------------------------------------------------------------------------------------|--|--|
| <b>Main heating 1</b> - type: Time and temperature zone control by arrangement of plumbing and electrical services |  |  |
| Function                                                                                                           |  |  |
| Ecodesign class                                                                                                    |  |  |
| Manufacturer                                                                                                       |  |  |
| Model                                                                                                              |  |  |
| <b>Water heating</b> - type: N/A                                                                                   |  |  |
| Manufacturer                                                                                                       |  |  |
| Model                                                                                                              |  |  |

### 7 Lighting

|                                         |         |    |
|-----------------------------------------|---------|----|
| Minimum permitted light source efficacy | 75 lm/W |    |
| Lowest light source efficacy            | 85 lm/W | OK |
| External lights control                 | N/A     |    |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                     |     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-----|
| <b>8 Mechanical ventilation</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                     |     |
| <b>System type:</b> N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     |     |
| Maximum permitted specific fan power                                                                                                                                                                                                                                                                                                                                                                                                                                                             | N/A                 |     |
| Specific fan power                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | N/A                 | N/A |
| Minimum permitted heat recovery efficiency                                                                                                                                                                                                                                                                                                                                                                                                                                                       | N/A                 |     |
| Heat recovery efficiency                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | N/A                 | N/A |
| Manufacturer/Model                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                     |     |
| Commissioning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                     |     |
| <b>9 Local generation</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                     |     |
| Technology type: <b>Photovoltaic system (1)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                     |     |
| Peak power                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 1.25 kWp            |     |
| Orientation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | South               |     |
| Pitch                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 30°                 |     |
| Overshading                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | None or very little |     |
| Manufacturer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                     |     |
| MCS certificate                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                     |     |
| <b>10 Heat networks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     |     |
| N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                     |     |
| <b>11 Supporting documentary evidence</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                     |     |
| N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                     |     |
| <b>12 Declarations</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                     |     |
| <b>a. Assessor Declaration</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                     |     |
| This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report. |                     |     |
| Signed:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Assessor ID:        |     |
| Name:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Date:               |     |
| <b>b. Client Declaration</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                     |     |
| N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                     |     |

# Summary for Input Data

|                      |                |               |                |            |
|----------------------|----------------|---------------|----------------|------------|
| Property Reference   | SAP VG 21-0282 |               | Issued on Date | 15/11/2024 |
| Assessment Reference | Plot 37        | Prop Type Ref | SAP VG 21-0282 |            |
| Property             |                |               |                |            |

|                                    |          |               |       |      |       |
|------------------------------------|----------|---------------|-------|------|-------|
| SAP Rating                         | 92 A     | DER           | 10.93 | TER  | 11.07 |
| Environmental                      | 91 B     | % DER < TER   |       |      | 1.26  |
| CO <sub>2</sub> Emissions (t/year) | 0.75     | DFEE          | 27.30 | TFEE | 30.37 |
| Compliance Check                   | See BREL | % DFEE < TFEE |       |      | 10.09 |
| % DPER < TPER                      | 0.58     | DPER          | 57.45 | TPER | 57.78 |

|                  |                        |             |           |
|------------------|------------------------|-------------|-----------|
| Assessor Details | Miss Victoria Gartside | Assessor ID | AL30-0001 |
| Client           |                        |             |           |

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

|                                |                            |
|--------------------------------|----------------------------|
| Orientation                    | South                      |
| Property Tenure                | ND                         |
| Transaction Type               | 6                          |
| Terrain Type                   | Suburban                   |
| 1.0 Property Type              | House, Mid-Terrace         |
| Which Floor                    | 0                          |
| 2.0 Number of Storeys          | 2                          |
| 3.0 Date Built                 | 2023                       |
| 3.0 Property Age Band          | L                          |
| 4.0 Sheltered Sides            | 2                          |
| 5.0 Sunlight/Shade             | Average or unknown         |
| 6.0 Thermal Mass Parameter     | Precise calculation        |
| Thermal Mass                   | 214.47 kJ/m <sup>2</sup> K |
| 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 |
|------------------|---------------|---------------------|----------------------|-----------------------|
|                  | 1st Storey:   | 8.74 m              | 35.97 m <sup>2</sup> | 2.40 m                |
|                  | 2nd Storey:   | 8.74 m              | 35.97 m <sup>2</sup> | 2.63 m                |
|                  |               | 16.84 m             | 21.25 m <sup>2</sup> | 2.61 m                |

|                 |                      |
|-----------------|----------------------|
| 8.0 Living Area | 12.91 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 |
|--------------------|-------------|-------------|-----------------------------------------------------------------------------------------------------------------|------------------------------|-----------------------------|-----------------------------|-----------------------------|-------------|---------|----------|-----------------------|
|                    | Brick wall  | Cavity Wall | Cavity wall; plasterboard on dabs or battens, lightweight aggregate block, filled cavity, any outside structure | 0.19                         | 110.00                      | 43.96                       | 31.25                       | 0.00        | None    | 12.71    | 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                       | 82.79                  | 0.00        | None    |

| 9.2 Internal Walls | Description     | Construction                 | Kappa (kJ/m <sup>2</sup> K) | Area (m <sup>2</sup> ) |
|--------------------|-----------------|------------------------------|-----------------------------|------------------------|
|                    | Internal Wall 2 | Plasterboard on timber frame | 9.00                        | 104.94                 |

| 10.0 External Roofs | Description | Type                | Construction                             | U-Value (W/m <sup>2</sup> K) | Kappa (kJ/m <sup>2</sup> K) | Gross Area(m <sup>2</sup> ) | Nett Area (m <sup>2</sup> ) | Shelter Code | Shelter Factor | Calculation Type | Openings |
|---------------------|-------------|---------------------|------------------------------------------|------------------------------|-----------------------------|-----------------------------|-----------------------------|--------------|----------------|------------------|----------|
|                     | Plane roof  | External Plane Roof | Plasterboard, insulated at ceiling level | 0.09                         | 9.00                        | 35.97                       | 35.97                       | None         | 0.00           | Enter Gross Area | 0.00     |

| 10.2 Internal Ceilings | Description | Construction | Kappa (kJ/m <sup>2</sup> K) | Area (m <sup>2</sup> ) |
|------------------------|-------------|--------------|-----------------------------|------------------------|
|------------------------|-------------|--------------|-----------------------------|------------------------|

# Summary for Input Data

|                                          |                     |                                                                       |  |  |  |  |  |                           |  |
|------------------------------------------|---------------------|-----------------------------------------------------------------------|--|--|--|--|--|---------------------------|--|
| <b>Description</b><br>Internal Ceiling 1 | <b>Storey</b><br>+1 | <b>Construction</b><br>Plasterboard ceiling, carpeted chipboard floor |  |  |  |  |  | <b>Area (m²)</b><br>35.97 |  |
|------------------------------------------|---------------------|-----------------------------------------------------------------------|--|--|--|--|--|---------------------------|--|

|                              |                      |                     |                                        |                        |                     |                       |                       |                  |  |
|------------------------------|----------------------|---------------------|----------------------------------------|------------------------|---------------------|-----------------------|-----------------------|------------------|--|
| <b>11.0 Heat Loss Floors</b> |                      |                     |                                        |                        |                     |                       |                       |                  |  |
| <b>Description</b>           | <b>Type</b>          | <b>Storey Index</b> | <b>Construction</b>                    | <b>U-Value (W/m²K)</b> | <b>Shelter Code</b> | <b>Shelter Factor</b> | <b>Kappa (kJ/m²K)</b> | <b>Area (m²)</b> |  |
| Heatloss Floor 1             | Ground Floor - Solid | Lowest occupied     | Slab on ground, screed over insulation | 0.13                   | None                | 0.00                  | 110.00                | 35.97            |  |

|                             |                     |                                                |  |  |  |  |  |                       |                  |
|-----------------------------|---------------------|------------------------------------------------|--|--|--|--|--|-----------------------|------------------|
| <b>11.2 Internal Floors</b> |                     |                                                |  |  |  |  |  |                       |                  |
| <b>Description</b>          | <b>Storey Index</b> | <b>Construction</b>                            |  |  |  |  |  | <b>Kappa (kJ/m²K)</b> | <b>Area (m²)</b> |
| Internal Floor              |                     | Plasterboard ceiling, carpeted chipboard floor |  |  |  |  |  | 9.00                  | 35.97            |

|                           |                    |             |                        |                    |                     |                |                   |                     |                        |
|---------------------------|--------------------|-------------|------------------------|--------------------|---------------------|----------------|-------------------|---------------------|------------------------|
| <b>12.0 Opening Types</b> |                    |             |                        |                    |                     |                |                   |                     |                        |
| <b>Description</b>        | <b>Data Source</b> | <b>Type</b> | <b>Glazing</b>         | <b>Glazing Gap</b> | <b>Filling Type</b> | <b>G-value</b> | <b>Frame Type</b> | <b>Frame Factor</b> | <b>U Value (W/m²K)</b> |
| Front door                | Manufacturer       | Solid Door  |                        |                    |                     | 0.00           |                   |                     | 1.10                   |
| Windows                   | Manufacturer       | Window      | Double Low-E Soft 0.05 |                    |                     | 0.73           |                   | 0.70                | 1.30                   |

|                      |                     |                 |                    |                  |              |  |  |  |  |
|----------------------|---------------------|-----------------|--------------------|------------------|--------------|--|--|--|--|
| <b>13.0 Openings</b> |                     |                 |                    |                  |              |  |  |  |  |
| <b>Name</b>          | <b>Opening Type</b> | <b>Location</b> | <b>Orientation</b> | <b>Area (m²)</b> | <b>Pitch</b> |  |  |  |  |
| Front door           | Front door          | Brick wall      | South              | 2.14             | 0            |  |  |  |  |
| Front Windows        | Windows             | Brick wall      | South              | 4.56             | 0            |  |  |  |  |
| Rear Windows         | Windows             | Brick wall      | North              | 6.01             | 0            |  |  |  |  |

|                              |                                    |
|------------------------------|------------------------------------|
| <b>14.0 Conservatory</b>     | <input type="text" value="None"/>  |
| <b>15.0 Draught Proofing</b> | <input type="text" value="100"/> % |
| <b>16.0 Draught Lobby</b>    | <input type="text" value="No"/>    |

|                              |                                                |
|------------------------------|------------------------------------------------|
| <b>17.0 Thermal Bridging</b> | <input type="text" value="Calculate Bridges"/> |
|------------------------------|------------------------------------------------|

|                                                      |                        |               |            |                            |                          |  |                 |  |  |
|------------------------------------------------------|------------------------|---------------|------------|----------------------------|--------------------------|--|-----------------|--|--|
| <b>17.1 List of Bridges</b>                          |                        |               |            |                            |                          |  |                 |  |  |
| <b>Bridge Type</b>                                   | <b>Source Type</b>     | <b>Length</b> | <b>Psi</b> | <b>Adjusted Reference:</b> |                          |  | <b>Imported</b> |  |  |
| E2 Other lintels (including other steel lintels)     | Independently assessed | 8.25          | 0.02       | 0.02                       | MFF-150-E2-02            |  | No              |  |  |
| E3 Sill                                              | Independently assessed | 5.65          | 0.02       | 0.02                       | RCD E3.01                |  | No              |  |  |
| E4 Jamb                                              | Independently assessed | 21.30         | 0.02       | 0.02                       |                          |  | No              |  |  |
| E5 Ground floor (normal)                             | Independently assessed | 8.74          | 0.09       | 0.09                       | Manufacturer Declaration |  | No              |  |  |
| E6 Intermediate floor within a dwelling              | Independently assessed | 8.74          | 0.00       | 0.00                       | RCD E6.01                |  | No              |  |  |
| E18 Party wall between dwellings                     | Independently assessed | 20.12         | 0.04       | 0.04                       | SMRF-P05-0.16            |  | No              |  |  |
| P1 Party wall - Ground floor                         | Independently assessed | 16.46         | 0.07       | 0.07                       | Manufacturer Declaration |  | No              |  |  |
| P2 Party wall - Intermediate floor within a dwelling | Table K1 - Default     | 16.46         | 0.00       | 0.00                       |                          |  | No              |  |  |
| P4 Party wall - Roof (insulation at ceiling level)   | Independently assessed | 16.46         | 0.10       | 0.10                       | MPW-P4-01                |  | No              |  |  |
| E10 Eaves (insulation at ceiling level)              | Independently assessed | 8.74          | 0.06       | 0.06                       | RCD E10.01               |  | No              |  |  |

|                |                                         |
|----------------|-----------------------------------------|
| <b>Y-value</b> | <input type="text" value="0.05"/> W/m²K |
|----------------|-----------------------------------------|

|                                       |                                 |
|---------------------------------------|---------------------------------|
| <b>19.0 Mechanical Ventilation</b>    |                                 |
| <b>Mechanical Ventilation</b>         |                                 |
| Mechanical Ventilation System Present | <input type="text" value="No"/> |

|                                                            |                                 |              |
|------------------------------------------------------------|---------------------------------|--------------|
| <b>19.1 Mechanical extract ventilation - Decentralised</b> |                                 |              |
| <b>SFP</b>                                                 | <b>Fan/Room Type</b>            | <b>Count</b> |
| 0.13                                                       | In Room Fan Kitchen             | 0            |
| 0.11                                                       | In Room Fan Other Wet Room      | 1            |
| 0.00                                                       | In Duct Fan Kitchen             | 0            |
| 0.00                                                       | In Duct Fan Other Wet Room      | 0            |
| 0.10                                                       | Through Wall Fan Kitchen        | 1            |
| 0.10                                                       | Through Wall Fan Other Wet Room | 1            |

|                                                  |                                |
|--------------------------------------------------|--------------------------------|
| <b>20.0 Fans, Open Fireplaces, Flues</b>         |                                |
| 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="3"/> |
| Number of passive vents                          | <input type="text" value="0"/> |
| Number of flueless gas fires                     | <input type="text" value="0"/> |

|                                  |                                 |
|----------------------------------|---------------------------------|
| <b>21.0 Fixed Cooling System</b> | <input type="text" value="No"/> |
|----------------------------------|---------------------------------|

# Summary for Input Data

## 22.0 Pressure Testing

|                           |             |                                             |
|---------------------------|-------------|---------------------------------------------|
|                           | Yes         |                                             |
| Designed AP <sub>50</sub> | 4.00        | m <sup>3</sup> /(h.m <sup>2</sup> ) @ 50 Pa |
| Property Tested?          | Yes         |                                             |
| Test Method               | Blower Door |                                             |

## 22.0 Lighting

|                   |             |                 |              |                 |              |
|-------------------|-------------|-----------------|--------------|-----------------|--------------|
| No Fixed Lighting | No          |                 |              |                 |              |
|                   | <b>Name</b> | <b>Efficacy</b> | <b>Power</b> | <b>Capacity</b> | <b>Count</b> |
|                   | Lighting    | 85.00           | 10.00        | 850.00          | 15           |

## 24.0 Main Heating 1

|                       |                            |   |
|-----------------------|----------------------------|---|
|                       | Database                   |   |
| Description           | Gas Boiler                 |   |
| Percentage of Heat    | 100.00                     | % |
| Database Ref. No.     | 17960                      |   |
| Fuel Type             | Mains gas                  |   |
| SAP Code              | 0                          |   |
| In Winter             | 88.70                      |   |
| In Summer             | 76.40                      |   |
| Model Name            | ecoFIT sustain 835         |   |
| Manufacturer          | Vaillant                   |   |
| System Type           | Combi boiler               |   |
| Controls SAP Code     | 2110                       |   |
| Delayed Start Stat    | Yes                        |   |
| Burner Control        | Modulating                 |   |
| HETAS approved System | No                         |   |
| Flue Type             | Balanced                   |   |
| Fan Assisted Flue     | Yes                        |   |
| Is MHS Pumped         | Pump in heated space       |   |
| Heating Pump Age      | 2013 or later              |   |
| Heat Emitter          | Radiators                  |   |
| Underfloor Heating    | Yes - Pipes in thin screed |   |
| Flow Temperature      | Unknown                    |   |
| Boiler Interlock      | Yes                        |   |
| Combi boiler type     | Standard Combi             |   |

## 25.0 Main Heating 2

None

## 26.0 Heat Networks

None

|               | Heat Source | Fuel Type | Heating Use | Efficiency | Percentage Of Heat | Heat | Heat Power Ratio | Electrical | Fuel Factor | Efficiency type |
|---------------|-------------|-----------|-------------|------------|--------------------|------|------------------|------------|-------------|-----------------|
| Heat source 1 | None        |           |             |            |                    |      |                  |            |             |                 |
| Heat source 2 | None        |           |             |            |                    |      |                  |            |             |                 |
| Heat source 3 | None        |           |             |            |                    |      |                  |            |             |                 |
| Heat source 4 | None        |           |             |            |                    |      |                  |            |             |                 |
| Heat source 5 | None        |           |             |            |                    |      |                  |            |             |                 |

## 27.0 Secondary Heating

None

## 28.0 Water Heating

|                                                  |                |
|--------------------------------------------------|----------------|
| Water Heating                                    | Main Heating 1 |
| SAP Code                                         | 901            |
| Flue Gas Heat Recovery System                    | No             |
| Waste Water Heat Recovery Instantaneous System 1 | No             |
| Waste Water Heat Recovery Instantaneous System 2 | No             |
| Waste Water Heat Recovery Storage System         | No             |

# Summary for Input Data

|                                    |                                         |
|------------------------------------|-----------------------------------------|
| Solar Panel                        | <input type="text" value="No"/>         |
| Water use <= 125 litres/person/day | <input type="text" value="Yes"/>        |
| Summer Immersion                   | <input type="text" value="No"/>         |
| Cold Water Source                  | <input type="text" value="From mains"/> |
| Bath Count                         | <input type="text" value="1"/>          |
| Supplementary Immersion            | <input type="text" value="No"/>         |
| Immersion Only Heating Hot Water   | <input type="text" value="No"/>         |

## 28.1 Showers

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

## 28.3 Waste Water Heat Recovery System

## 29.0 Hot Water Cylinder

|                          |                                   |
|--------------------------|-----------------------------------|
|                          | <input type="text" value="None"/> |
| Cylinder Stat            | <input type="text" value="No"/>   |
| Cylinder In Heated Space | <input type="text" value="No"/>   |
| Independent Time Control | <input type="text" value="No"/>   |
| In Airing Cupboard       | <input type="text" value="No"/>   |

## 31.0 Thermal Store

## 32.0 Photovoltaic Unit

|                        |                                           |
|------------------------|-------------------------------------------|
|                        | <input type="text" value="One Dwelling"/> |
| Export Capable Meter?  | <input type="text" value="Yes"/>          |
| Connected To Dwelling  | <input type="text" value="Yes"/>          |
| Diverter               | <input type="text" value="No"/>           |
| Battery Capacity [kWh] | <input type="text" value="0.00"/>         |

| PV Cells kWp | Orientation | Elevation | Overshading    | FGHRS | MCS Certificate | Overshading Factor | MCS Certificate Reference | Panel Manufacturer |
|--------------|-------------|-----------|----------------|-------|-----------------|--------------------|---------------------------|--------------------|
| 1.25         | South       | 30°       | None Or Little | No    | No              | 1.00               |                           |                    |

## 34.0 Small-scale Hydro

|                                           |                                     |
|-------------------------------------------|-------------------------------------|
|                                           | <input type="text" value="None"/>   |
| Electricity Generated                     | <input type="text" value="0.00"/>   |
| Apportioned                               | <input type="text" value="0.00"/>   |
| Connected to dwelling's electricity meter | <input type="text" value="Yes"/>    |
| Electricity Generation                    | <input type="text" value="Annual"/> |

kWh/Year

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

## Recommendations

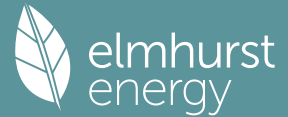
### Lower cost measures

None

### Further measures to achieve even higher standards

None

# Full SAP Calculation Printout



|                                    |                        |               |               |                |                |            |
|------------------------------------|------------------------|---------------|---------------|----------------|----------------|------------|
| Property Reference                 | SAP VG 21-0282         |               |               |                | Issued on Date | 15/11/2024 |
| Assessment Reference               | Plot 37                |               | Prop Type Ref | SAP VG 21-0282 |                |            |
| Property                           |                        |               |               |                |                |            |
|                                    |                        |               |               |                |                |            |
| SAP Rating                         | 92 A                   | DER           | 10.93         | TER            | 11.07          |            |
| Environmental                      | 91 B                   | % DER < TER   |               |                |                | 1.26       |
| CO <sub>2</sub> Emissions (t/year) | 0.75                   | DFEE          | 27.30         | TFEE           | 30.37          |            |
| Compliance Check                   | See BREL               | % DFEE < TFEE |               |                |                | 10.09      |
| % DPER < TPER                      | 0.58                   | DPER          | 57.45         | TPER           | 57.78          |            |
|                                    |                        |               |               |                |                |            |
| Assessor Details                   | Miss Victoria Gartside |               |               |                | Assessor ID    | AL30-0001  |
| 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> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Ground floor                                           | 35.9700 (1b)              | x 2.4000 (2b)                   | = 86.3280 (1b) - (3b)       |
| First floor                                            | 35.9700 (1c)              | x 2.6300 (2c)                   | = 94.6011 (1c) - (3c)       |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 71.9400                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 180.9291 (5)              |

## 2. Ventilation rate

|                                                                                                    | m <sup>3</sup> per hour                 |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 3 * 10 = 30.0000 (7a)                   |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Air changes per hour                                                                               |                                         |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 30.0000 / (5) = 0.1658 (8)              |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 4.0000 (17)                             |
| Infiltration rate                                                                                  | 0.3658 (18)                             |
| Number of sides sheltered                                                                          | 2 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.3109 (21)        |

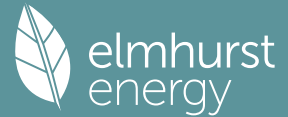
|                 | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed      | 5.1000 | 5.0000 | 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 | 0.3964 | 0.3887 | 0.3809 | 0.3420 | 0.3343 | 0.2954 | 0.2954 | 0.2876 | 0.3109 | 0.3343 | 0.3498 | 0.3654 (22b) |
| Effective ac    | 0.5786 | 0.5755 | 0.5725 | 0.5585 | 0.5559 | 0.5436 | 0.5436 | 0.5414 | 0.5483 | 0.5559 | 0.5612 | 0.5667 (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   |
|----------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------------|-----------------|
| Front door                                                     |                         |                            | 2.1400                    | 1.1000                        | 2.3540       |                                      | (26)            |
| Windows (Uw = 1.30)                                            |                         |                            | 10.5700                   | 1.2357                        | 13.0618      |                                      | (27)            |
| Heatloss Floor 1                                               |                         |                            | 35.9700                   | 0.1300                        | 4.6761       | 110.0000                             | 3956.7000 (28a) |
| Brick wall                                                     | 43.9600                 | 12.7100                    | 31.2500                   | 0.1900                        | 5.9375       | 110.0000                             | 3437.5000 (29a) |
| Plane roof                                                     | 35.9700                 |                            | 35.9700                   | 0.0900                        | 3.2373       | 9.0000                               | 323.7300 (30)   |
| Total net area of external elements Aum(A, m <sup>2</sup> )    |                         |                            | 115.9000                  |                               |              |                                      | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                            |                         |                            |                           | (26)...(30) + (32) =          | 29.2667      |                                      | (33)            |
| Party Wall 1                                                   |                         |                            | 82.7900                   | 0.0000                        | 0.0000       | 70.0000                              | 5795.3000 (32)  |
| Internal Wall 2                                                |                         |                            | 104.9400                  |                               |              | 9.0000                               | 944.4600 (32c)  |
| Internal Floor                                                 |                         |                            | 35.9700                   |                               |              | 18.0000                              | 647.4600 (32d)  |
| Internal Ceiling 1                                             |                         |                            | 35.9700                   |                               |              | 9.0000                               | 323.7300 (32e)  |
| Heat capacity Cm = Sum(A x k)                                  |                         |                            |                           |                               |              | (28)...(30) + (32) + (32a)...(32e) = | 15428.8800 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K |                         |                            |                           |                               |              |                                      | 214.4687 (35)   |
| List of Thermal Bridges                                        |                         |                            |                           |                               |              |                                      |                 |
| K1 Element                                                     |                         |                            |                           | Length                        | Psi-value    | Total                                |                 |
| E2 Other lintels (including other steel lintels)               |                         |                            |                           | 8.2500                        | 0.0240       | 0.1980                               |                 |
| E3 Sill                                                        |                         |                            |                           | 5.6500                        | 0.0220       | 0.1243                               |                 |
| E4 Jamb                                                        |                         |                            |                           | 21.3000                       | 0.0170       | 0.3621                               |                 |



# Full SAP Calculation Printout



|                                                            |         |                       |              |
|------------------------------------------------------------|---------|-----------------------|--------------|
| E5 Ground floor (normal)                                   | 8.7400  | 0.0920                | 0.8041       |
| E6 Intermediate floor within a dwelling                    | 8.7400  | 0.0010                | 0.0087       |
| E18 Party wall between dwellings                           | 20.1200 | 0.0400                | 0.8048       |
| P1 Party wall - Ground floor                               | 16.4600 | 0.0690                | 1.1357       |
| P2 Party wall - Intermediate floor within a dwelling       | 16.4600 | 0.0000                | 0.0000       |
| P4 Party wall - Roof (insulation at ceiling level)         | 16.4600 | 0.1010                | 1.6625       |
| E10 Eaves (insulation at ceiling level)                    | 8.7400  | 0.0600                | 0.5244       |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |         |                       | 5.6246 (36)  |
| Point Thermal bridges                                      |         |                       | 0.0000       |
| Total fabric heat loss                                     |         | (33) + (36) + (36a) = | 34.8913 (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                                                 | 34.5454 | 34.3632 | 34.1846 | 33.3457 | 33.1888 | 32.4582 | 32.4582 | 32.3229 | 32.7396 | 33.1888 | 33.5063 | 33.8382 |
| Average = Sum(39)m / 12 =                                           | 69.4367 | 69.2545 | 69.0759 | 68.2370 | 68.0801 | 67.3495 | 67.3495 | 67.2142 | 67.6309 | 68.0801 | 68.3976 | 68.7295 |
|                                                                     |         |         |         |         |         |         |         |         |         |         |         | 68.2363 |
| HLP                                                                 | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |
| HLP (average)                                                       | 0.9652  | 0.9627  | 0.9602  | 0.9485  | 0.9463  | 0.9362  | 0.9362  | 0.9343  | 0.9401  | 0.9463  | 0.9508  | 0.9554  |
| Days in mont                                                        | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31      |
|                                                                     |         |         |         |         |         |         |         |         |         |         |         | 0.9485  |

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

|                                                                 |          |          |          |          |          |          |          |          |          |          |          |               |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Assumed occupancy                                               |          |          |          |          |          |          |          |          |          |          |          | 2.2923 (42)   |
| Hot water usage for mixer showers                               |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                 | 62.6538  | 61.7122  | 60.3402  | 57.7150  | 55.7777  | 53.6172  | 52.3892  | 53.7509  | 55.2435  | 57.5632  | 60.2448  | 62.4137 (42a) |
| Hot water usage for baths                                       |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                 | 27.0664  | 26.6644  | 26.0984  | 25.0546  | 24.2731  | 23.4065  | 22.9384  | 23.5005  | 24.1126  | 25.0399  | 26.1051  | 26.9749 (42b) |
| Hot water usage for other uses                                  |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                 | 38.1053  | 36.7197  | 35.3340  | 33.9484  | 32.5627  | 31.1771  | 31.1771  | 32.5627  | 33.9484  | 35.3340  | 36.7197  | 38.1053 (42c) |
| Average daily hot water use (litres/day)                        |          |          |          |          |          |          |          |          |          |          |          | 117.5007 (43) |
|                                                                 |          |          |          |          |          |          |          |          |          |          |          |               |
| Daily hot water use                                             | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
|                                                                 | 127.8255 | 125.0963 | 121.7725 | 116.7180 | 112.6135 | 108.2008 | 106.5048 | 109.8142 | 113.3045 | 117.9371 | 123.0695 | 127.4939 (44) |
| Energy conte                                                    | 202.4443 | 178.1355 | 187.1599 | 159.7811 | 151.5995 | 133.0456 | 128.8083 | 135.9729 | 139.7158 | 160.0395 | 175.3350 | 199.6247 (45) |
| Energy content (annual)                                         |          |          |          |          |          |          |          |          |          |          |          |               |
| Distribution loss (46)m = 0.15 x (45)m                          |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                 | 30.3666  | 26.7203  | 28.0740  | 23.9672  | 22.7399  | 19.9568  | 19.3212  | 20.3959  | 20.9574  | 24.0059  | 26.3003  | 29.9437 (46)  |
| Water storage loss:                                             |          |          |          |          |          |          |          |          |          |          |          |               |
| Total storage loss                                              |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (56)   |
| If cylinder contains dedicated solar storage                    |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (57)   |
| Primary loss                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (59)   |
| Combi loss                                                      | 0.6873   | 0.6242   | 0.6807   | 0.6134   | 0.6069   | 0.5561   | 0.5472   | 0.5596   | 0.5555   | 0.6066   | 0.6286   | 0.6804 (61)   |
| Total heat required for water heating calculated for each month |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                 | 203.1316 | 178.7597 | 187.8406 | 160.3946 | 152.2064 | 133.6017 | 129.3554 | 136.5325 | 140.2712 | 160.6461 | 175.9637 | 200.3051 (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                                                 |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                 | 203.1316 | 178.7597 | 187.8406 | 160.3946 | 152.2064 | 133.6017 | 129.3554 | 136.5325 | 140.2712 | 160.6461 | 175.9637 | 200.3051 (64) |
| 12Total per year (kWh/year)                                     |          |          |          |          |          |          |          |          |          |          |          |               |
| Electric shower(s)                                              |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (64a)  |
|                                                                 |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (64a)  |
| Heat gains from water heating, kWh/month                        |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                 | 67.4846  | 59.3861  | 62.4008  | 53.2806  | 50.5586  | 44.3767  | 42.9655  | 45.3509  | 46.5944  | 53.3648  | 58.4561  | 66.5453 (65)  |

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

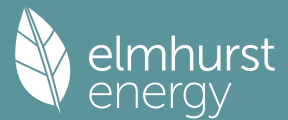
|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Metabolic gains (Table 5), Watts                                                    |          |          |          |          |          |          |          |          |          |          |          |               |
| (66)m                                                                               | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
|                                                                                     | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                     | 108.0577 | 119.6353 | 108.0577 | 111.6596 | 108.0577 | 111.6596 | 108.0577 | 108.0577 | 111.6596 | 108.0577 | 111.6596 | 108.0577 (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                     | 201.7819 | 203.8757 | 198.5993 | 187.3663 | 173.1867 | 159.8598 | 150.9567 | 148.8628 | 154.1393 | 165.3722 | 179.5519 | 192.8787 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                     | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614 (69)  |
| Pumps, fans                                                                         | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000 (70)   |
| Losses e.g. evaporation (negative values) (Table 5)                                 |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                     | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 (71) |
| Water heating gains (Table 5)                                                       |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                     | 90.7051  | 88.3722  | 83.8721  | 74.0008  | 67.9550  | 61.6343  | 57.7494  | 60.9555  | 64.7144  | 71.7269  | 81.1890  | 89.4426 (72)  |
| Total internal gains                                                                |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                     | 460.9289 | 472.2675 | 450.9133 | 433.4110 | 409.5837 | 390.5380 | 374.1480 | 375.2603 | 387.8976 | 405.5411 | 432.7847 | 450.7633 (73) |

## 6. Solar gains

| [Jan]       |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 |          | g<br>Specific data<br>or Table 6b |          | FF<br>Specific data<br>or Table 6c |          | Access<br>factor<br>Table 6d |  | Gains<br>W    |
|-------------|----------|----------|----------|------------|--------------------------------|----------|-----------------------------------|----------|------------------------------------|----------|------------------------------|--|---------------|
| North       |          |          |          | 6.0100     | 10.6334                        |          | 0.7300                            |          | 0.7000                             |          | 0.7700                       |  | 22.6308 (74)  |
| South       |          |          |          | 4.5600     | 46.7521                        |          | 0.7300                            |          | 0.7000                             |          | 0.7700                       |  | 75.4953 (78)  |
| Solar gains | 98.1261  | 166.8905 | 230.9878 | 296.0505   | 344.5098                       | 348.7439 | 333.3504                          | 295.4765 | 252.8838                           | 184.8412 | 117.4057                     |  | 84.1010 (83)  |
| Total gains | 559.0550 | 639.1580 | 681.9011 | 729.4615   | 754.0935                       | 739.2819 | 707.4984                          | 670.7368 | 640.7814                           | 590.3823 | 550.1904                     |  | 534.8643 (84) |

## 7. Mean internal temperature (heating season)

# Full SAP Calculation Printout



|                                                                             |         |         |         |         |         |         |         |         |                           |         |         |              |             |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|-------------|
| 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                                                                         | 61.7224 | 61.8848 | 62.0448 | 62.8075 | 62.9523 | 63.6352 | 63.6352 | 63.7633 | 63.3704                   | 62.9523 | 62.6601 | 62.3575      |             |
| alpha                                                                       | 5.1148  | 5.1257  | 5.1363  | 5.1872  | 5.1968  | 5.2423  | 5.2423  | 5.2509  | 5.2247                    | 5.1968  | 5.1773  | 5.1572       |             |
| util living area                                                            | 0.9875  | 0.9745  | 0.9511  | 0.8855  | 0.7575  | 0.5682  | 0.4163  | 0.4567  | 0.6844                    | 0.9044  | 0.9743  | 0.9898 (86)  |             |
| MIT                                                                         | 19.9399 | 20.1409 | 20.3833 | 20.6853 | 20.8916 | 20.9807 | 20.9968 | 20.9949 | 20.9507                   | 20.6950 | 20.2742 | 19.9067 (87) |             |
| Th 2                                                                        | 20.1124 | 20.1146 | 20.1166 | 20.1264 | 20.1283 | 20.1368 | 20.1368 | 20.1384 | 20.1335                   | 20.1283 | 20.1246 | 20.1207 (88) |             |
| util rest of house                                                          | 0.9842  | 0.9682  | 0.9388  | 0.8582  | 0.7070  | 0.4974  | 0.3359  | 0.3733  | 0.6135                    | 0.8754  | 0.9668  | 0.9871 (89)  |             |
| MIT 2                                                                       | 18.8860 | 19.1404 | 19.4433 | 19.8117 | 20.0369 | 20.1252 | 20.1357 | 20.1364 | 20.1000                   | 19.8318 | 19.3184 | 18.8502 (90) |             |
| Living area fraction                                                        | 19.0752 | 19.3199 | 19.6120 | 19.9685 | 20.1903 | 20.2787 | 20.2902 | 20.2905 | fLA = Living area / (4) = |         |         |              | 0.1795 (91) |
| MIT                                                                         | 19.0752 | 19.3199 | 19.6120 | 19.9685 | 20.1903 | 20.2787 | 20.2902 | 20.2905 | 20.2526                   | 19.9867 | 19.4899 | 19.0398 (92) |             |
| Temperature adjustment                                                      | 18.9252 | 19.1699 | 19.4620 | 19.8185 | 20.0403 | 20.1287 | 20.1402 | 20.1405 | 20.1026                   | 19.8367 | 19.3399 | -0.1500      |             |
| adjusted MIT                                                                | 18.9252 | 19.1699 | 19.4620 | 19.8185 | 20.0403 | 20.1287 | 20.1402 | 20.1405 | 20.1026                   | 19.8367 | 19.3399 | 18.8898 (93) |             |

## 8. Space heating requirement

|                                                                                |           |          |          |          |          |          |          |          |          |               |          |                |
|--------------------------------------------------------------------------------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|----------|----------------|
|                                                                                | Jan       | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov      | Dec            |
| Utilisation                                                                    | 0.9782    | 0.9593   | 0.9275   | 0.8471   | 0.7015   | 0.4967   | 0.3363   | 0.3735   | 0.6108   | 0.8639        | 0.9578   | 0.9819 (94)    |
| Useful gains                                                                   | 546.8744  | 613.1693 | 632.4708 | 617.9304 | 529.0172 | 367.2105 | 237.9025 | 250.5009 | 391.4098 | 510.0178      | 526.9921 | 525.1728 (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                                                               | 1015.5229 | 988.2555 | 895.3586 | 745.0474 | 567.8089 | 372.3547 | 238.4310 | 251.4121 | 405.9634 | 628.8370      | 837.1820 | 1009.6214 (97) |
| Space heating kWh                                                              | 348.6745  | 252.0579 | 195.5885 | 91.5242  | 28.8610  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 88.4015       | 223.3367 | 360.4298 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |          |          |          |          |          |          |          |          |               |          | 1588.8741      |
| 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                                                              | 348.6745  | 252.0579 | 195.5885 | 91.5242  | 28.8610  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 88.4015       | 223.3367 | 360.4298 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |          |          |          |          |          |          |          |          |               |          | 1588.8741      |
| Space heating per m2                                                           |           |          |          |          |          |          |          |          |          | (98c) / (4) = |          | 22.0861 (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 %)                                                     |          |          |          |          |          |          |          |          |          |          |          |            | 88.7000 (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                                                                            | 348.6745 | 252.0579 | 195.5885 | 91.5242  | 28.8610  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 88.4015  | 223.3367 | 360.4298   | (98)          |
| Space heating efficiency (main heating system 1)                                                     | 88.7000  | 88.7000  | 88.7000  | 88.7000  | 88.7000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 88.7000  | 88.7000  | 88.7000    | (210)         |
| Space heating fuel (main heating system)                                                             | 393.0941 | 284.1690 | 220.5057 | 103.1840 | 32.5378  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 99.6635  | 251.7889 | 406.3470   | (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                                                                            | 203.1316 | 178.7597 | 187.8406 | 160.3946 | 152.2064 | 133.6017 | 129.3554 | 136.5325 | 140.2712 | 160.6461 | 175.9637 | 200.3051   | (64)          |
| Efficiency of water heater (217)m                                                                    | 83.7373  | 83.1457  | 82.2156  | 80.4532  | 78.1268  | 76.4000  | 76.4000  | 76.4000  | 76.4000  | 80.3552  | 82.8239  | 76.4000    | (216)         |
| Fuel for water heating, kWh/month                                                                    | 242.5821 | 214.9956 | 228.4732 | 199.3638 | 194.8196 | 174.8713 | 169.3134 | 178.7074 | 183.6011 | 199.9199 | 212.4552 | 238.8102   | (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                                                                                             | 21.9933  | 17.6439  | 15.8864  | 11.6390  | 8.9903   | 7.3452   | 8.2013   | 10.6603  | 13.8467  | 18.1676  | 20.5203  | 22.6046    | (232)         |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -22.2542 | -32.7449 | -49.1800 | -57.8285 | -64.5019 | -60.9914 | -60.2074 | -55.7392 | -48.2263 | -38.5059 | -24.9337 | -19.0769   | (233a)        |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | (234a)        |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | (235a)        |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | (235c)        |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -9.0499  | -19.4926 | -39.7864 | -61.4040 | -82.7998 | -83.8297 | -82.6998 | -69.1195 | -49.5632 | -28.2727 | -12.1974 | -7.1192    | (233b)        |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | (234b)        |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | (235b)        |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | (235d)        |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |            |               |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 1791.2899  | (211)         |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000     | (213)         |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000     | (215)         |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 76.4000    |               |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          | 2437.9129  | (219)         |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000     | (221)         |
| Electricity for pumps and fans:                                                                      |          |          |          |          |          |          |          |          |          |          |          |            |               |
| central heating pump                                                                                 |          |          |          |          |          |          |          |          |          |          |          | 41.0000    | (230c)        |
| main heating flue fan                                                                                |          |          |          |          |          |          |          |          |          |          |          | 45.0000    | (230e)        |
| Total electricity for the above, kWh/year                                                            |          |          |          |          |          |          |          |          |          |          |          | 86.0000    | (231)         |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |          |          |          |          |          |          |          |          | 177.4988   | (232)         |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |          |          |          |          |          |          |          |          |            |               |
| PV generation                                                                                        |          |          |          |          |          |          |          |          |          |          |          | -1079.5246 | (233)         |
| Wind generation                                                                                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000     | (234)         |
| Hydro-electric generation (Appendix N)                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000     | (235a)        |
| Electricity generated - Micro CHP (Appendix N)                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000     | (235)         |

# Full SAP Calculation Printout



## Appendix Q - special features

|                                     |                 |
|-------------------------------------|-----------------|
| Energy saved or generated           | -0.0000 (236)   |
| Energy used                         | 0.0000 (237)    |
| Total delivered energy for all uses | 3413.1770 (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                   | 1791.2899          | 0.2100                        | 376.1709 (261)           |
| Total CO2 associated with community systems     |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                      | 2437.9129          | 0.2100                        | 511.9617 (264)           |
| Space and water heating                         |                    |                               | 888.1326 (265)           |
| Pumps, fans and electric keep-hot               | 86.0000            | 0.1387                        | 11.9293 (267)            |
| Energy for lighting                             | 177.4988           | 0.1443                        | 25.6186 (268)            |
| Energy saving/generation technologies           |                    |                               |                          |
| PV Unit electricity used in dwelling            | -534.1903          | 0.1337                        | -71.4146                 |
| PV Unit electricity exported                    | -545.3343          | 0.1252                        | -68.2559                 |
| Total                                           |                    |                               | -139.6705 (269)          |
| Total CO2, kg/year                              |                    |                               | 786.0099 (272)           |
| EPC Dwelling Carbon Dioxide Emission Rate (DER) |                    |                               | 10.9300 (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               | 1791.2899          | 1.1300                              | 2024.1576 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2437.9129          | 1.1300                              | 2754.8416 (278)            |
| Space and water heating                     |                    |                                     | 4778.9992 (279)            |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008 (281)             |
| Energy for lighting                         | 177.4988           | 1.5338                              | 272.2537 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -534.1903          | 1.4940                              | -798.0994                  |
| PV Unit electricity exported                | -545.3343          | 0.4594                              | -250.5261                  |
| Total                                       |                    |                                     | -1048.6255 (283)           |
| Total Primary energy kWh/year               |                    |                                     | 4132.7281 (286)            |
| Dwelling Primary energy Rate (DPER)         |                    |                                     | 57.4500 (287)              |

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)        |
|--------------------------------------------------------|--------------|---------------------------------|-----------------------|
| Ground floor                                           | 35.9700 (1b) | x 2.4000 (2b)                   | = 86.3280 (1b) - (3b) |
| First floor                                            | 35.9700 (1c) | x 2.6300 (2c)                   | = 94.6011 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 71.9400      |                                 | (4)                   |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 180.9291 (5)        |

### 2. Ventilation rate

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

|                                                      |                                                       |                 |            |
|------------------------------------------------------|-------------------------------------------------------|-----------------|------------|
| Infiltration due to chimneys, flues and fans         | = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 30.0000 / (5) = | 0.1658 (8) |
| Pressure test                                        |                                                       | Yes             |            |
| Pressure Test Method                                 |                                                       | Blower Door     |            |
| Measured/design AP50                                 |                                                       | 5.0000 (17)     |            |
| Infiltration rate                                    |                                                       | 0.4158 (18)     |            |
| Number of sides sheltered                            |                                                       | 2 (19)          |            |
| Shelter factor                                       | (20) = 1 - [0.075 x (19)] =                           | 0.8500 (20)     |            |
| Infiltration rate adjusted to include shelter factor | (21) = (18) x (20) =                                  | 0.3534 (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 | 0.4506 | 0.4418 | 0.4330 | 0.3888 | 0.3799 | 0.3358 | 0.3358 | 0.3269 | 0.3534 | 0.3799 | 0.3976 | 0.4153 (22b) |
| Effective ac    | 0.6015 | 0.5976 | 0.5937 | 0.5756 | 0.5722 | 0.5564 | 0.5564 | 0.5534 | 0.5625 | 0.5722 | 0.5791 | 0.5862 (25)  |

# Full SAP Calculation Printout



## 3. Heat losses and heat loss parameter

| Element                                        | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K     | A x U<br>W/K | K-value<br>kJ/m2K | A x K<br>kJ/K |
|------------------------------------------------|-------------|----------------|---------------|----------------------|--------------|-------------------|---------------|
| TER Opaque door                                |             |                | 2.1400        | 1.0000               | 2.1400       |                   | (26)          |
| TER Opening Type (Uw = 1.20)                   |             |                | 10.5700       | 1.1450               | 12.1031      |                   | (27)          |
| Heatloss Floor 1                               |             |                | 35.9700       | 0.1300               | 4.6761       |                   | (28a)         |
| Brick wall                                     | 43.9600     | 12.7100        | 31.2500       | 0.1800               | 5.6250       |                   | (29a)         |
| Plane roof                                     | 35.9700     |                | 35.9700       | 0.1100               | 3.9567       |                   | (30)          |
| Total net area of external elements Aum(A, m2) |             |                | 115.9000      |                      |              |                   | (31)          |
| Fabric heat loss, W/K = Sum (A x U)            |             |                |               | (26)...(30) + (32) = | 28.5009      |                   | (33)          |
| Party Wall 1                                   |             |                | 82.7900       | 0.0000               | 0.0000       |                   | (32)          |

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

214.4687 (35)

List of Thermal Bridges

| K1 Element                                                 | Length  | Psi-value             | Total        |
|------------------------------------------------------------|---------|-----------------------|--------------|
| E2 Other lintels (including other steel lintels)           | 8.2500  | 0.0500                | 0.4125       |
| E3 Sill                                                    | 5.6500  | 0.0500                | 0.2825       |
| E4 Jamb                                                    | 21.3000 | 0.0500                | 1.0650       |
| E5 Ground floor (normal)                                   | 8.7400  | 0.1600                | 1.3984       |
| E6 Intermediate floor within a dwelling                    | 8.7400  | 0.0000                | 0.0000       |
| E8 Party wall between dwellings                            | 20.1200 | 0.0600                | 1.2072       |
| P1 Party wall - Ground floor                               | 16.4600 | 0.0800                | 1.3168       |
| P2 Party wall - Intermediate floor within a dwelling       | 16.4600 | 0.0000                | 0.0000       |
| P4 Party wall - Roof (insulation at ceiling level)         | 16.4600 | 0.1200                | 1.9752       |
| E10 Eaves (insulation at ceiling level)                    | 8.7400  | 0.0600                | 0.5244       |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |         |                       | 8.1820 (36)  |
| Point Thermal bridges                                      |         |                       | 0.0000       |
| Total fabric heat loss                                     |         | (33) + (36) + (36a) = | 36.6829 (37) |

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

| (38)m                     | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Heat transfer coeff       | 35.9157 | 35.6803 | 35.4495 | 34.3657 | 34.1629 | 33.2190 | 33.2190 | 33.0441 | 33.5826 | 34.1629 | 34.5731 | 35.0020 (38) |
| Average = Sum(39)m / 12 = | 72.5985 | 72.3631 | 72.1324 | 71.0486 | 70.8458 | 69.9018 | 69.9018 | 69.7270 | 70.2654 | 70.8458 | 71.2560 | 71.6849 (39) |

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec         |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
| HLP           | 1.0092 | 1.0059 | 1.0027 | 0.9876 | 0.9848 | 0.9717 | 0.9717 | 0.9692 | 0.9767 | 0.9848 | 0.9905 | 0.9965 (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 0.9876      |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31          |

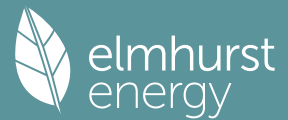
## 4. Water heating energy requirements (kWh/year)

|                                                                 |          |          |          |          |          |          |          |          |          |                                        |          |                |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------------------------------|----------|----------------|
| Assumed occupancy                                               |          |          |          |          |          |          |          |          |          |                                        |          | 2.2923 (42)    |
| Hot water usage for mixer showers                               | 62.6538  | 61.7122  | 60.3402  | 57.7150  | 55.7777  | 53.6172  | 52.3892  | 53.7509  | 55.2435  | 57.5632                                | 60.2448  | 62.4137 (42a)  |
| Hot water usage for baths                                       | 27.0664  | 26.6644  | 26.0984  | 25.0546  | 24.2731  | 23.4065  | 22.9384  | 23.5005  | 24.1126  | 25.0399                                | 26.1051  | 26.9749 (42b)  |
| Hot water usage for other uses                                  | 38.1053  | 36.7197  | 35.3340  | 33.9484  | 32.5627  | 31.1771  | 31.1771  | 32.5627  | 33.9484  | 35.3340                                | 36.7197  | 38.1053 (42c)  |
| Average daily hot water use (litres/day)                        |          |          |          |          |          |          |          |          |          |                                        |          | 117.5007 (43)  |
| Daily hot water use                                             | 127.8255 | 125.0963 | 121.7725 | 116.7180 | 112.6135 | 108.2008 | 106.5048 | 109.8142 | 113.3045 | 117.9371                               | 123.0695 | 127.4939 (44)  |
| Energy conte                                                    | 202.4443 | 178.1355 | 187.1599 | 159.7811 | 151.5995 | 133.0456 | 128.8083 | 135.9729 | 139.7158 | 160.0395                               | 175.3350 | 199.6247 (45)  |
| Energy content (annual)                                         |          |          |          |          |          |          |          |          |          | Total = Sum(45)m =                     |          | 1951.6620      |
| Distribution loss (46)m = 0.15 x (45)m                          | 30.3666  | 26.7203  | 28.0740  | 23.9672  | 22.7399  | 19.9568  | 19.3212  | 20.3959  | 20.9574  | 24.0059                                | 26.3003  | 29.9437 (46)   |
| Water storage loss:                                             |          |          |          |          |          |          |          |          |          |                                        |          |                |
| Total storage loss                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000 (56)    |
| If cylinder contains dedicated solar storage                    |          |          |          |          |          |          |          |          |          |                                        |          |                |
| 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                                                      | 50.9589  | 46.0274  | 50.9589  | 49.3151  | 50.9589  | 49.3151  | 50.9589  | 50.9589  | 49.3151  | 50.9589                                | 49.3151  | 50.9589 (61)   |
| Total heat required for water heating calculated for each month | 253.4032 | 224.1629 | 238.1188 | 209.0962 | 202.5584 | 182.3606 | 179.7672 | 186.9318 | 189.0308 | 210.9984                               | 224.6501 | 250.5836 (62)  |
| WWHRS                                                           | -28.6427 | -25.3318 | -26.5260 | -21.9646 | -20.4702 | -17.5165 | -16.4189 | -17.4599 | -18.1233 | -21.3653                               | -24.2043 | -28.1123 (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                                                 | 224.7605 | 198.8310 | 211.5927 | 187.1316 | 182.0882 | 164.8441 | 163.3482 | 169.4719 | 170.9076 | 189.6331                               | 200.4458 | 222.4713 (64)  |
| 12Total per year (kWh/year)                                     |          |          |          |          |          |          |          |          |          | Total per year (kWh/year) = Sum(64)m = |          | 2285.5261 (64) |
| Electric shower(s)                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000 (64a)   |
| Heat gains from water heating, kWh/month                        | 80.0525  | 70.7369  | 74.9704  | 65.4560  | 63.1466  | 56.5664  | 55.5685  | 57.9507  | 58.7843  | 65.9529                                | 70.6277  | 79.1149 (65)   |

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

|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Metabolic gains (Table 5), Watts                                                    |          |          |          |          |          |          |          |          |          |          |          |               |
| (66)m                                                                               | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 108.0577 | 119.6353 | 108.0577 | 111.6596 | 108.0577 | 111.6596 | 108.0577 | 108.0577 | 111.6596 | 108.0577 | 111.6596 | 108.0577 (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 201.7819 | 203.8757 | 198.5993 | 187.3663 | 173.1867 | 159.8598 | 150.9567 | 148.8628 | 154.1393 | 165.3722 | 179.5519 | 192.8787 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614 (69)  |
| Pumps, fans                                                                         | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000 (70)   |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 (71) |
| Water heating gains (Table 5)                                                       | 107.5974 | 105.2632 | 100.7666 | 90.9111  | 84.8744  | 78.5645  | 74.6888  | 77.8907  | 81.6448  | 88.6463  | 98.0940  | 106.3373 (72) |
| Total internal gains                                                                | 477.8212 | 489.1586 | 467.8079 | 450.3213 | 426.5030 | 407.4682 | 391.0875 | 392.1955 | 404.8280 | 422.4606 | 449.6898 | 467.6580 (73) |

# Full SAP Calculation Printout



## 6. Solar gains

| [Jan] | Area<br>m2 |  |  |  | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W   |  |  |  |
|-------|------------|--|--|--|--------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|--|--|--|
| North | 6.0100     |  |  |  | 10.6334                        | 0.6300                            | 0.7000                             | 0.7700                       | 19.5307 (74) |  |  |  |
| South | 4.5600     |  |  |  | 46.7521                        | 0.6300                            | 0.7000                             | 0.7700                       | 65.1535 (78) |  |  |  |

|             |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Solar gains | 84.6842  | 144.0288 | 199.3456 | 255.4956 | 297.3167 | 300.9708 | 287.6859 | 255.0003 | 218.2422 | 159.5205 | 101.3227 | 72.5804 (83)  |
| Total gains | 562.5054 | 633.1873 | 667.1535 | 705.8169 | 723.8197 | 708.4390 | 678.7734 | 647.1958 | 623.0702 | 581.9810 | 551.0125 | 540.2383 (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                                                                         | 59.0343 | 59.2263 | 59.4158 | 60.3221 | 60.4948 | 61.3117 | 61.3117 | 61.4654 | 60.9945                   | 60.4948 | 60.1465 | 59.7867      |
| alpha                                                                       | 4.9356  | 4.9484  | 4.9611  | 5.0215  | 5.0330  | 5.0874  | 5.0874  | 5.0977  | 5.0663                    | 5.0330  | 5.0098  | 4.9858       |
| util living area                                                            | 0.9878  | 0.9771  | 0.9582  | 0.9043  | 0.7927  | 0.6076  | 0.4487  | 0.4885  | 0.7162                    | 0.9155  | 0.9758  | 0.9898 (86)  |
| MIT                                                                         | 19.8647 | 20.0548 | 20.2961 | 20.6155 | 20.8522 | 20.9705 | 20.9947 | 20.9920 | 20.9328                   | 20.6456 | 20.2142 | 19.8394 (87) |
| Th 2                                                                        | 20.0757 | 20.0784 | 20.0811 | 20.0937 | 20.0960 | 20.1070 | 20.1070 | 20.1090 | 20.1028                   | 20.0960 | 20.0913 | 20.0863 (88) |
| util rest of house                                                          | 0.9845  | 0.9712  | 0.9472  | 0.8795  | 0.7432  | 0.5320  | 0.3599  | 0.3974  | 0.6435                    | 0.8884  | 0.9685  | 0.9871 (89)  |
| MIT 2                                                                       | 18.7637 | 19.0054 | 19.3088 | 19.7047 | 19.9692 | 20.0889 | 20.1050 | 20.1058 | 20.0563                   | 19.7488 | 19.2182 | 18.7395 (90) |
| Living area fraction                                                        | 18.9613 | 19.1937 | 19.4860 | 19.8682 | 20.1277 | 20.2471 | 20.2647 | 20.2648 | fLA = Living area / (4) = | 19.9097 | 19.3969 | 0.1795 (91)  |
| MIT                                                                         | 18.9613 | 19.1937 | 19.4860 | 19.8682 | 20.1277 | 20.2471 | 20.2647 | 20.2648 | 20.2136                   | 19.9097 | 19.3969 | 18.9369 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |
| adjusted MIT                                                                | 18.9613 | 19.1937 | 19.4860 | 19.8682 | 20.1277 | 20.2471 | 20.2647 | 20.2648 | 20.2136                   | 19.9097 | 19.3969 | 18.9369 (93) |

## 8. Space heating requirement

|                                                                                |           |           |          |          |          |          |          |          |          |               |          |                |
|--------------------------------------------------------------------------------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|---------------|----------|----------------|
|                                                                                | Jan       | Feb       | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov      | Dec            |
| Utilisation                                                                    | 0.9793    | 0.9639    | 0.9384   | 0.8723   | 0.7451   | 0.5442   | 0.3757   | 0.4136   | 0.6531   | 0.8818        | 0.9613   | 0.9824 (94)    |
| Useful gains                                                                   | 550.8489  | 610.2986  | 626.0640 | 615.7014 | 539.3055 | 385.5627 | 255.0447 | 267.6676 | 406.9232 | 513.1724      | 529.6791 | 530.7461 (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                                                               | 1064.3866 | 1034.3359 | 936.7090 | 779.2724 | 597.0637 | 394.7439 | 256.1690 | 269.4833 | 429.5713 | 659.5558      | 876.2300 | 1056.4091 (97) |
| Space heating kWh                                                              | 382.0720  | 284.9530  | 231.1199 | 117.7711 | 42.9721  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 108.9093      | 249.5166 | 391.0933 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |          |          |          |          |          |          |          |               |          | 1808.4073      |
| 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                                                              | 382.0720  | 284.9530  | 231.1199 | 117.7711 | 42.9721  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 108.9093      | 249.5166 | 391.0933 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |          |          |          |          |          |          |          |               |          | 1808.4073      |
| Space heating per m2                                                           |           |           |          |          |          |          |          |          |          | (98c) / (4) = |          | 25.1377 (99)   |

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

|                                                                                                      |          |          |          |           |           |           |           |           |          |          |          |                 |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|-----------|-----------|-----------|-----------|-----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                |          |          |          |           |           |           |           |           |          |          |          | 0.0000 (201)    |
| Fraction of space heat from main system(s)                                                           |          |          |          |           |           |           |           |           |          |          |          | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                                                     |          |          |          |           |           |           |           |           |          |          |          | 92.4000 (206)   |
| Efficiency of main space heating system 2 (in %)                                                     |          |          |          |           |           |           |           |           |          |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                              |          |          |          |           |           |           |           |           |          |          |          | 0.0000 (208)    |
|                                                                                                      | Jan      | Feb      | Mar      | Apr       | May       | Jun       | Jul       | Aug       | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                                                            | 382.0720 | 284.9530 | 231.1199 | 117.7711  | 42.9721   | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 108.9093 | 249.5166 | 391.0933 (98)   |
| Space heating efficiency (main heating system 1)                                                     | 92.4000  | 92.4000  | 92.4000  | 92.4000   | 92.4000   | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 92.4000  | 92.4000  | 92.4000 (210)   |
| Space heating fuel (main heating system)                                                             | 413.4979 | 308.3907 | 250.1297 | 127.4579  | 46.5066   | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 117.8672 | 270.0397 | 423.2611 (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                                                                            | 224.7605 | 198.8310 | 211.5927 | 187.1316  | 182.0882  | 164.8441  | 163.3482  | 169.4719  | 170.9076 | 189.6331 | 200.4458 | 222.4713 (64)   |
| Efficiency of water heater (217)m                                                                    | 85.5081  | 85.1519  | 84.5710  | 83.4169   | 81.8111   | 80.3000   | 80.3000   | 80.3000   | 80.3000  | 83.2375  | 84.8518  | 85.5768 (216)   |
| Fuel for water heating, kWh/month                                                                    | 262.8529 | 233.5015 | 250.1953 | 224.3329  | 222.5714  | 205.2853  | 203.4225  | 211.0484  | 212.8363 | 227.8218 | 236.2305 | 259.9668 (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                                                                                             | 22.4523  | 18.0120  | 16.2178  | 11.8819   | 9.1779    | 7.4984    | 8.3724    | 10.8828   | 14.1356  | 18.5467  | 20.9485  | 23.0763 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |           |           |           |           |           |          |          |          |                 |
| (233a)m                                                                                              | -33.7590 | -47.6438 | -68.5569 | -77.1746  | -83.3056  | -77.8005  | -76.8549  | -72.5248  | -64.8761 | -54.5410 | -37.1385 | -29.1821 (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                                                                                              | -18.9082 | -39.8008 | -79.1499 | -118.9349 | -157.3101 | -158.0668 | -156.1907 | -132.2085 | -96.8660 | -56.9184 | -25.2463 | -14.9488 (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)   |

# Full SAP Calculation Printout



|                                                               |            |        |
|---------------------------------------------------------------|------------|--------|
| Annual totals kWh/year                                        |            |        |
| Space heating fuel - main system 1                            | 1957.1507  | (211)  |
| Space heating fuel - main system 2                            | 0.0000     | (213)  |
| Space heating fuel - secondary                                | 0.0000     | (215)  |
| Efficiency of water heater                                    | 80.3000    |        |
| Water heating fuel used                                       | 2750.0656  | (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)           | 181.2025   | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q) |            |        |
| PV generation                                                 | -1777.9074 | (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                           | 3196.5115  | (238)  |

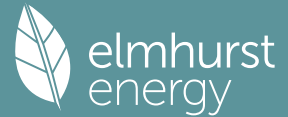
## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                               | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|-----------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1                 | 1957.1507          | 0.2100                        | 411.0017 (261)           |
| Total CO2 associated with community systems   |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                    | 2750.0656          | 0.2100                        | 577.5138 (264)           |
| Space and water heating                       |                    |                               | 988.5154 (265)           |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293 (267)            |
| Energy for lighting                           | 181.2025           | 0.1443                        | 26.1531 (268)            |
| Energy saving/generation technologies         |                    |                               |                          |
| PV Unit electricity used in dwelling          | -723.3579          | 0.1346                        | -97.3340                 |
| PV Unit electricity exported                  | -1054.5494         | 0.1259                        | -132.7510                |
| Total                                         |                    |                               | -230.0850 (269)          |
| Total CO2, kg/year                            |                    |                               | 796.5128 (272)           |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 11.0700 (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               | 1957.1507          | 1.1300                              | 2211.5803 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2750.0656          | 1.1300                              | 3107.5741 (278)            |
| Space and water heating                     |                    |                                     | 5319.1544 (279)            |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008 (281)             |
| Energy for lighting                         | 181.2025           | 1.5338                              | 277.9345 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -723.3579          | 1.4973                              | -1083.0870                 |
| PV Unit electricity exported                | -1054.5494         | 0.4621                              | -487.2871                  |
| Total                                       |                    |                                     | -1570.3740 (283)           |
| Total Primary energy kWh/year               |                    |                                     | 4156.8157 (286)            |
| Target Primary Energy Rate (TPER)           |                    |                                     | 57.7800 (287)              |

# Full SAP Calculation Printout



|                                    |                        |  |               |               |                |             |           |  |
|------------------------------------|------------------------|--|---------------|---------------|----------------|-------------|-----------|--|
| Property Reference                 | SAP VG 21-0282         |  |               |               | Issued on Date | 15/11/2024  |           |  |
| Assessment Reference               | Plot 37                |  |               | Prop Type Ref | SAP VG 21-0282 |             |           |  |
| Property                           |                        |  |               |               |                |             |           |  |
|                                    |                        |  |               |               |                |             |           |  |
| SAP Rating                         | 92 A                   |  | DER           | 10.93         |                | TER         | 11.07     |  |
| Environmental                      | 91 B                   |  | % DER < TER   |               |                |             | 1.26      |  |
| CO <sub>2</sub> Emissions (t/year) | 0.75                   |  | DFEE          | 27.30         |                | TFEE        | 30.37     |  |
| Compliance Check                   | See BREL               |  | % DFEE < TFEE |               |                |             | 10.09     |  |
| % DPER < TPER                      | 0.58                   |  | DPER          | 57.45         |                | TPER        | 57.78     |  |
|                                    |                        |  |               |               |                |             |           |  |
| Assessor Details                   | Miss Victoria Gartside |  |               |               |                | Assessor ID | AL30-0001 |  |
| 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> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Ground floor                                           | 35.9700 (1b)              | x 2.4000 (2b)                   | = 86.3280 (1b) - (3b)       |
| First floor                                            | 35.9700 (1c)              | x 2.6300 (2c)                   | = 94.6011 (1c) - (3c)       |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 71.9400                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 180.9291 (5)              |

## 2. Ventilation rate

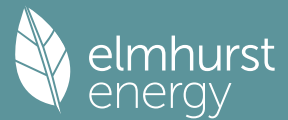
|                                                                                                    | m <sup>3</sup> per hour                 |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 3 * 10 = 30.0000 (7a)                   |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 30.0000 / (5) = 0.1658 (8)              |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 4.0000 (17)                             |
| Infiltration rate                                                                                  | 0.3658 (18)                             |
| Number of sides sheltered                                                                          | 2 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.3109 (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                                                                                         | 0.3964 | 0.3887 | 0.3809 | 0.3420 | 0.3343 | 0.2954 | 0.2954 | 0.2876 | 0.3109 | 0.3343 | 0.3498 | 0.3654 (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                                                                                            | 0.5786 | 0.5755 | 0.5725 | 0.5585 | 0.5559 | 0.5436 | 0.5436 | 0.5414 | 0.5483 | 0.5559 | 0.5612 | 0.5667 (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   |
|----------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------------|-----------------|
| Front door                                                     |                         |                            | 2.1400                    | 1.1000                        | 2.3540       |                                      | (26)            |
| Windows (Uw = 1.30)                                            |                         |                            | 10.5700                   | 1.2357                        | 13.0618      |                                      | (27)            |
| Heatloss Floor 1                                               |                         |                            | 35.9700                   | 0.1300                        | 4.6761       | 110.0000                             | 3956.7000 (28a) |
| Brick wall                                                     | 43.9600                 | 12.7100                    | 31.2500                   | 0.1900                        | 5.9375       | 110.0000                             | 3437.5000 (29a) |
| Plane roof                                                     | 35.9700                 |                            | 35.9700                   | 0.0900                        | 3.2373       | 9.0000                               | 323.7300 (30)   |
| Total net area of external elements Aum(A, m <sup>2</sup> )    |                         |                            | 115.9000                  |                               |              |                                      | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                            |                         |                            |                           | (26)...(30) + (32) =          | 29.2667      |                                      | (33)            |
| Party Wall 1                                                   |                         |                            | 82.7900                   | 0.0000                        | 0.0000       | 70.0000                              | 5795.3000 (32)  |
| Internal Wall 2                                                |                         |                            | 104.9400                  |                               |              | 9.0000                               | 944.4600 (32c)  |
| Internal Floor                                                 |                         |                            | 35.9700                   |                               |              | 18.0000                              | 647.4600 (32d)  |
| Internal Ceiling 1                                             |                         |                            | 35.9700                   |                               |              | 9.0000                               | 323.7300 (32e)  |
| Heat capacity Cm = Sum(A x k)                                  |                         |                            |                           |                               |              | (28)...(30) + (32) + (32a)...(32e) = | 15428.8800 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K |                         |                            |                           |                               |              |                                      | 214.4687 (35)   |
| List of Thermal Bridges                                        |                         |                            |                           |                               |              |                                      |                 |
| K1 Element                                                     |                         |                            |                           | Length                        | Psi-value    | Total                                |                 |
| E2 Other lintels (including other steel lintels)               |                         |                            |                           | 8.2500                        | 0.0240       | 0.1980                               |                 |

# Full SAP Calculation Printout



|                                                            |         |                       |              |
|------------------------------------------------------------|---------|-----------------------|--------------|
| E3 Sill                                                    | 5.6500  | 0.0220                | 0.1243       |
| E4 Jamb                                                    | 21.3000 | 0.0170                | 0.3621       |
| E5 Ground floor (normal)                                   | 8.7400  | 0.0920                | 0.8041       |
| E6 Intermediate floor within a dwelling                    | 8.7400  | 0.0010                | 0.0087       |
| E18 Party wall between dwellings                           | 20.1200 | 0.0400                | 0.8048       |
| P1 Party wall - Ground floor                               | 16.4600 | 0.0690                | 1.1357       |
| P2 Party wall - Intermediate floor within a dwelling       | 16.4600 | 0.0000                | 0.0000       |
| P4 Party wall - Roof (insulation at ceiling level)         | 16.4600 | 0.1010                | 1.6625       |
| E10 Eaves (insulation at ceiling level)                    | 8.7400  | 0.0600                | 0.5244       |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |         |                       | 5.6246 (36)  |
| Point Thermal Bridges                                      |         |                       | 0.0000       |
| Total fabric heat loss                                     |         | (33) + (36) + (36a) = | 34.8913 (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                                                               | 34.5454 | 34.3632 | 34.1846 | 33.3457 | 33.1888 | 32.4582 | 32.4582 | 32.3229 | 32.7396 | 33.1888 | 33.5063 | 33.8382 | (38) |
| Heat transfer coeff                                                 | 69.4367 | 69.2545 | 69.0759 | 68.2370 | 68.0801 | 67.3495 | 67.3495 | 67.2142 | 67.6309 | 68.0801 | 68.3976 | 68.7295 | (39) |
| Average = Sum(39)m / 12 =                                           |         |         |         |         |         |         |         |         |         |         |         | 68.2363 |      |
| HLP                                                                 | 0.9652  | 0.9627  | 0.9602  | 0.9485  | 0.9463  | 0.9362  | 0.9362  | 0.9343  | 0.9401  | 0.9463  | 0.9508  | 0.9554  | (40) |
| HLP (average)                                                       |         |         |         |         |         |         |         |         |         |         |         | 0.9485  |      |
| Days in mont                                                        | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31      |      |

|                                                                                |          |         |         |         |         |         |         |         |         |         |         |          |             |
|--------------------------------------------------------------------------------|----------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------|-------------|
| 4. Water heating energy requirements (kWh/year)                                |          |         |         |         |         |         |         |         |         |         |         |          |             |
| Assumed occupancy                                                              |          |         |         |         |         |         |         |         |         |         |         |          | 2.2923 (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                                                      | 27.0664  | 26.6644 | 26.0984 | 25.0546 | 24.2731 | 23.4065 | 22.9384 | 23.5005 | 24.1126 | 25.0399 | 26.1051 | 26.9749  | (42b)       |
| Hot water usage for other uses                                                 | 38.1053  | 36.7197 | 35.3340 | 33.9484 | 32.5627 | 31.1771 | 31.1771 | 32.5627 | 33.9484 | 35.3340 | 36.7197 | 38.1053  | (42c)       |
| Average daily hot water use (litres/day)                                       |          |         |         |         |         |         |         |         |         |         |         | 59.7360  | (43)        |
| Daily hot water use                                                            | Jan      | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec      |             |
| Energy conte                                                                   | 65.1717  | 63.3841 | 61.4324 | 59.0030 | 56.8358 | 54.5836 | 54.1155 | 56.0633 | 58.0609 | 60.3739 | 62.8247 | 65.0802  | (44)        |
| Energy content (annual)                                                        | 103.2161 | 90.2581 | 94.4193 | 80.7722 | 76.5120 | 67.1169 | 65.4480 | 69.4180 | 71.5949 | 81.9268 | 89.5053 | 101.8999 | (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:                                                            |          |         |         |         |         |         |         |         |         |         |         |          |             |
| 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                | 87.7336  | 76.7194 | 80.2564 | 68.6563 | 65.0352 | 57.0494 | 55.6308 | 59.0053 | 60.8557 | 69.6378 | 76.0795 | 86.6149  | (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                                                                | 87.7336  | 76.7194 | 80.2564 | 68.6563 | 65.0352 | 57.0494 | 55.6308 | 59.0053 | 60.8557 | 69.6378 | 76.0795 | 86.6149  | (64)        |
| 12Total per year (kWh/year)                                                    |          |         |         |         |         |         |         |         |         |         |         | 843.2744 | (64)        |
| Electric shower(s)                                                             | 50.1752  | 44.7065 | 48.8178 | 46.5863 | 47.4604 | 45.2726 | 46.7817 | 47.4604 | 46.5863 | 48.8178 | 47.8999 | 50.1752  | (64a)       |
| Heat gains from water heating, kWh/month                                       | 34.4772  | 30.3565 | 32.2686 | 28.8107 | 28.1239 | 25.5805 | 25.6031 | 26.6164 | 26.8605 | 29.6139 | 30.9949 | 34.1975  | (65)        |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |         |         |         |         |         |         |         |         |         |         | 570.7403 | (64a)       |

|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |          |      |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| 5. Internal gains (see Table 5 and 5a)                                              |          |          |          |          |          |          |          |          |          |          |          |          |      |
| Metabolic gains (Table 5), Watts                                                    | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |      |
| (66)m                                                                               | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 108.0577 | 119.6353 | 108.0577 | 111.6596 | 108.0577 | 111.6596 | 108.0577 | 108.0577 | 111.6596 | 108.0577 | 111.6596 | 108.0577 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 201.7819 | 203.8757 | 198.5993 | 187.3663 | 173.1867 | 159.8598 | 150.9567 | 148.8628 | 154.1393 | 165.3722 | 179.5519 | 192.8787 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | (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)                                 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | (71) |
| Water heating gains (Table 5)                                                       | 46.3403  | 45.1733  | 43.3717  | 40.0148  | 37.8009  | 35.5285  | 34.4128  | 35.7748  | 37.3062  | 39.8036  | 43.0484  | 45.9644  | (72) |
| Total internal gains                                                                | 413.5642 | 426.0687 | 407.4130 | 396.4250 | 376.4296 | 364.4322 | 350.8115 | 350.0796 | 360.4894 | 370.6179 | 391.6442 | 404.2851 | (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 |          |          |          |          |          |          |          |      |
| North          | 6.0100   | 10.6334    | 0.7300        | 0.7000        | 0.7700   | 22.6308  | (74)     |          |          |          |          |          |      |
| South          | 4.5600   | 46.7521    | 0.7300        | 0.7000        | 0.7700   | 75.4953  | (78)     |          |          |          |          |          |      |
| Solar gains    | 98.1261  | 166.8905   | 230.9878      | 296.0505      | 344.5098 | 348.7439 | 333.3504 | 295.4765 | 252.8838 | 184.8412 | 117.4057 | 84.1010  | (83) |
| Total gains    | 511.6903 | 592.9591   | 638.4007      | 692.4755      | 720.9394 | 713.1761 | 684.1618 | 645.5561 | 613.3733 | 555.4590 | 509.0499 | 488.3862 | (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                                                                         | 61.7224 | 61.8848 | 62.0448 | 62.8075 | 62.9523 | 63.6352 | 63.6352 | 63.7633 | 63.3704 | 62.9523 | 62.6601 | 62.3575      |
| alpha                                                                       | 5.1148  | 5.1257  | 5.1363  | 5.1872  | 5.1968  | 5.2423  | 5.2423  | 5.2509  | 5.2247  | 5.1968  | 5.1773  | 5.1572       |
| util living area                                                            | 0.9914  | 0.9812  | 0.9617  | 0.9023  | 0.7797  | 0.5866  | 0.4301  | 0.4737  | 0.7074  | 0.9215  | 0.9813  | 0.9931 (86)  |
| MIT                                                                         | 19.8618 | 20.0692 | 20.3229 | 20.6484 | 20.8756 | 20.9777 | 20.9963 | 20.9940 | 20.9426 | 20.6563 | 20.2103 | 19.8291 (87) |
| Th 2                                                                        | 20.1124 | 20.1146 | 20.1166 | 20.1264 | 20.1283 | 20.1368 | 20.1368 | 20.1384 | 20.1335 | 20.1283 | 20.1246 | 20.1207 (88) |
| util rest of house                                                          | 0.9891  | 0.9763  | 0.9516  | 0.8776  | 0.7304  | 0.5144  | 0.3473  | 0.3876  | 0.6365  | 0.8961  | 0.9756  | 0.9913 (89)  |
| MIT 2                                                                       | 19.0798 | 19.2857 | 19.5349 | 19.8491 | 20.0455 | 20.1262 | 20.1358 | 20.1365 | 20.1026 | 19.8639 | 19.4346 | 19.0539 (90) |
| Living area fraction                                                        | 19.2201 | 19.4263 | 19.6763 | 19.9926 | 20.1945 | 20.2790 | 20.2902 | 20.2904 | 20.2533 | 20.0061 | 19.5738 | 19.1931 (92) |
| MIT                                                                         | 19.2201 | 19.4263 | 19.6763 | 19.9926 | 20.1945 | 20.2790 | 20.2902 | 20.2904 | 20.2533 | 20.0061 | 19.5738 | 19.1931 (93) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 19.2201 | 19.4263 | 19.6763 | 19.9926 | 20.1945 | 20.2790 | 20.2902 | 20.2904 | 20.2533 | 20.0061 | 19.5738 | 19.1931 (93) |

## 8. Space heating requirement

|                                                                                |           |           |          |          |          |          |          |          |          |               |          |                |
|--------------------------------------------------------------------------------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|---------------|----------|----------------|
|                                                                                | Jan       | Feb       | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov      | Dec            |
| Utilisation                                                                    | 0.9861    | 0.9716    | 0.9455   | 0.8733   | 0.7344   | 0.5266   | 0.3621   | 0.4030   | 0.6469   | 0.8919        | 0.9710   | 0.9887 (94)    |
| Useful gains                                                                   | 504.5758  | 576.0910  | 603.6199 | 604.7050 | 529.4590 | 375.5723 | 247.7482 | 260.1337 | 396.7945 | 495.4304      | 494.2748 | 482.8669 (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                                                               | 1036.0035 | 1006.0136 | 910.1630 | 756.9234 | 578.3051 | 382.4794 | 248.5328 | 261.4907 | 416.1566 | 640.3663      | 853.1765 | 1030.4654 (97) |
| Space heating kWh                                                              | 395.3822  | 288.9080  | 228.0681 | 109.5972 | 36.3415  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 107.8323      | 258.4093 | 407.4133 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |          |          |          |          |          |          |          |               |          | 1831.9518      |
| 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                                                              | 395.3822  | 288.9080  | 228.0681 | 109.5972 | 36.3415  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 107.8323      | 258.4093 | 407.4133 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |          |          |          |          |          |          |          |               |          | 1831.9518      |
| Space heating per m2                                                           |           |           |          |          |          |          |          |          |          | (98c) / (4) = |          | 25.4650 (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  | 633.0853 | 498.3863 | 510.8280 | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (100)   |
| Utilisation                                         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.9163   | 0.9587   | 0.9439   | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (101)   |
| Useful loss                                         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 580.0756 | 477.7867 | 482.1791 | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (102)   |
| Total gains                                         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 788.0943 | 756.4594 | 713.4912 | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (103)   |
| Space cooling kWh                                   | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 149.7735 | 207.3325 | 172.0962 | 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  | 37.4434  | 51.8331  | 43.0241  | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (107)   |
| Space cooling requirement                           |        |        |        |        |         |          |          |          |                          |         |        | 132.3005 (107) |
| Energy for space heating                            |        |        |        |        |         |          |          |          |                          |         |        | 25.4650 (99)   |
| Energy for space cooling                            |        |        |        |        |         |          |          |          |                          |         |        | 1.8390 (108)   |
| Total                                               |        |        |        |        |         |          |          |          |                          |         |        | 27.3040 (109)  |
| Fabric Energy Efficiency (DFEE)                     |        |        |        |        |         |          |          |          |                          |         |        | 27.3 (109)     |

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

### CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

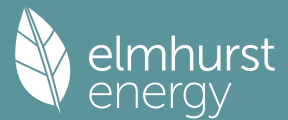
## 1. Overall dwelling characteristics

|                                                        |              |                                   |                                   |
|--------------------------------------------------------|--------------|-----------------------------------|-----------------------------------|
|                                                        | Area (m2)    | Storey height (m)                 | Volume (m3)                       |
| Ground floor                                           | 35.9700 (1b) | x                                 | 2.4000 (2b) = 86.3280 (1b) - (3b) |
| First floor                                            | 35.9700 (1c) | x                                 | 2.6300 (2c) = 94.6011 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 71.9400      |                                   | (4)                               |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 180.9291 (5)                      |

## 2. Ventilation rate

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

# Full SAP Calculation Printout



Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 30.0000 / (5) = 0.1658 (8)  
Pressure test Yes  
Pressure Test Method Blower Door  
Measured/design AP50 5.0000 (17)  
Infiltration rate 0.4158 (18)  
Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)  
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3534 (21)

|                                                                                                         |        |        |        |        |        |        |        |        |        |        |        |              |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|                                                                                                         | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate                                                                                         | 0.4506 | 0.4418 | 0.4330 | 0.3888 | 0.3799 | 0.3358 | 0.3358 | 0.3269 | 0.3534 | 0.3799 | 0.3976 | 0.4153 (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                                                                                            | 0.6015 | 0.5976 | 0.5937 | 0.5756 | 0.5722 | 0.5564 | 0.5564 | 0.5534 | 0.5625 | 0.5722 | 0.5791 | 0.5862 (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 |
|-------------------------------------------------|-------------|----------------|---------------|------------------|----------------------|-------------------|---------------|
| TER Opaque door                                 |             |                | 2.1400        | 1.0000           | 2.1400               |                   | (26)          |
| TER Opening Type (Uw = 1.20)                    |             |                | 10.5700       | 1.1450           | 12.1031              |                   | (27)          |
| Heatloss Floor 1                                |             |                | 35.9700       | 0.1300           | 4.6761               |                   | (28a)         |
| Brick wall                                      | 43.9600     | 12.7100        | 31.2500       | 0.1800           | 5.6250               |                   | (29a)         |
| Plane roof                                      | 35.9700     |                | 35.9700       | 0.1100           | 3.9567               |                   | (30)          |
| Total net area of external elements Aum (A, m2) |             |                | 115.9000      |                  |                      |                   | (31)          |
| Fabric heat loss, W/K = Sum (A x U)             |             |                |               |                  | (26)...(30) + (32) = | 28.5009           | (33)          |
| Party Wall 1                                    |             |                | 82.7900       | 0.0000           | 0.0000               |                   | (32)          |

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 214.4687 (35)

### List of Thermal Bridges

| K1 Element                                           | Length  | Psi-value | Total  |
|------------------------------------------------------|---------|-----------|--------|
| E2 Other lintels (including other steel lintels)     | 8.2500  | 0.0500    | 0.4125 |
| E3 Sill                                              | 5.6500  | 0.0500    | 0.2825 |
| E4 Jamb                                              | 21.3000 | 0.0500    | 1.0650 |
| E5 Ground floor (normal)                             | 8.7400  | 0.1600    | 1.3984 |
| E6 Intermediate floor within a dwelling              | 8.7400  | 0.0000    | 0.0000 |
| E8 Party wall between dwellings                      | 20.1200 | 0.0600    | 1.2072 |
| P1 Party wall - Ground floor                         | 16.4600 | 0.0800    | 1.3168 |
| P2 Party wall - Intermediate floor within a dwelling | 16.4600 | 0.0000    | 0.0000 |
| P4 Party wall - Roof (insulation at ceiling level)   | 16.4600 | 0.1200    | 1.9752 |
| E10 Eaves (insulation at ceiling level)              | 8.7400  | 0.0600    | 0.5244 |

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.1820 (36)

### Point Thermal Bridges

Total fabric heat loss (33) + (36) + (36a) = 36.6829 (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          |
|                           | 35.9157 | 35.6803 | 35.4495 | 34.3657 | 34.1629 | 33.2190 | 33.2190 | 33.0441 | 33.5826 | 34.1629 | 34.5731 | 35.0020 (38) |
| Heat transfer coeff       | 72.5985 | 72.3631 | 72.1324 | 71.0486 | 70.8458 | 69.9018 | 69.9018 | 69.7270 | 70.2654 | 70.8458 | 71.2560 | 71.6849 (39) |
| Average = Sum(39)m / 12 = |         |         |         |         |         |         |         |         |         |         |         | 71.0476      |

|               |        |        |        |        |        |        |        |        |        |        |        |             |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
| HLP           | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec         |
|               | 1.0092 | 1.0059 | 1.0027 | 0.9876 | 0.9848 | 0.9717 | 0.9717 | 0.9692 | 0.9767 | 0.9848 | 0.9905 | 0.9965 (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 0.9876      |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31          |

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

Assumed occupancy 2.2923 (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 27.0664 26.6644 26.0984 25.0546 24.2731 23.4065 22.9384 23.5005 24.1126 25.0399 26.1051 26.9749 (42b)

Hot water usage for other uses 38.1053 36.7197 35.3340 33.9484 32.5627 31.1771 31.1771 32.5627 33.9484 35.3340 36.7197 38.1053 (42c)

Average daily hot water use (litres/day) 59.7360 (43)

|                                        |          |         |         |         |         |         |         |         |         |                    |         |               |
|----------------------------------------|----------|---------|---------|---------|---------|---------|---------|---------|---------|--------------------|---------|---------------|
| Daily hot water use                    | Jan      | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct                | Nov     | Dec           |
|                                        | 65.1717  | 63.3841 | 61.4324 | 59.0030 | 56.8358 | 54.5836 | 54.1155 | 56.0633 | 58.0609 | 60.3739            | 62.8247 | 65.0802 (44)  |
| Energy conte                           | 103.2161 | 90.2581 | 94.4193 | 80.7722 | 76.5120 | 67.1169 | 65.4480 | 69.4180 | 71.5949 | 81.9268            | 89.5053 | 101.8999 (45) |
| Energy content (annual)                |          |         |         |         |         |         |         |         |         | Total = Sum(45)m = |         | 992.0875      |
| Distribution loss (46)m = 0.15 x (45)m | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000             | 0.0000  | 0.0000 (46)   |

Water storage loss:  
Total storage loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)

If cylinder contains dedicated solar storage 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)

Primary loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (59)

Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)

Total heat required for water heating calculated for each month 87.7336 76.7194 80.2564 68.6563 65.0352 57.0494 55.6308 59.0053 60.8557 69.6378 76.0795 86.6149 (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)

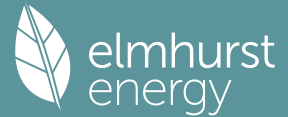
Output from w/h 87.7336 76.7194 80.2564 68.6563 65.0352 57.0494 55.6308 59.0053 60.8557 69.6378 76.0795 86.6149 (64)

12Total per year (kWh/year) Total per year (kWh/year) = Sum(64)m = 843.2744 (64)

Electric shower(s) 50.1752 44.7065 48.8178 46.5863 47.4604 45.2726 46.7817 47.4604 46.5863 48.8178 47.8999 50.1752 (64a)

Heat gains from water heating, kWh/month 34.4772 30.3565 32.2686 28.8107 28.1239 25.5805 25.6031 26.6164 26.8605 29.6139 30.9949 34.1975 (65)

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## 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                                                                               | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 108.0577 | 119.6353 | 108.0577 | 111.6596 | 108.0577 | 111.6596 | 108.0577 | 108.0577 | 111.6596 | 108.0577 | 111.6596 | 108.0577 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 201.7819 | 203.8757 | 198.5993 | 187.3663 | 173.1867 | 159.8598 | 150.9567 | 148.8628 | 154.1393 | 165.3722 | 179.5519 | 192.8787 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | (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)                                 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | (71) |
| Water heating gains (Table 5)                                                       | 46.3403  | 45.1733  | 43.3717  | 40.0148  | 37.8009  | 35.5285  | 34.4128  | 35.7748  | 37.3062  | 39.8036  | 43.0484  | 45.9644  | (72) |
| Total internal gains                                                                | 413.5642 | 426.0687 | 407.4130 | 396.4250 | 376.4296 | 364.4322 | 350.8115 | 350.0796 | 360.4894 | 370.6179 | 391.6442 | 404.2851 | (73) |

## 6. Solar gains

| [Jan]       |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d |          |          | Gains<br>W   |               |
|-------------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|----------|----------|--------------|---------------|
| North       |          |          |          | 6.0100     | 10.6334                        | 0.6300                            | 0.7000                             | 0.7700                       |          |          | 19.5307 (74) |               |
| South       |          |          |          | 4.5600     | 46.7521                        | 0.6300                            | 0.7000                             | 0.7700                       |          |          | 65.1535 (78) |               |
|             |          |          |          |            |                                |                                   |                                    |                              |          |          |              |               |
| Solar gains | 84.6842  | 144.0288 | 199.3456 | 255.4956   | 297.3167                       | 300.9708                          | 287.6859                           | 255.0003                     | 218.2422 | 159.5205 | 101.3227     | 72.5804 (83)  |
| Total gains | 498.2484 | 570.0974 | 606.7586 | 651.9206   | 673.7463                       | 665.4030                          | 638.4974                           | 605.0799                     | 578.7316 | 530.1383 | 492.9669     | 476.8655 (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     | Dec     |              |
|------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| tau                    | 59.0343 | 59.2263 | 59.4158 | 60.3221 | 60.4948 | 61.3117 | 61.3117 | 61.4654 | 60.9945 | 60.4948 | 60.1465 | 59.7867 | 21.0000 (85) |
| alpha                  | 4.9356  | 4.9484  | 4.9611  | 5.0215  | 5.0330  | 5.0874  | 5.0874  | 5.0977  | 5.0663  | 5.0330  | 5.0098  | 4.9858  |              |
| util living area       | 0.9927  | 0.9849  | 0.9707  | 0.9257  | 0.8248  | 0.6402  | 0.4756  | 0.5201  | 0.7535  | 0.9380  | 0.9845  | 0.9940  | (86)         |
| MIT                    | 19.7592 | 19.9560 | 20.2090 | 20.5551 | 20.8207 | 20.9628 | 20.9932 | 20.9894 | 20.9152 | 20.5838 | 20.1234 | 19.7342 | (87)         |
| Th 2                   | 20.0757 | 20.0784 | 20.0811 | 20.0937 | 20.0960 | 20.1070 | 20.1070 | 20.1090 | 20.1028 | 20.0960 | 20.0913 | 20.0863 | (88)         |
| util rest of house     | 0.9906  | 0.9809  | 0.9625  | 0.9048  | 0.7783  | 0.5629  | 0.3821  | 0.4242  | 0.6822  | 0.9162  | 0.9796  | 0.9924  | (89)         |
| MIT 2                  | 18.9491 | 19.1458 | 19.3962 | 19.7369 | 19.9736 | 20.0889 | 20.1050 | 20.1056 | 20.0558 | 19.7710 | 19.3228 | 18.9326 | (90)         |
| Living area fraction   | 19.0945 | 19.2911 | 19.5421 | 19.8837 | 20.1257 | 20.2457 | 20.2644 | 20.2642 | 20.2100 | 19.9169 | 19.4665 | 19.0765 | (91)         |
| MIT                    | 19.0945 | 19.2911 | 19.5421 | 19.8837 | 20.1257 | 20.2457 | 20.2644 | 20.2642 | 20.2100 | 19.9169 | 19.4665 | 19.0765 | (92)         |
| Temperature adjustment |         |         |         |         |         |         |         |         |         |         |         | 0.0000  |              |
| adjusted MIT           | 19.0945 | 19.2911 | 19.5421 | 19.8837 | 20.1257 | 20.2457 | 20.2644 | 20.2642 | 20.2100 | 19.9169 | 19.4665 | 19.0765 | (93)         |

## 8. Space heating requirement

|                                                                                | Jan       | Feb       | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec       |       |
|--------------------------------------------------------------------------------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-------|
| Utilisation                                                                    | 0.9878    | 0.9764    | 0.9565   | 0.8991   | 0.7800   | 0.5754   | 0.3989   | 0.4413   | 0.6914   | 0.9110   | 0.9752   | 0.9899    | (94)  |
| Useful gains                                                                   | 492.1553  | 556.6378  | 580.3699 | 586.1639 | 525.5175 | 382.8993 | 254.6691 | 267.0064 | 400.1418 | 482.9348 | 480.7614 | 472.0590  | (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                                                               | 1074.0585 | 1041.3882 | 940.7577 | 780.3793 | 596.9220 | 394.6462 | 256.1463 | 269.4420 | 429.3226 | 660.0602 | 881.1863 | 1066.4184 | (97)  |
| Space heating kWh                                                              | 432.9359  | 325.7523  | 268.1285 | 139.8351 | 53.1249  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 131.7813 | 288.3060 | 442.2034  | (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |          |          |          |          |          |          |          |          |          | 2082.0674 |       |
| 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                                                              | 432.9359  | 325.7523  | 268.1285 | 139.8351 | 53.1249  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 131.7813 | 288.3060 | 442.2034  | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |          |          |          |          |          |          |          |          |          | 2082.0674 |       |
| Space heating per m <sup>2</sup>                                               |           |           |          |          |          |          |          |          |          |          |          | 28.9417   | (99)  |

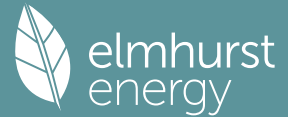
## 8c. Space cooling requirement

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  | 657.0770 | 517.2734 | 529.9252 | 0.0000                   | 0.0000  | 0.0000 | 0.0000   | (100) |
| Utilisation                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.8775   | 0.9344   | 0.9153   | 0.0000                   | 0.0000  | 0.0000 | 0.0000   | (101) |
| Useful loss                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 576.5615 | 483.3484 | 485.0485 | 0.0000                   | 0.0000  | 0.0000 | 0.0000   | (102) |
| Total gains                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 732.2556 | 703.0853 | 666.1813 | 0.0000                   | 0.0000  | 0.0000 | 0.0000   | (103) |
| Space cooling kWh                | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 112.0997 | 163.4843 | 134.7629 | 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  | 28.0249  | 40.8711  | 33.6907  | 0.0000                   | 0.0000  | 0.0000 | 0.0000   | (107) |
| Space cooling requirement        |        |        |        |        |         |          |          |          |                          |         |        | 102.5867 | (107) |
| Energy for space heating         |        |        |        |        |         |          |          |          |                          |         |        | 28.9417  | (99)  |
| Energy for space cooling         |        |        |        |        |         |          |          |          |                          |         |        | 1.4260   | (108) |
| Total                            |        |        |        |        |         |          |          |          |                          |         |        | 30.3677  | (109) |
| Fabric Energy Efficiency (TFEE)  |        |        |        |        |         |          |          |          |                          |         |        | 30.4     | (109) |



# Full SAP Calculation Printout



|                                    |                        |               |               |                |                |            |
|------------------------------------|------------------------|---------------|---------------|----------------|----------------|------------|
| Property Reference                 | SAP VG 21-0282         |               |               |                | Issued on Date | 15/11/2024 |
| Assessment Reference               | Plot 37                |               | Prop Type Ref | SAP VG 21-0282 |                |            |
| Property                           |                        |               |               |                |                |            |
|                                    |                        |               |               |                |                |            |
| SAP Rating                         | 92 A                   | DER           | 10.93         | TER            | 11.07          |            |
| Environmental                      | 91 B                   | % DER < TER   |               |                |                | 1.26       |
| CO <sub>2</sub> Emissions (t/year) | 0.75                   | DFEE          | 27.30         | TFEE           | 30.37          |            |
| Compliance Check                   | See BREL               | % DFEE < TFEE |               |                |                | 10.09      |
| % DPER < TPER                      | 0.58                   | DPER          | 57.45         | TPER           | 57.78          |            |
|                                    |                        |               |               |                |                |            |
| Assessor Details                   | Miss Victoria Gartside |               |               |                | Assessor ID    | AL30-0001  |
| 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> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Ground floor                                           | 35.9700 (1b)              | x 2.4000 (2b)                   | = 86.3280 (1b) - (3b)       |
| First floor                                            | 35.9700 (1c)              | x 2.6300 (2c)                   | = 94.6011 (1c) - (3c)       |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 71.9400                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 180.9291 (5)              |

## 2. Ventilation rate

|                                                                                                    | m <sup>3</sup> per hour                 |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 3 * 10 = 30.0000 (7a)                   |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Air changes per hour                                                                               |                                         |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 30.0000 / (5) = 0.1658 (8)              |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 4.0000 (17)                             |
| Infiltration rate                                                                                  | 0.3658 (18)                             |
| Number of sides sheltered                                                                          | 2 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.3109 (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 | 0.3964 | 0.3887 | 0.3809 | 0.3420 | 0.3343 | 0.2954 | 0.2954 | 0.2876 | 0.3109 | 0.3343 | 0.3498 | 0.3654 (22b) |
| Effective ac    | 0.5786 | 0.5755 | 0.5725 | 0.5585 | 0.5559 | 0.5436 | 0.5436 | 0.5414 | 0.5483 | 0.5559 | 0.5612 | 0.5667 (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   |
|----------------------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------------|-----------------|
| Front door                                                                 |                         |                            | 2.1400                    | 1.1000                        | 2.3540       |                                      | (26)            |
| Windows (U <sub>w</sub> = 1.30)                                            |                         |                            | 10.5700                   | 1.2357                        | 13.0618      |                                      | (27)            |
| Heatloss Floor 1                                                           |                         |                            | 35.9700                   | 0.1300                        | 4.6761       | 110.0000                             | 3956.7000 (28a) |
| Brick wall                                                                 | 43.9600                 | 12.7100                    | 31.2500                   | 0.1900                        | 5.9375       | 110.0000                             | 3437.5000 (29a) |
| Plane roof                                                                 | 35.9700                 |                            | 35.9700                   | 0.0900                        | 3.2373       | 9.0000                               | 323.7300 (30)   |
| Total net area of external elements A <sub>um</sub> (A, m <sup>2</sup> )   |                         |                            | 115.9000                  |                               |              |                                      | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                                        |                         |                            |                           | (26)...(30) + (32) =          | 29.2667      |                                      | (33)            |
| Party Wall 1                                                               |                         |                            | 82.7900                   | 0.0000                        | 0.0000       | 70.0000                              | 5795.3000 (32)  |
| Internal Wall 2                                                            |                         |                            | 104.9400                  |                               |              | 9.0000                               | 944.4600 (32c)  |
| Internal Floor                                                             |                         |                            | 35.9700                   |                               |              | 18.0000                              | 647.4600 (32d)  |
| Internal Ceiling 1                                                         |                         |                            | 35.9700                   |                               |              | 9.0000                               | 323.7300 (32e)  |
| Heat capacity C <sub>m</sub> = Sum(A x k)                                  |                         |                            |                           |                               |              | (28)...(30) + (32) + (32a)...(32e) = | 15428.8800 (34) |
| Thermal mass parameter (TMP = C <sub>m</sub> / TFA) in kJ/m <sup>2</sup> K |                         |                            |                           |                               |              |                                      | 214.4687 (35)   |
| List of Thermal Bridges                                                    |                         |                            |                           |                               |              |                                      |                 |
| K1 Element                                                                 |                         |                            |                           | Length                        | Psi-value    | Total                                |                 |
| E2 Other lintels (including other steel lintels)                           |                         |                            |                           | 8.2500                        | 0.0240       | 0.1980                               |                 |
| E3 Sill                                                                    |                         |                            |                           | 5.6500                        | 0.0220       | 0.1243                               |                 |
| E4 Jamb                                                                    |                         |                            |                           | 21.3000                       | 0.0170       | 0.3621                               |                 |



|                                                                     |         |         |         |         |         |         |         |         |         |         |         |              |
|---------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| 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                                                               | 34.5454 | 34.3632 | 34.1846 | 33.3457 | 33.1888 | 32.4582 | 32.4582 | 32.3229 | 32.7396 | 33.1888 | 33.5063 | 33.8382 (38) |
| Heat transfer coeff                                                 | 69.4367 | 69.2545 | 69.0759 | 68.2370 | 68.0801 | 67.3495 | 67.3495 | 67.2142 | 67.6309 | 68.0801 | 68.3976 | 68.7295 (39) |
| Average = Sum(39)m / 12 =                                           |         |         |         |         |         |         |         |         |         |         |         | 68.2363      |
| HLP                                                                 | 0.9652  | 0.9627  | 0.9602  | 0.9485  | 0.9463  | 0.9362  | 0.9362  | 0.9343  | 0.9401  | 0.9463  | 0.9508  | 0.9554 (40)  |
| HLP (average)                                                       |         |         |         |         |         |         |         |         |         |         |         | 0.9485       |
| Days in mont                                                        | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31           |

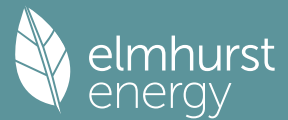
|                                                                 |                                        |          |          |          |          |          |          |          |          |          |          |                |
|-----------------------------------------------------------------|----------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Assumed occupancy                                               |                                        |          |          |          |          |          |          |          |          |          |          | 2.2923 (42)    |
| Hot water usage for mixer showers                               | 62.6538                                | 61.7122  | 60.3402  | 57.7150  | 55.7777  | 53.6172  | 52.3892  | 53.7509  | 55.2435  | 57.5632  | 60.2448  | 62.4137 (42a)  |
| Hot water usage for baths                                       | 27.0664                                | 26.6644  | 26.0984  | 25.0546  | 24.2731  | 23.4065  | 22.9384  | 23.5005  | 24.1126  | 25.0399  | 26.1051  | 26.9749 (42b)  |
| Hot water usage for other uses                                  | 38.1053                                | 36.7197  | 35.3340  | 33.9484  | 32.5627  | 31.1771  | 31.1771  | 32.5627  | 33.9484  | 35.3340  | 36.7197  | 38.1053 (42c)  |
| Average daily hot water use (litres/day)                        |                                        |          |          |          |          |          |          |          |          |          |          | 117.5007 (43)  |
|                                                                 | Jan                                    | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec            |
| Daily hot water use                                             | 127.8255                               | 125.0963 | 121.7725 | 116.7180 | 112.6135 | 108.2008 | 106.5048 | 109.8142 | 113.3045 | 117.9371 | 123.0695 | 127.4939 (44)  |
| Energy content (annual)                                         | 202.4443                               | 178.1355 | 187.1599 | 159.7811 | 151.5995 | 133.0456 | 128.8083 | 135.9729 | 139.7158 | 160.0395 | 175.3350 | 199.6247 (45)  |
| Distribution loss (46)m = 0.15 x (45)m                          |                                        |          |          |          |          |          |          |          |          |          |          | 1951.6620      |
| Water storage loss:                                             | 30.3666                                | 26.7203  | 28.0740  | 23.9672  | 22.7399  | 19.9568  | 19.3212  | 20.3959  | 20.9574  | 24.0059  | 26.3003  | 29.9437 (46)   |
| 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                                                      | 0.6873                                 | 0.6242   | 0.6807   | 0.6134   | 0.6069   | 0.5561   | 0.5472   | 0.5596   | 0.5555   | 0.6066   | 0.6286   | 0.6804 (61)    |
| Total heat required for water heating calculated for each month | 203.1316                               | 178.7597 | 187.8406 | 160.3946 | 152.2064 | 133.6017 | 129.3554 | 136.5325 | 140.2712 | 160.6461 | 175.9637 | 200.3051 (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                                                 | 203.1316                               | 178.7597 | 187.8406 | 160.3946 | 152.2064 | 133.6017 | 129.3554 | 136.5325 | 140.2712 | 160.6461 | 175.9637 | 200.3051 (64)  |
| 12Total per year (kWh/year)                                     | Total per year (kWh/year) = Sum(64)m = |          |          |          |          |          |          |          |          |          |          | 1959.0085 (64) |
| Electric shower(s)                                              | 0.0000                                 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (64a)   |
| Heat gains from water heating, kWh/month                        | 67.4846                                | 59.3861  | 62.4008  | 53.2806  | 50.5586  | 44.3767  | 42.9655  | 45.3509  | 46.5944  | 53.3648  | 58.4561  | 66.5453 (65)   |

| Metabolic gains (Table 5), Watts                                                    |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
|                                                                                     | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
| (66)m                                                                               | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 108.0577 | 119.6353 | 108.0577 | 111.6596 | 108.0577 | 111.6596 | 108.0577 | 108.0577 | 111.6596 | 108.0577 | 111.6596 | 108.0577 (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 201.7819 | 203.8757 | 198.5993 | 187.3663 | 173.1867 | 159.8598 | 150.9567 | 148.8628 | 154.1393 | 165.3722 | 179.5519 | 192.8787 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614 (69)  |
| Pumps, fans                                                                         | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 3.0000   | 3.0000   | 3.0000 (70)   |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 (71) |
| Water heating gains (Table 5)                                                       | 90.7051  | 88.3722  | 83.8721  | 74.0008  | 67.9550  | 61.6343  | 57.7494  | 60.9555  | 64.7144  | 71.7269  | 81.1890  | 89.4426 (72)  |
| Total internal gains                                                                | 460.9289 | 472.2675 | 450.9133 | 433.4110 | 409.5837 | 390.5380 | 374.1480 | 375.2603 | 387.8976 | 405.5411 | 432.7847 | 450.7633 (73) |

| [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 |              |          |               |
| North       |          |          |          | 6.0100   | 10.6334    |          | 0.7300        |               | 0.7700   | 22.6308 (74) |          |               |
| South       |          |          |          | 4.5600   | 46.7521    |          | 0.7300        |               | 0.7700   | 75.4953 (78) |          |               |
|             |          |          |          |          |            |          |               |               |          |              |          |               |
| Solar gains | 98.1261  | 166.8905 | 230.9878 | 296.0505 | 344.5098   | 348.7439 | 333.3504      | 295.4765      | 252.8838 | 184.8412     | 117.4057 | 84.1010 (83)  |
| Total gains | 559.0550 | 639.1580 | 681.9011 | 729.4615 | 754.0935   | 739.2819 | 707.4984      | 670.7368      | 640.7814 | 590.3823     | 550.1904 | 534.8643 (84) |

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# Full SAP Calculation Printout



|                                                                             |         |         |         |         |         |         |         |         |                           |         |         |              |             |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|-------------|
| 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                                                                         | 61.7224 | 61.8848 | 62.0448 | 62.8075 | 62.9523 | 63.6352 | 63.6352 | 63.7633 | 63.3704                   | 62.9523 | 62.6601 | 62.3575      |             |
| alpha                                                                       | 5.1148  | 5.1257  | 5.1363  | 5.1872  | 5.1968  | 5.2423  | 5.2423  | 5.2509  | 5.2247                    | 5.1968  | 5.1773  | 5.1572       |             |
| util living area                                                            | 0.9875  | 0.9745  | 0.9511  | 0.8855  | 0.7575  | 0.5682  | 0.4163  | 0.4567  | 0.6844                    | 0.9044  | 0.9743  | 0.9898 (86)  |             |
| MIT                                                                         | 19.9399 | 20.1409 | 20.3833 | 20.6853 | 20.8916 | 20.9807 | 20.9968 | 20.9949 | 20.9507                   | 20.6950 | 20.2742 | 19.9067 (87) |             |
| Th 2                                                                        | 20.1124 | 20.1146 | 20.1166 | 20.1264 | 20.1283 | 20.1368 | 20.1368 | 20.1384 | 20.1335                   | 20.1283 | 20.1246 | 20.1207 (88) |             |
| util rest of house                                                          | 0.9842  | 0.9682  | 0.9388  | 0.8582  | 0.7070  | 0.4974  | 0.3359  | 0.3733  | 0.6135                    | 0.8754  | 0.9668  | 0.9871 (89)  |             |
| MIT 2                                                                       | 18.8860 | 19.1404 | 19.4433 | 19.8117 | 20.0369 | 20.1252 | 20.1357 | 20.1364 | 20.1000                   | 19.8318 | 19.3184 | 18.8502 (90) |             |
| Living area fraction                                                        | 19.0752 | 19.3199 | 19.6120 | 19.9685 | 20.1903 | 20.2787 | 20.2902 | 20.2905 | fLA = Living area / (4) = |         |         |              | 0.1795 (91) |
| MIT                                                                         | 19.0752 | 19.3199 | 19.6120 | 19.9685 | 20.1903 | 20.2787 | 20.2902 | 20.2905 | 20.2526                   | 19.9867 | 19.4899 | 19.0398 (92) |             |
| Temperature adjustment                                                      | 18.9252 | 19.1699 | 19.4620 | 19.8185 | 20.0403 | 20.1287 | 20.1402 | 20.1405 | 20.1026                   | 19.8367 | 19.3399 | -0.1500      |             |
| adjusted MIT                                                                | 18.9252 | 19.1699 | 19.4620 | 19.8185 | 20.0403 | 20.1287 | 20.1402 | 20.1405 | 20.1026                   | 19.8367 | 19.3399 | 18.8898 (93) |             |

## 8. Space heating requirement

|                                                                                |           |          |          |          |          |          |          |          |          |               |          |                |
|--------------------------------------------------------------------------------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|----------|----------------|
|                                                                                | Jan       | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov      | Dec            |
| Utilisation                                                                    | 0.9782    | 0.9593   | 0.9275   | 0.8471   | 0.7015   | 0.4967   | 0.3363   | 0.3735   | 0.6108   | 0.8639        | 0.9578   | 0.9819 (94)    |
| Useful gains                                                                   | 546.8744  | 613.1693 | 632.4708 | 617.9304 | 529.0172 | 367.2105 | 237.9025 | 250.5009 | 391.4098 | 510.0178      | 526.9921 | 525.1728 (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                                                               | 1015.5229 | 988.2555 | 895.3586 | 745.0474 | 567.8089 | 372.3547 | 238.4310 | 251.4121 | 405.9634 | 628.8370      | 837.1820 | 1009.6214 (97) |
| Space heating kWh                                                              | 348.6745  | 252.0579 | 195.5885 | 91.5242  | 28.8610  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 88.4015       | 223.3367 | 360.4298 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |          |          |          |          |          |          |          |          |               |          | 1588.8741      |
| 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                                                              | 348.6745  | 252.0579 | 195.5885 | 91.5242  | 28.8610  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 88.4015       | 223.3367 | 360.4298 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |          |          |          |          |          |          |          |          |               |          | 1588.8741      |
| Space heating per m2                                                           |           |          |          |          |          |          |          |          |          | (98c) / (4) = |          | 22.0861 (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 %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 88.7000 (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                                                                            | 348.6745 | 252.0579 | 195.5885 | 91.5242  | 28.8610  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 88.4015  | 223.3367 | 360.4298 (98)    |
| Space heating efficiency (main heating system 1)                                                     | 88.7000  | 88.7000  | 88.7000  | 88.7000  | 88.7000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 88.7000  | 88.7000  | 88.7000 (210)    |
| Space heating fuel (main heating system)                                                             | 393.0941 | 284.1690 | 220.5057 | 103.1840 | 32.5378  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 99.6635  | 251.7889 | 406.3470 (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                                                                            | 203.1316 | 178.7597 | 187.8406 | 160.3946 | 152.2064 | 133.6017 | 129.3554 | 136.5325 | 140.2712 | 160.6461 | 175.9637 | 200.3051 (64)    |
| Efficiency of water heater                                                                           | 83.7373  | 83.1457  | 82.2156  | 80.4532  | 78.1268  | 76.4000  | 76.4000  | 76.4000  | 76.4000  | 80.3552  | 82.8239  | 76.4000 (216)    |
| Fuel for water heating, kWh/month                                                                    | 242.5821 | 214.9956 | 228.4732 | 199.3638 | 194.8196 | 174.8713 | 169.3134 | 178.7074 | 183.6011 | 199.9199 | 212.4552 | 238.8102 (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                                                                                             | 21.9933  | 17.6439  | 15.8864  | 11.6390  | 8.9903   | 7.3452   | 8.2013   | 10.6603  | 13.8467  | 18.1676  | 20.5203  | 22.6046 (232)    |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -22.2542 | -32.7449 | -49.1800 | -57.8285 | -64.5019 | -60.9914 | -60.2074 | -55.7392 | -48.2263 | -38.5059 | -24.9337 | -19.0769 (233a)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)    |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)    |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)    |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -9.0499  | -19.4926 | -39.7864 | -61.4040 | -82.7998 | -83.8297 | -82.6998 | -69.1195 | -49.5632 | -28.2727 | -12.1974 | -7.1192 (233b)   |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)    |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)    |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)    |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |                  |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 1791.2899 (211)  |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)     |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)     |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 76.4000          |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          | 2437.9129 (219)  |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (221)     |
| Electricity for pumps and fans:                                                                      |          |          |          |          |          |          |          |          |          |          |          |                  |
| central heating pump                                                                                 |          |          |          |          |          |          |          |          |          |          |          | 41.0000 (230c)   |
| main heating flue fan                                                                                |          |          |          |          |          |          |          |          |          |          |          | 45.0000 (230e)   |
| Total electricity for the above, kWh/year                                                            |          |          |          |          |          |          |          |          |          |          |          | 86.0000 (231)    |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |          |          |          |          |          |          |          |          | 177.4988 (232)   |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |          |          |          |          |          |          |          |          |                  |
| PV generation                                                                                        |          |          |          |          |          |          |          |          |          |          |          | -1079.5246 (233) |
| Wind generation                                                                                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (234)     |
| Hydro-electric generation (Appendix N)                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (235a)    |
| Electricity generated - Micro CHP (Appendix N)                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (235)     |

# Full SAP Calculation Printout



## Appendix Q - special features

|                                     |                 |
|-------------------------------------|-----------------|
| Energy saved or generated           | -0.0000 (236)   |
| Energy used                         | 0.0000 (237)    |
| Total delivered energy for all uses | 3413.1770 (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                   | 1791.2899          | 0.2100                        | 376.1709 (261)           |
| Total CO2 associated with community systems     |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                      | 2437.9129          | 0.2100                        | 511.9617 (264)           |
| Space and water heating                         |                    |                               | 888.1326 (265)           |
| Pumps, fans and electric keep-hot               | 86.0000            | 0.1387                        | 11.9293 (267)            |
| Energy for lighting                             | 177.4988           | 0.1443                        | 25.6186 (268)            |
| Energy saving/generation technologies           |                    |                               |                          |
| PV Unit electricity used in dwelling            | -534.1903          | 0.1337                        | -71.4146                 |
| PV Unit electricity exported                    | -545.3343          | 0.1252                        | -68.2559                 |
| Total                                           |                    |                               | -139.6705 (269)          |
| Total CO2, kg/year                              |                    |                               | 786.0099 (272)           |
| EPC Dwelling Carbon Dioxide Emission Rate (DER) |                    |                               | 10.9300 (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               | 1791.2899          | 1.1300                              | 2024.1576 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2437.9129          | 1.1300                              | 2754.8416 (278)            |
| Space and water heating                     |                    |                                     | 4778.9992 (279)            |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008 (281)             |
| Energy for lighting                         | 177.4988           | 1.5338                              | 272.2537 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -534.1903          | 1.4940                              | -798.0994                  |
| PV Unit electricity exported                | -545.3343          | 0.4594                              | -250.5261                  |
| Total                                       |                    |                                     | -1048.6255 (283)           |
| Total Primary energy kWh/year               |                    |                                     | 4132.7281 (286)            |
| Dwelling Primary energy Rate (DPER)         |                    |                                     | 57.4500 (287)              |

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)        |
|--------------------------------------------------------|--------------|---------------------------------|-----------------------|
| Ground floor                                           | 35.9700 (1b) | x 2.4000 (2b)                   | = 86.3280 (1b) - (3b) |
| First floor                                            | 35.9700 (1c) | x 2.6300 (2c)                   | = 94.6011 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 71.9400      |                                 | (4)                   |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 180.9291 (5)        |

### 2. Ventilation rate

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

|                                                      |                                                       |                 |             |
|------------------------------------------------------|-------------------------------------------------------|-----------------|-------------|
| Infiltration due to chimneys, flues and fans         | = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 30.0000 / (5) = | 0.1658 (8)  |
| Pressure test                                        |                                                       | Yes             |             |
| Pressure Test Method                                 |                                                       | Blower Door     |             |
| Measured/design AP50                                 |                                                       | 5.0000          | (17)        |
| Infiltration rate                                    |                                                       | 0.4158          | (18)        |
| Number of sides sheltered                            |                                                       | 2               | (19)        |
| Shelter factor                                       | (20) = 1 - [0.075 x (19)] =                           |                 | 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor | (21) = (18) x (20) =                                  |                 | 0.3534 (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 | 0.4506 | 0.4418 | 0.4330 | 0.3888 | 0.3799 | 0.3358 | 0.3358 | 0.3269 | 0.3534 | 0.3799 | 0.3976 | 0.4153 (22b) |
| Effective ac    | 0.6015 | 0.5976 | 0.5937 | 0.5756 | 0.5722 | 0.5564 | 0.5564 | 0.5534 | 0.5625 | 0.5722 | 0.5791 | 0.5862 (25)  |



# Full SAP Calculation Printout



## 3. Heat losses and heat loss parameter

| Element                                        | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K     | A x U<br>W/K | K-value<br>kJ/m2K | A x K<br>kJ/K |       |
|------------------------------------------------|-------------|----------------|---------------|----------------------|--------------|-------------------|---------------|-------|
| TER Opaque door                                |             |                | 2.1400        | 1.0000               | 2.1400       |                   |               | (26)  |
| TER Opening Type (Uw = 1.20)                   |             |                | 10.5700       | 1.1450               | 12.1031      |                   |               | (27)  |
| Heatloss Floor 1                               |             |                | 35.9700       | 0.1300               | 4.6761       |                   |               | (28a) |
| Brick wall                                     | 43.9600     | 12.7100        | 31.2500       | 0.1800               | 5.6250       |                   |               | (29a) |
| Plane roof                                     | 35.9700     |                | 35.9700       | 0.1100               | 3.9567       |                   |               | (30)  |
| Total net area of external elements Aum(A, m2) |             |                | 115.9000      |                      |              |                   |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)            |             |                |               | (26)...(30) + (32) = | 28.5009      |                   |               | (33)  |
| Party Wall 1                                   |             |                | 82.7900       | 0.0000               | 0.0000       |                   |               | (32)  |

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

214.4687 (35)

List of Thermal Bridges

| K1 Element                                                 | Length  | Psi-value | Total                 |              |
|------------------------------------------------------------|---------|-----------|-----------------------|--------------|
| E2 Other lintels (including other steel lintels)           | 8.2500  | 0.0500    | 0.4125                |              |
| E3 Sill                                                    | 5.6500  | 0.0500    | 0.2825                |              |
| E4 Jamb                                                    | 21.3000 | 0.0500    | 1.0650                |              |
| E5 Ground floor (normal)                                   | 8.7400  | 0.1600    | 1.3984                |              |
| E6 Intermediate floor within a dwelling                    | 8.7400  | 0.0000    | 0.0000                |              |
| E18 Party wall between dwellings                           | 20.1200 | 0.0600    | 1.2072                |              |
| P1 Party wall - Ground floor                               | 16.4600 | 0.0800    | 1.3168                |              |
| P2 Party wall - Intermediate floor within a dwelling       | 16.4600 | 0.0000    | 0.0000                |              |
| P4 Party wall - Roof (insulation at ceiling level)         | 16.4600 | 0.1200    | 1.9752                |              |
| E10 Eaves (insulation at ceiling level)                    | 8.7400  | 0.0600    | 0.5244                |              |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |         |           |                       | 8.1820 (36)  |
| Point Thermal bridges                                      |         |           | (36a) =               | 0.0000       |
| Total fabric heat loss                                     |         |           | (33) + (36) + (36a) = | 36.6829 (37) |

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

|                           | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |      |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| (38)m                     | 35.9157 | 35.6803 | 35.4495 | 34.3657 | 34.1629 | 33.2190 | 33.2190 | 33.0441 | 33.5826 | 34.1629 | 34.5731 | 35.0020 | (38) |
| Heat transfer coeff       | 72.5985 | 72.3631 | 72.1324 | 71.0486 | 70.8458 | 69.9018 | 69.9018 | 69.7270 | 70.2654 | 70.8458 | 71.2560 | 71.6849 | (39) |
| Average = Sum(39)m / 12 = |         |         |         |         |         |         |         |         |         |         |         | 71.0476 |      |

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |      |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| HLP           | 1.0092 | 1.0059 | 1.0027 | 0.9876 | 0.9848 | 0.9717 | 0.9717 | 0.9692 | 0.9767 | 0.9848 | 0.9905 | 0.9965 | (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 0.9876 |      |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |      |

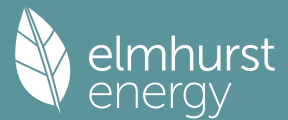
## 4. Water heating energy requirements (kWh/year)

|                                                                 |          |          |          |          |          |          |          |          |          |                                        |          |           |             |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------------------------------|----------|-----------|-------------|
| Assumed occupancy                                               |          |          |          |          |          |          |          |          |          |                                        |          |           | 2.2923 (42) |
| Hot water usage for mixer showers                               | 62.6538  | 61.7122  | 60.3402  | 57.7150  | 55.7777  | 53.6172  | 52.3892  | 53.7509  | 55.2435  | 57.5632                                | 60.2448  | 62.4137   | (42a)       |
| Hot water usage for baths                                       | 27.0664  | 26.6644  | 26.0984  | 25.0546  | 24.2731  | 23.4065  | 22.9384  | 23.5005  | 24.1126  | 25.0399                                | 26.1051  | 26.9749   | (42b)       |
| Hot water usage for other uses                                  | 38.1053  | 36.7197  | 35.3340  | 33.9484  | 32.5627  | 31.1771  | 31.1771  | 32.5627  | 33.9484  | 35.3340                                | 36.7197  | 38.1053   | (42c)       |
| Average daily hot water use (litres/day)                        |          |          |          |          |          |          |          |          |          |                                        |          | 117.5007  | (43)        |
|                                                                 | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct                                    | Nov      | Dec       |             |
| Daily hot water use                                             | 127.8255 | 125.0963 | 121.7725 | 116.7180 | 112.6135 | 108.2008 | 106.5048 | 109.8142 | 113.3045 | 117.9371                               | 123.0695 | 127.4939  | (44)        |
| Energy conte                                                    | 202.4443 | 178.1355 | 187.1599 | 159.7811 | 151.5995 | 133.0456 | 128.8083 | 135.9729 | 139.7158 | 160.0395                               | 175.3350 | 199.6247  | (45)        |
| Energy content (annual)                                         |          |          |          |          |          |          |          |          |          | Total = Sum(45)m =                     |          | 1951.6620 |             |
| Distribution loss (46)m = 0.15 x (45)m                          | 30.3666  | 26.7203  | 28.0740  | 23.9672  | 22.7399  | 19.9568  | 19.3212  | 20.3959  | 20.9574  | 24.0059                                | 26.3003  | 29.9437   | (46)        |
| Water storage loss:                                             |          |          |          |          |          |          |          |          |          |                                        |          |           |             |
| Total storage loss                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000    | (56)        |
| If cylinder contains dedicated solar storage                    |          |          |          |          |          |          |          |          |          |                                        |          |           |             |
| 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                                                      | 50.9589  | 46.0274  | 50.9589  | 49.3151  | 50.9589  | 49.3151  | 50.9589  | 50.9589  | 49.3151  | 50.9589                                | 49.3151  | 50.9589   | (61)        |
| Total heat required for water heating calculated for each month | 253.4032 | 224.1629 | 238.1188 | 209.0962 | 202.5584 | 182.3606 | 179.7672 | 186.9318 | 189.0308 | 210.9984                               | 224.6501 | 250.5836  | (62)        |
| WWHRS                                                           | -28.6427 | -25.3318 | -26.5260 | -21.9646 | -20.4702 | -17.5165 | -16.4189 | -17.4599 | -18.1233 | -21.3653                               | -24.2043 | -28.1123  | (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                                                 | 224.7605 | 198.8310 | 211.5927 | 187.1316 | 182.0882 | 164.8441 | 163.3482 | 169.4719 | 170.9076 | 189.6331                               | 200.4458 | 222.4713  | (64)        |
| 12Total per year (kWh/year)                                     |          |          |          |          |          |          |          |          |          | Total per year (kWh/year) = Sum(64)m = |          | 2285.5261 | (64)        |
| Electric shower(s)                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000    | (64a)       |
| Heat gains from water heating, kWh/month                        | 80.0525  | 70.7369  | 74.9704  | 65.4560  | 63.1466  | 56.5664  | 55.5685  | 57.9507  | 58.7843  | 65.9529                                | 70.6277  | 79.1149   | (65)        |

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

|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |          |      |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| Metabolic gains (Table 5), Watts                                                    |          |          |          |          |          |          |          |          |          |          |          |          |      |
| (66)m                                                                               | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | 114.6143 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 108.0577 | 119.6353 | 108.0577 | 111.6596 | 108.0577 | 111.6596 | 108.0577 | 108.0577 | 111.6596 | 108.0577 | 111.6596 | 108.0577 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 201.7819 | 203.8757 | 198.5993 | 187.3663 | 173.1867 | 159.8598 | 150.9567 | 148.8628 | 154.1393 | 165.3722 | 179.5519 | 192.8787 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | 34.4614  | (69) |
| Pumps, fans                                                                         | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | (71) |
| Water heating gains (Table 5)                                                       | 107.5974 | 105.2632 | 100.7666 | 90.9111  | 84.8744  | 78.5645  | 74.6888  | 77.8907  | 81.6448  | 88.6463  | 98.0940  | 106.3373 | (72) |
| Total internal gains                                                                | 477.8212 | 489.1586 | 467.8079 | 450.3213 | 426.5030 | 407.4682 | 391.0875 | 392.1955 | 404.8280 | 422.4606 | 449.6898 | 467.6580 | (73) |

# Full SAP Calculation Printout



## 6. Solar gains

| [Jan]       |          |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c |          |          | Access<br>factor<br>Table 6d | Gains<br>W    |
|-------------|----------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|----------|----------|------------------------------|---------------|
| North       |          |          |          |          | 6.0100     | 10.6334                        | 0.6300                            | 0.7000                             |          |          | 0.7700                       | 19.5307 (74)  |
| South       |          |          |          |          | 4.5600     | 46.7521                        | 0.6300                            | 0.7000                             |          |          | 0.7700                       | 65.1535 (78)  |
| Solar gains | 84.6842  | 144.0288 | 199.3456 | 255.4956 | 297.3167   | 300.9708                       | 287.6859                          | 255.0003                           | 218.2422 | 159.5205 | 101.3227                     | 72.5804 (83)  |
| Total gains | 562.5054 | 633.1873 | 667.1535 | 705.8169 | 723.8197   | 708.4390                       | 678.7734                          | 647.1958                           | 623.0702 | 581.9810 | 551.0125                     | 540.2383 (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                                                                         | 59.0343 | 59.2263 | 59.4158 | 60.3221 | 60.4948 | 61.3117 | 61.3117 | 61.4654 | 60.9945             | 60.4948 | 60.1465 | 59.7867      |
| alpha                                                                       | 4.9356  | 4.9484  | 4.9611  | 5.0215  | 5.0330  | 5.0874  | 5.0874  | 5.0977  | 5.0663              | 5.0330  | 5.0098  | 4.9858       |
| util living area                                                            | 0.9878  | 0.9771  | 0.9582  | 0.9043  | 0.7927  | 0.6076  | 0.4487  | 0.4885  | 0.7162              | 0.9155  | 0.9758  | 0.9898 (86)  |
| MIT                                                                         | 19.8647 | 20.0548 | 20.2961 | 20.6155 | 20.8522 | 20.9705 | 20.9947 | 20.9920 | 20.9328             | 20.6456 | 20.2142 | 19.8394 (87) |
| Th 2                                                                        | 20.0757 | 20.0784 | 20.0811 | 20.0937 | 20.0960 | 20.1070 | 20.1070 | 20.1090 | 20.1028             | 20.0960 | 20.0913 | 20.0863 (88) |
| util rest of house                                                          | 0.9845  | 0.9712  | 0.9472  | 0.8795  | 0.7432  | 0.5320  | 0.3599  | 0.3974  | 0.6435              | 0.8884  | 0.9685  | 0.9871 (89)  |
| MIT 2                                                                       | 18.7637 | 19.0054 | 19.3088 | 19.7047 | 19.9692 | 20.0889 | 20.1050 | 20.1058 | 20.0563             | 19.7488 | 19.2182 | 18.7395 (90) |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | fLA = Living area / | (4) =   |         | 0.1795 (91)  |
| MIT                                                                         | 18.9613 | 19.1937 | 19.4860 | 19.8682 | 20.1277 | 20.2471 | 20.2647 | 20.2648 | 20.2136             | 19.9097 | 19.3969 | 18.9369 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                     |         |         | 0.0000       |
| adjusted MIT                                                                | 18.9613 | 19.1937 | 19.4860 | 19.8682 | 20.1277 | 20.2471 | 20.2647 | 20.2648 | 20.2136             | 19.9097 | 19.3969 | 18.9369 (93) |

## 8. Space heating requirement

|                                                                                |           |           |          |          |          |          |          |          |          |               |          |                |
|--------------------------------------------------------------------------------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|---------------|----------|----------------|
|                                                                                | Jan       | Feb       | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov      | Dec            |
| Utilisation                                                                    | 0.9793    | 0.9639    | 0.9384   | 0.8723   | 0.7451   | 0.5442   | 0.3757   | 0.4136   | 0.6531   | 0.8818        | 0.9613   | 0.9824 (94)    |
| Useful gains                                                                   | 550.8489  | 610.2986  | 626.0640 | 615.7014 | 539.3055 | 385.5627 | 255.0447 | 267.6676 | 406.9232 | 513.1724      | 529.6791 | 530.7461 (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                                                               | 1064.3866 | 1034.3359 | 936.7090 | 779.2724 | 597.0637 | 394.7439 | 256.1690 | 269.4833 | 429.5713 | 659.5558      | 876.2300 | 1056.4091 (97) |
| Space heating kWh                                                              | 382.0720  | 284.9530  | 231.1199 | 117.7711 | 42.9721  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 108.9093      | 249.5166 | 391.0933 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |          |          |          |          |          |          |          |               |          | 1808.4073      |
| 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                                                              | 382.0720  | 284.9530  | 231.1199 | 117.7711 | 42.9721  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 108.9093      | 249.5166 | 391.0933 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |          |          |          |          |          |          |          |               |          | 1808.4073      |
| Space heating per m2                                                           |           |           |          |          |          |          |          |          |          | (98c) / (4) = |          | 25.1377 (99)   |

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

|                                                                                                      |          |          |          |           |           |           |           |           |          |          |          |                 |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|-----------|-----------|-----------|-----------|-----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                |          |          |          |           |           |           |           |           |          |          |          | 0.0000 (201)    |
| Fraction of space heat from main system(s)                                                           |          |          |          |           |           |           |           |           |          |          |          | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                                                     |          |          |          |           |           |           |           |           |          |          |          | 92.4000 (206)   |
| Efficiency of main space heating system 2 (in %)                                                     |          |          |          |           |           |           |           |           |          |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                              |          |          |          |           |           |           |           |           |          |          |          | 0.0000 (208)    |
|                                                                                                      | Jan      | Feb      | Mar      | Apr       | May       | Jun       | Jul       | Aug       | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                                                            | 382.0720 | 284.9530 | 231.1199 | 117.7711  | 42.9721   | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 108.9093 | 249.5166 | 391.0933 (98)   |
| Space heating efficiency (main heating system 1)                                                     | 92.4000  | 92.4000  | 92.4000  | 92.4000   | 92.4000   | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 92.4000  | 92.4000  | 92.4000 (210)   |
| Space heating fuel (main heating system)                                                             | 413.4979 | 308.3907 | 250.1297 | 127.4579  | 46.5066   | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 117.8672 | 270.0397 | 423.2611 (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                                                                            | 224.7605 | 198.8310 | 211.5927 | 187.1316  | 182.0882  | 164.8441  | 163.3482  | 169.4719  | 170.9076 | 189.6331 | 200.4458 | 222.4713 (64)   |
| Efficiency of water heater                                                                           | 85.5081  | 85.1519  | 84.5710  | 83.4169   | 81.8111   | 80.3000   | 80.3000   | 80.3000   | 80.3000  | 83.2375  | 84.8518  | 85.5768 (216)   |
| Fuel for water heating, kWh/month                                                                    | 262.8529 | 233.5015 | 250.1953 | 224.3329  | 222.5714  | 205.2853  | 203.4225  | 211.0484  | 212.8363 | 227.8218 | 236.2305 | 259.9668 (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                                                                                             | 22.4523  | 18.0120  | 16.2178  | 11.8819   | 9.1779    | 7.4984    | 8.3724    | 10.8828   | 14.1356  | 18.5467  | 20.9485  | 23.0763 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -33.7590 | -47.6438 | -68.5569 | -77.1746  | -83.3056  | -77.8005  | -76.8549  | -72.5248  | -64.8761 | -54.5410 | -37.1385 | -29.1821 (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -18.9082 | -39.8008 | -79.1499 | -118.9349 | -157.3101 | -158.0668 | -156.1907 | -132.2085 | -96.8660 | -56.9184 | -25.2463 | -14.9488 (233b) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |

# Full SAP Calculation Printout



|                                                               |            |        |
|---------------------------------------------------------------|------------|--------|
| Annual totals kWh/year                                        |            |        |
| Space heating fuel - main system 1                            | 1957.1507  | (211)  |
| Space heating fuel - main system 2                            | 0.0000     | (213)  |
| Space heating fuel - secondary                                | 0.0000     | (215)  |
| Efficiency of water heater                                    | 80.3000    |        |
| Water heating fuel used                                       | 2750.0656  | (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)           | 181.2025   | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q) |            |        |
| PV generation                                                 | -1777.9074 | (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                           | 3196.5115  | (238)  |

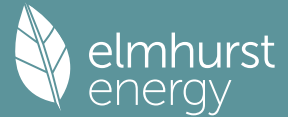
## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                               | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|-----------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1                 | 1957.1507          | 0.2100                        | 411.0017 (261)           |
| Total CO2 associated with community systems   |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                    | 2750.0656          | 0.2100                        | 577.5138 (264)           |
| Space and water heating                       |                    |                               | 988.5154 (265)           |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293 (267)            |
| Energy for lighting                           | 181.2025           | 0.1443                        | 26.1531 (268)            |
| Energy saving/generation technologies         |                    |                               |                          |
| PV Unit electricity used in dwelling          | -723.3579          | 0.1346                        | -97.3340                 |
| PV Unit electricity exported                  | -1054.5494         | 0.1259                        | -132.7510                |
| Total                                         |                    |                               | -230.0850 (269)          |
| Total CO2, kg/year                            |                    |                               | 796.5128 (272)           |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 11.0700 (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               | 1957.1507          | 1.1300                              | 2211.5803 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2750.0656          | 1.1300                              | 3107.5741 (278)            |
| Space and water heating                     |                    |                                     | 5319.1544 (279)            |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008 (281)             |
| Energy for lighting                         | 181.2025           | 1.5338                              | 277.9345 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -723.3579          | 1.4973                              | -1083.0870                 |
| PV Unit electricity exported                | -1054.5494         | 0.4621                              | -487.2871                  |
| Total                                       |                    |                                     | -1570.3740 (283)           |
| Total Primary energy kWh/year               |                    |                                     | 4156.8157 (286)            |
| Target Primary Energy Rate (TPER)           |                    |                                     | 57.7800 (287)              |

# Full SAP Calculation Printout



|                                    |                        |               |               |                |                |            |
|------------------------------------|------------------------|---------------|---------------|----------------|----------------|------------|
| Property Reference                 | SAP VG 21-0282         |               |               |                | Issued on Date | 15/11/2024 |
| Assessment Reference               | Plot 37                |               | Prop Type Ref | SAP VG 21-0282 |                |            |
| Property                           |                        |               |               |                |                |            |
|                                    |                        |               |               |                |                |            |
| SAP Rating                         | 92 A                   | DER           | 10.93         | TER            | 11.07          |            |
| Environmental                      | 91 B                   | % DER < TER   |               |                |                | 1.26       |
| CO <sub>2</sub> Emissions (t/year) | 0.75                   | DFEE          | 27.30         | TFEE           | 30.37          |            |
| Compliance Check                   | See BREL               | % DFEE < TFEE |               |                |                | 10.09      |
| % DPER < TPER                      | 0.58                   | DPER          | 57.45         | TPER           | 57.78          |            |
|                                    |                        |               |               |                |                |            |
| Assessor Details                   | Miss Victoria Gartside |               |               |                | Assessor ID    | AL30-0001  |
| Client                             |                        |               |               |                |                |            |

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

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Ground floor                                           | 35.9700 (1b)              | x 2.4000 (2b)                   | = 86.3280 (1b) - (3b)       |
| First floor                                            | 35.9700 (1c)              | x 2.6300 (2c)                   | = 94.6011 (1c) - (3c)       |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 71.9400                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 180.9291 (5)              |

## 2. Ventilation rate

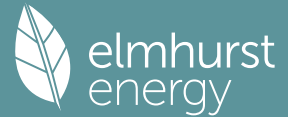
|                                                                                                    | m <sup>3</sup> per hour                 |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 3 * 10 = 30.0000 (7a)                   |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Air changes per hour                                                                               |                                         |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 30.0000 / (5) = 0.1658 (8)              |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 4.0000 (17)                             |
| Infiltration rate                                                                                  | 0.3658 (18)                             |
| Number of sides sheltered                                                                          | 2 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.3109 (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 | 0.3964 | 0.3887 | 0.3809 | 0.3420 | 0.3343 | 0.2954 | 0.2954 | 0.2876 | 0.3109 | 0.3343 | 0.3498 | 0.3654 (22b) |
| Effective ac    | 0.5786 | 0.5755 | 0.5725 | 0.5585 | 0.5559 | 0.5436 | 0.5436 | 0.5414 | 0.5483 | 0.5559 | 0.5612 | 0.5667 (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   |
|----------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------------|-----------------|
| Front door                                                     |                         |                            | 2.1400                    | 1.1000                        | 2.3540       |                                      | (26)            |
| Windows (Uw = 1.30)                                            |                         |                            | 10.5700                   | 1.2357                        | 13.0618      |                                      | (27)            |
| Heatloss Floor 1                                               |                         |                            | 35.9700                   | 0.1300                        | 4.6761       | 110.0000                             | 3956.7000 (28a) |
| Brick wall                                                     | 43.9600                 | 12.7100                    | 31.2500                   | 0.1900                        | 5.9375       | 110.0000                             | 3437.5000 (29a) |
| Plane roof                                                     | 35.9700                 |                            | 35.9700                   | 0.0900                        | 3.2373       | 9.0000                               | 323.7300 (30)   |
| Total net area of external elements Aum(A, m <sup>2</sup> )    |                         |                            | 115.9000                  |                               |              |                                      | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                            |                         |                            |                           | (26)...(30) + (32) =          | 29.2667      |                                      | (33)            |
| Party Wall 1                                                   |                         |                            | 82.7900                   | 0.0000                        | 0.0000       | 70.0000                              | 5795.3000 (32)  |
| Internal Wall 2                                                |                         |                            | 104.9400                  |                               |              | 9.0000                               | 944.4600 (32c)  |
| Internal Floor                                                 |                         |                            | 35.9700                   |                               |              | 18.0000                              | 647.4600 (32d)  |
| Internal Ceiling 1                                             |                         |                            | 35.9700                   |                               |              | 9.0000                               | 323.7300 (32e)  |
| Heat capacity Cm = Sum(A x k)                                  |                         |                            |                           |                               |              | (28)...(30) + (32) + (32a)...(32e) = | 15428.8800 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K |                         |                            |                           |                               |              |                                      | 214.4687 (35)   |
| List of Thermal Bridges                                        |                         |                            |                           |                               |              |                                      |                 |
| K1 Element                                                     |                         |                            |                           | Length                        | Psi-value    | Total                                |                 |
| E2 Other lintels (including other steel lintels)               |                         |                            |                           | 8.2500                        | 0.0240       | 0.1980                               |                 |
| E3 Sill                                                        |                         |                            |                           | 5.6500                        | 0.0220       | 0.1243                               |                 |
| E4 Jamb                                                        |                         |                            |                           | 21.3000                       | 0.0170       | 0.3621                               |                 |

# Full SAP Calculation Printout



|                                                            |         |                       |              |
|------------------------------------------------------------|---------|-----------------------|--------------|
| E5 Ground floor (normal)                                   | 8.7400  | 0.0920                | 0.8041       |
| E6 Intermediate floor within a dwelling                    | 8.7400  | 0.0010                | 0.0087       |
| E18 Party wall between dwellings                           | 20.1200 | 0.0400                | 0.8048       |
| P1 Party wall - Ground floor                               | 16.4600 | 0.0690                | 1.1357       |
| P2 Party wall - Intermediate floor within a dwelling       | 16.4600 | 0.0000                | 0.0000       |
| P4 Party wall - Roof (insulation at ceiling level)         | 16.4600 | 0.1010                | 1.6625       |
| E10 Eaves (insulation at ceiling level)                    | 8.7400  | 0.0600                | 0.5244       |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |         |                       | 5.6246 (36)  |
| Point Thermal bridges                                      |         |                       | 0.0000       |
| Total fabric heat loss                                     |         | (33) + (36) + (36a) = | 34.8913 (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                                                 | 34.5454 | 34.3632 | 34.1846 | 33.3457 | 33.1888 | 32.4582 | 32.4582 | 32.3229 | 32.7396 | 33.1888 | 33.5063 | 33.8382 |
| Average = Sum(39)m / 12 =                                           | 69.4367 | 69.2545 | 69.0759 | 68.2370 | 68.0801 | 67.3495 | 67.3495 | 67.2142 | 67.6309 | 68.0801 | 68.3976 | 68.7295 |
|                                                                     |         |         |         |         |         |         |         |         |         |         |         | 68.2363 |
| HLP                                                                 | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |
| HLP (average)                                                       | 0.9652  | 0.9627  | 0.9602  | 0.9485  | 0.9463  | 0.9362  | 0.9362  | 0.9343  | 0.9401  | 0.9463  | 0.9508  | 0.9554  |
| Days in mont                                                        | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31      |
|                                                                     |         |         |         |         |         |         |         |         |         |         |         | 0.9485  |
|                                                                     |         |         |         |         |         |         |         |         |         |         |         | 0.9485  |

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

|                                                                                |          |          |          |          |          |          |          |          |          |          |          |               |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |          |          | 2.2923 (42)   |
| Hot water usage for mixer showers                                              |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                | 62.6538  | 61.7122  | 60.3402  | 57.7150  | 55.7777  | 53.6172  | 52.3892  | 53.7509  | 55.2435  | 57.5632  | 60.2448  | 62.4137 (42a) |
| Hot water usage for baths                                                      |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                | 27.0664  | 26.6644  | 26.0984  | 25.0546  | 24.2731  | 23.4065  | 22.9384  | 23.5005  | 24.1126  | 25.0399  | 26.1051  | 26.9749 (42b) |
| Hot water usage for other uses                                                 |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                | 38.1053  | 36.7197  | 35.3340  | 33.9484  | 32.5627  | 31.1771  | 31.1771  | 32.5627  | 33.9484  | 35.3340  | 36.7197  | 38.1053 (42c) |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |          |          | 117.5007 (43) |
|                                                                                |          |          |          |          |          |          |          |          |          |          |          |               |
| Daily hot water use                                                            | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
|                                                                                | 127.8255 | 125.0963 | 121.7725 | 116.7180 | 112.6135 | 108.2008 | 106.5048 | 109.8142 | 113.3045 | 117.9371 | 123.0695 | 127.4939 (44) |
| Energy conte                                                                   | 202.4443 | 178.1355 | 187.1599 | 159.7811 | 151.5995 | 133.0456 | 128.8083 | 135.9729 | 139.7158 | 160.0395 | 175.3350 | 199.6247 (45) |
| Energy content (annual)                                                        |          |          |          |          |          |          |          |          |          |          |          |               |
| Distribution loss (46)m = 0.15 x (45)m                                         |          |          |          |          |          |          |          |          |          |          |          | 1951.6620     |
|                                                                                | 30.3666  | 26.7203  | 28.0740  | 23.9672  | 22.7399  | 19.9568  | 19.3212  | 20.3959  | 20.9574  | 24.0059  | 26.3003  | 29.9437 (46)  |
| Water storage loss:                                                            |          |          |          |          |          |          |          |          |          |          |          |               |
| Total storage loss                                                             |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (56)   |
| If cylinder contains dedicated solar storage                                   |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (57)   |
| Primary loss                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (59)   |
| Combi loss                                                                     | 0.6873   | 0.6242   | 0.6807   | 0.6134   | 0.6069   | 0.5561   | 0.5472   | 0.5596   | 0.5555   | 0.6066   | 0.6286   | 0.6804 (61)   |
| Total heat required for water heating calculated for each month                |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                | 203.1316 | 178.7597 | 187.8406 | 160.3946 | 152.2064 | 133.6017 | 129.3554 | 136.5325 | 140.2712 | 160.6461 | 175.9637 | 200.3051 (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                                                                |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                | 203.1316 | 178.7597 | 187.8406 | 160.3946 | 152.2064 | 133.6017 | 129.3554 | 136.5325 | 140.2712 | 160.6461 | 175.9637 | 200.3051 (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                                       |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                | 67.4846  | 59.3861  | 62.4008  | 53.2806  | 50.5586  | 44.3767  | 42.9655  | 45.3509  | 46.5944  | 53.3648  | 58.4561  | 66.5453 (65)  |

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

|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Metabolic gains (Table 5), Watts                                                    |          |          |          |          |          |          |          |          |          |          |          |               |
| (66)m                                                                               | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
|                                                                                     | 137.5372 | 137.5372 | 137.5372 | 137.5372 | 137.5372 | 137.5372 | 137.5372 | 137.5372 | 137.5372 | 137.5372 | 137.5372 | 137.5372 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                     | 25.1268  | 22.3174  | 18.1497  | 13.7405  | 10.2712  | 8.6714   | 9.3697   | 12.1791  | 16.3468  | 20.7560  | 24.2253  | 25.8251 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                     | 301.1670 | 304.2921 | 296.4168 | 279.6512 | 258.4875 | 238.5967 | 225.3085 | 222.1833 | 230.0586 | 246.8243 | 267.9879 | 287.8787 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                     | 51.0460  | 51.0460  | 51.0460  | 51.0460  | 51.0460  | 51.0460  | 51.0460  | 51.0460  | 51.0460  | 51.0460  | 51.0460  | 51.0460 (69)  |
| Pumps, fans                                                                         | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 3.0000   | 3.0000   | 3.0000 (70)   |
| Losses e.g. evaporation (negative values) (Table 5)                                 |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                     | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 (71) |
| Water heating gains (Table 5)                                                       |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                     | 90.7051  | 88.3722  | 83.8721  | 74.0008  | 67.9550  | 61.6343  | 57.7494  | 60.9555  | 64.7144  | 71.7269  | 81.1890  | 89.4426 (72)  |
| Total internal gains                                                                |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                     | 516.8906 | 514.8734 | 498.3304 | 467.2842 | 436.6055 | 405.7941 | 389.3193 | 392.2096 | 408.0115 | 439.1989 | 473.2939 | 503.0382 (73) |

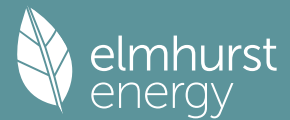
## 6. Solar gains

|             |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| [Jan]       |          |          |          |          |          |          |          |          |          |          |          |               |
|             | Area     |          |          |          |          |          |          |          |          |          |          |               |
|             | m2       |          |          |          |          |          |          |          |          |          |          |               |
| North       | 6.0100   |          |          |          |          |          |          |          |          |          |          |               |
| South       | 4.5600   |          |          |          |          |          |          |          |          |          |          |               |
|             |          |          |          |          |          |          |          |          |          |          |          |               |
|             |          |          |          |          |          |          |          |          |          |          |          |               |
|             |          |          |          |          |          |          |          |          |          |          |          |               |
|             |          |          |          |          |          |          |          |          |          |          |          |               |
| Solar gains | 98.1261  | 166.8905 | 230.9878 | 296.0505 | 344.5098 | 348.7439 | 333.3504 | 295.4765 | 252.8838 | 184.8412 | 117.4057 | 84.1010 (83)  |
| Total gains | 615.0167 | 681.7639 | 729.3182 | 763.3347 | 781.1154 | 754.5380 | 722.6697 | 687.6862 | 660.8954 | 624.0401 | 590.6996 | 587.1392 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |              |
|-----------------------------------------------------------------------------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) | 21.0000 (85) |
|-----------------------------------------------------------------------------|--------------|

# Full SAP Calculation Printout



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                    | 61.7224 | 61.8848 | 62.0448 | 62.8075 | 62.9523 | 63.6352 | 63.6352 | 63.7633 | 63.3704                   | 62.9523 | 62.6601 | 62.3575      |
| alpha                  | 5.1148  | 5.1257  | 5.1363  | 5.1872  | 5.1968  | 5.2423  | 5.2423  | 5.2509  | 5.2247                    | 5.1968  | 5.1773  | 5.1572       |
| util living area       | 0.9813  | 0.9672  | 0.9378  | 0.8694  | 0.7397  | 0.5578  | 0.4078  | 0.4459  | 0.6680                    | 0.8866  | 0.9660  | 0.9847 (86)  |
| MIT                    | 20.0297 | 20.2046 | 20.4452 | 20.7163 | 20.9031 | 20.9822 | 20.9971 | 20.9955 | 20.9559                   | 20.7289 | 20.3347 | 19.9920 (87) |
| Th 2                   | 20.1124 | 20.1146 | 20.1166 | 20.1264 | 20.1283 | 20.1368 | 20.1368 | 20.1384 | 20.1335                   | 20.1283 | 20.1246 | 20.1207 (88) |
| util rest of house     | 0.9766  | 0.9593  | 0.9230  | 0.8399  | 0.6885  | 0.4879  | 0.3290  | 0.3642  | 0.5974                    | 0.8544  | 0.9564  | 0.9809 (89)  |
| MIT 2                  | 18.9989 | 19.2192 | 19.5173 | 19.8457 | 20.0474 | 20.1262 | 20.1358 | 20.1366 | 20.1038                   | 19.8686 | 19.3926 | 18.9578 (90) |
| Living area fraction   |         |         |         |         |         |         |         |         | FLA = Living area / (4) = |         |         | 0.1795 (91)  |
| MIT                    | 19.1839 | 19.3960 | 19.6838 | 20.0019 | 20.2010 | 20.2798 | 20.2903 | 20.2907 | 20.2567                   | 20.0230 | 19.5617 | 19.1434 (92) |
| Temperature adjustment |         |         |         |         |         |         |         |         |                           |         |         | -0.1500      |
| adjusted MIT           | 19.0339 | 19.2460 | 19.5338 | 19.8519 | 20.0510 | 20.1298 | 20.1403 | 20.1407 | 20.1067                   | 19.8730 | 19.4117 | 18.9934 (93) |

## 8. Space heating requirement

|                                                                                | Jan       | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov      | Dec            |
|--------------------------------------------------------------------------------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|----------|----------------|
| Utilisation                                                                    | 0.9691    | 0.9494   | 0.9113   | 0.8294   | 0.6837   | 0.4873   | 0.3293   | 0.3644   | 0.5951   | 0.8434        | 0.9464   | 0.9742 (94)    |
| Useful gains                                                                   | 596.0061  | 647.2848 | 664.5964 | 633.0796 | 534.0236 | 367.7143 | 237.9628 | 250.6198 | 393.2998 | 526.3422      | 559.0319 | 572.0106 (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                                                               | 1023.0743 | 993.5268 | 900.3226 | 747.3253 | 568.5343 | 372.4280 | 238.4408 | 251.4309 | 406.2380 | 631.3083      | 842.0895 | 1016.7420 (97) |
| Space heating kWh                                                              | 317.7388  | 232.6746 | 175.3803 | 82.2569  | 25.6760  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 78.0948       | 203.8015 | 330.8802 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |          |          |          |          |          |          |          |          |               |          | 1446.5031      |
| 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                                                              | 317.7388  | 232.6746 | 175.3803 | 82.2569  | 25.6760  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 78.0948       | 203.8015 | 330.8802 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |          |          |          |          |          |          |          |          |               |          | 1446.5031      |
| Space heating per m2                                                           |           |          |          |          |          |          |          |          |          | (98c) / (4) = |          | 20.1071 (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 %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 88.7000 (206)    |
| Efficiency of main space heating system 2 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)     |
| Efficiency of secondary/supplementary heating system, %                                              |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)     |
| Space heating requirement                                                                            | 317.7388 | 232.6746 | 175.3803 | 82.2569  | 25.6760  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 78.0948  | 203.8015 | 330.8802 (98)    |
| Space heating efficiency (main heating system 1)                                                     | 88.7000  | 88.7000  | 88.7000  | 88.7000  | 88.7000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 88.7000  | 88.7000  | 88.7000 (210)    |
| Space heating fuel (main heating system)                                                             | 358.2173 | 262.3164 | 197.7230 | 92.7361  | 28.9470  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 88.0438  | 229.7649 | 373.0329 (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                                                                            | 203.1316 | 178.7597 | 187.8406 | 160.3946 | 152.2064 | 133.6017 | 129.3554 | 136.5325 | 140.2712 | 160.6461 | 175.9637 | 200.3051 (64)    |
| Efficiency of water heater (217)m                                                                    | 83.4599  | 82.9012  | 81.8826  | 80.1686  | 77.9605  | 76.4000  | 76.4000  | 76.4000  | 76.4000  | 80.0302  | 82.5426  | 76.4000 (216)    |
| Fuel for water heating, kWh/month                                                                    | 243.3882 | 215.6299 | 229.4024 | 200.0717 | 195.2354 | 174.8713 | 169.3134 | 178.7074 | 183.6011 | 200.7319 | 213.1792 | 239.5327 (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                                                                                             | 21.9933  | 17.6439  | 15.8864  | 11.6390  | 8.9903   | 7.3452   | 8.2013   | 10.6603  | 13.8467  | 18.1676  | 20.5203  | 22.6046 (232)    |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |                  |
| (233a)m                                                                                              | -22.2542 | -32.7449 | -49.1800 | -57.8285 | -64.5019 | -60.9914 | -60.2074 | -55.7392 | -48.2263 | -38.5059 | -24.9337 | -19.0769 (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                                                                                              | -9.0499  | -19.4926 | -39.7864 | -61.4040 | -82.7998 | -83.8297 | -82.6998 | -69.1195 | -49.5632 | -28.2727 | -12.1974 | -7.1192 (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                                                                   |          |          |          |          |          |          |          |          |          |          |          | 1630.7814 (211)  |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)     |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)     |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 76.4000          |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          | 2443.6647 (219)  |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (221)     |
| Electricity for pumps and fans:                                                                      |          |          |          |          |          |          |          |          |          |          |          |                  |
| central heating pump                                                                                 |          |          |          |          |          |          |          |          |          |          |          | 41.0000 (230c)   |
| main heating flue fan                                                                                |          |          |          |          |          |          |          |          |          |          |          | 45.0000 (230e)   |
| Total electricity for the above, kWh/year                                                            |          |          |          |          |          |          |          |          |          |          |          | 86.0000 (231)    |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |          |          |          |          |          |          |          |          | 177.4988 (232)   |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |          |          |          |          |          |          |          |          |                  |
| PV generation                                                                                        |          |          |          |          |          |          |          |          |          |          |          | -1079.5246 (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                                                                        |          |          |          |          |          |          |          |          |          |          |          |                  |

# Full SAP Calculation Printout



|                                     |                 |
|-------------------------------------|-----------------|
| Energy saved or generated           | -0.0000 (236)   |
| Energy used                         | 0.0000 (237)    |
| Total delivered energy for all uses | 3258.4203 (238) |

## 10a. Fuel costs - using Table 12 prices

|                                             | Fuel<br>kWh/year | Fuel price<br>p/kWh | Fuel cost<br>£/year |
|---------------------------------------------|------------------|---------------------|---------------------|
| Space heating - main system 1               | 1630.7814        | 3.6400              | 59.3604 (240)       |
| Total CO2 associated with community systems |                  |                     | 0.0000 (473)        |
| Water heating (other fuel)                  | 2443.6647        | 3.6400              | 88.9494 (247)       |
| Energy for instantaneous electric shower(s) | 0.0000           | 16.4900             | 0.0000 (247a)       |
| Pumps, fans and electric keep-hot           | 86.0000          | 16.4900             | 14.1814 (249)       |
| Energy for lighting                         | 177.4988         | 16.4900             | 29.2696 (250)       |
| Additional standing charges                 |                  |                     | 92.0000 (251)       |
| Energy saving/generation technologies       |                  |                     |                     |
| PV Unit electricity used in dwelling        | -534.1903        | 16.4900             | -88.0880            |
| PV Unit electricity exported                | -545.3343        | 5.5900              | -30.4842            |
| Total                                       |                  |                     | -118.5722 (252)     |
| Total energy cost                           |                  |                     | 165.1886 (255)      |

## 11a. SAP rating - Individual heating systems

|                                  |                                         |              |
|----------------------------------|-----------------------------------------|--------------|
| Energy cost deflator (Table 12): |                                         | 0.3600 (256) |
| Energy cost factor (ECF)         | $[(255) \times (256)] / [(4) + 45.0] =$ | 0.5085 (257) |
| SAP value                        |                                         | 91.7567      |
| SAP rating (Section 12)          |                                         | 92 (258)     |
| SAP band                         |                                         | A            |

## 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               | 1630.7814          | 0.2100                        | 342.4641 (261)           |
| Total CO2 associated with community systems |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                  | 2443.6647          | 0.2100                        | 513.1696 (264)           |
| Space and water heating                     |                    |                               | 855.6337 (265)           |
| Pumps, fans and electric keep-hot           | 86.0000            | 0.1387                        | 11.9293 (267)            |
| Energy for lighting                         | 177.4988           | 0.1443                        | 25.6186 (268)            |
| Energy saving/generation technologies       |                    |                               |                          |
| PV Unit electricity used in dwelling        | -534.1903          | 0.1337                        | -71.4146                 |
| PV Unit electricity exported                | -545.3343          | 0.1252                        | -68.2559                 |
| Total                                       |                    |                               | -139.6705 (269)          |
| Total CO2, kg/year                          |                    |                               | 753.5110 (272)           |
| CO2 emissions per m2                        |                    |                               | 10.4700 (273)            |
| EI value                                    |                    |                               | 91.3656                  |
| EI rating                                   |                    |                               | 91 (274)                 |
| EI band                                     |                    |                               | B                        |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

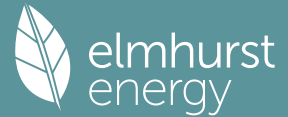
## 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m)              | Volume<br>(m3)        |
|--------------------------------------------------------|--------------|-----------------------------------|-----------------------|
| Ground floor                                           | 35.9700 (1b) | x 2.4000 (2b)                     | = 86.3280 (1b) - (3b) |
| First floor                                            | 35.9700 (1c) | x 2.6300 (2c)                     | = 94.6011 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 71.9400      |                                   | (4)                   |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 180.9291 (5)          |

## 2. Ventilation rate

|                                                    | m3 per hour                             |
|----------------------------------------------------|-----------------------------------------|
| Number of open chimneys                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                | 3 * 10 = 30.0000 (7a)                   |
| Number of passive vents                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans       | 30.0000 / (5) = 0.1658 (8)              |
| Pressure test                                      | Yes                                     |
| Pressure Test Method                               | Blower Door                             |
| Measured/design AP50                               | 4.0000 (17)                             |
| Infiltration rate                                  | 0.3658 (18)                             |
| Number of sides sheltered                          | 2 (19)                                  |
| Shelter factor                                     | (20) = 1 - [0.075 x (19)] = 0.8500 (20) |

# Full SAP Calculation Printout



Infiltration rate adjusted to include shelter factor

(21) = (18) x (20) = 0.3109 (21)

|                 |        |        |        |        |        |        |        |        |        |        |        |        |       |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| Wind speed      | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |       |
| Wind factor     | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 | (22)  |
| Adj infilt rate | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 | (22a) |
| Effective ac    | 0.3964 | 0.3887 | 0.3809 | 0.3420 | 0.3343 | 0.2954 | 0.2954 | 0.2876 | 0.3109 | 0.3343 | 0.3498 | 0.3654 | (22b) |
|                 | 0.5786 | 0.5755 | 0.5725 | 0.5585 | 0.5559 | 0.5436 | 0.5436 | 0.5414 | 0.5483 | 0.5559 | 0.5612 | 0.5667 | (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 |       |
|------------------------------------------------------------|-------------|----------------|---------------|----------------------|--------------|-----------------------|---------------|-------|
| Front door                                                 |             |                | 2.1400        | 1.1000               | 2.3540       |                       |               | (26)  |
| Windows (Uw = 1.30)                                        |             |                | 10.5700       | 1.2357               | 13.0618      |                       |               | (27)  |
| Heatloss Floor 1                                           |             |                | 35.9700       | 0.1300               | 4.6761       | 110.0000              | 3956.7000     | (28a) |
| Brick wall                                                 | 43.9600     | 12.7100        | 31.2500       | 0.1900               | 5.9375       | 110.0000              | 3437.5000     | (29a) |
| Plane roof                                                 | 35.9700     |                | 35.9700       | 0.0900               | 3.2373       | 9.0000                | 323.7300      | (30)  |
| Total net area of external elements Aum(A, m2)             |             |                | 115.9000      |                      |              |                       |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)                        |             |                |               | (26)...(30) + (32) = | 29.2667      |                       |               | (33)  |
| Party Wall 1                                               |             |                | 82.7900       | 0.0000               | 0.0000       | 70.0000               | 5795.3000     | (32)  |
| Internal Wall 2                                            |             |                | 104.9400      |                      |              | 9.0000                | 944.4600      | (32c) |
| Internal Floor                                             |             |                | 35.9700       |                      |              | 18.0000               | 647.4600      | (32d) |
| Internal Ceiling 1                                         |             |                | 35.9700       |                      |              | 9.0000                | 323.7300      | (32e) |
| Heat capacity Cm = Sum(A x k)                              |             |                |               |                      |              |                       |               |       |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K          |             |                |               |                      |              |                       |               | (34)  |
| List of Thermal Bridges                                    |             |                |               |                      |              |                       |               | (35)  |
| K1 Element                                                 |             |                |               | Length               | Psi-value    |                       | Total         |       |
| E2 Other lintels (including other steel lintels)           |             |                |               | 8.2500               | 0.0240       |                       | 0.1980        |       |
| E3 Sill                                                    |             |                |               | 5.6500               | 0.0220       |                       | 0.1243        |       |
| E4 Jamb                                                    |             |                |               | 21.3000              | 0.0170       |                       | 0.3621        |       |
| E5 Ground floor (normal)                                   |             |                |               | 8.7400               | 0.0920       |                       | 0.8041        |       |
| E6 Intermediate floor within a dwelling                    |             |                |               | 8.7400               | 0.0010       |                       | 0.0087        |       |
| E18 Party wall between dwellings                           |             |                |               | 20.1200              | 0.0400       |                       | 0.8048        |       |
| P1 Party wall - Ground floor                               |             |                |               | 16.4600              | 0.0690       |                       | 1.1357        |       |
| P2 Party wall - Intermediate floor within a dwelling       |             |                |               | 16.4600              | 0.0000       |                       | 0.0000        |       |
| P4 Party wall - Roof (insulation at ceiling level)         |             |                |               | 16.4600              | 0.1010       |                       | 1.6625        |       |
| E10 Eaves (insulation at ceiling level)                    |             |                |               | 8.7400               | 0.0600       |                       | 0.5244        |       |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |             |                |               |                      |              |                       | 5.6246        | (36)  |
| Point Thermal bridges                                      |             |                |               |                      |              |                       | 0.0000        |       |
| Total fabric heat loss                                     |             |                |               |                      |              | (33) + (36) + (36a) = | 34.8913       | (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                                                 | 34.5454 | 34.3632 | 34.1846 | 33.3457 | 33.1888 | 32.4582 | 32.4582 | 32.3229 | 32.7396 | 33.1888 | 33.5063 | 33.8382 | (38) |
| Average = Sum(39)m / 12 =                                           | 69.4367 | 69.2545 | 69.0759 | 68.2370 | 68.0801 | 67.3495 | 67.3495 | 67.2142 | 67.6309 | 68.0801 | 68.3976 | 68.7295 | (39) |
|                                                                     |         |         |         |         |         |         |         |         |         |         |         | 68.2363 |      |
| HLP                                                                 | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |      |
| HLP (average)                                                       | 0.9652  | 0.9627  | 0.9602  | 0.9485  | 0.9463  | 0.9362  | 0.9362  | 0.9343  | 0.9401  | 0.9463  | 0.9508  | 0.9554  | (40) |
| Days in mont                                                        | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31      |      |

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

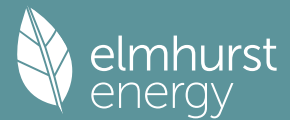
|                                                                 |          |          |          |          |          |          |          |          |          |          |          |          |             |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-------------|
| Assumed occupancy                                               |          |          |          |          |          |          |          |          |          |          |          |          | 2.2923 (42) |
| Hot water usage for mixer showers                               |          |          |          |          |          |          |          |          |          |          |          |          |             |
| Hot water usage for baths                                       | 62.6538  | 61.7122  | 60.3402  | 57.7150  | 55.7777  | 53.6172  | 52.3892  | 53.7509  | 55.2435  | 57.5632  | 60.2448  | 62.4137  | (42a)       |
| Hot water usage for other uses                                  | 27.0664  | 26.6644  | 26.0984  | 25.0546  | 24.2731  | 23.4065  | 22.9384  | 23.5005  | 24.1126  | 25.0399  | 26.1051  | 26.9749  | (42b)       |
| Average daily hot water use (litres/day)                        | 38.1053  | 36.7197  | 35.3340  | 33.9484  | 32.5627  | 31.1771  | 31.1771  | 32.5627  | 33.9484  | 35.3340  | 36.7197  | 38.1053  | (42c)       |
|                                                                 |          |          |          |          |          |          |          |          |          |          |          | 117.5007 | (43)        |
| Daily hot water use                                             | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |             |
| Energy conte                                                    | 127.8255 | 125.0963 | 121.7725 | 116.7180 | 112.6135 | 108.2008 | 106.5048 | 109.8142 | 113.3045 | 117.9371 | 123.0695 | 127.4939 | (44)        |
| Energy content (annual)                                         | 202.4443 | 178.1355 | 187.1599 | 159.7811 | 151.5995 | 133.0456 | 128.8083 | 135.9729 | 139.7158 | 160.0395 | 175.3350 | 199.6247 | (45)        |
| Distribution loss (46)m = 0.15 x (45)m                          |          |          |          |          |          |          |          |          |          |          |          |          |             |
| Water storage loss:                                             | 30.3666  | 26.7203  | 28.0740  | 23.9672  | 22.7399  | 19.9568  | 19.3212  | 20.3959  | 20.9574  | 24.0059  | 26.3003  | 29.9437  | (46)        |
| 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                                                      | 0.6873   | 0.6242   | 0.6807   | 0.6134   | 0.6069   | 0.5561   | 0.5472   | 0.5596   | 0.5555   | 0.6066   | 0.6286   | 0.6804   | (61)        |
| Total heat required for water heating calculated for each month | 203.1316 | 178.7597 | 187.8406 | 160.3946 | 152.2064 | 133.6017 | 129.3554 | 136.5325 | 140.2712 | 160.6461 | 175.9637 | 200.3051 | (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                                                 | 203.1316 | 178.7597 | 187.8406 | 160.3946 | 152.2064 | 133.6017 | 129.3554 | 136.5325 | 140.2712 | 160.6461 | 175.9637 | 200.3051 | (64)        |
| Electric shower(s)                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (64a)       |
| Heat gains from water heating, kWh/month                        | 67.4846  | 59.3861  | 62.4008  | 53.2806  | 50.5586  | 44.3767  | 42.9655  | 45.3509  | 46.5944  | 53.3648  | 58.4561  | 66.5453  | (65)        |

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

|                                  |          |          |          |          |          |          |          |          |          |          |          |          |      |
|----------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| Metabolic gains (Table 5), Watts |          |          |          |          |          |          |          |          |          |          |          |          |      |
| (66)m                            | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      | (66) |
|                                  | 137.5372 | 137.5372 | 137.5372 | 137.5372 | 137.5372 | 137.5372 | 137.5372 | 137.5372 | 137.5372 | 137.5372 | 137.5372 | 137.5372 |      |



# Full SAP Calculation Printout



|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 25.1268  | 22.3174  | 18.1497  | 13.7405  | 10.2712  | 8.6714   | 9.3697   | 12.1791  | 16.3468  | 20.7560  | 24.2253  | 25.8251 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 301.1670 | 304.2921 | 296.4168 | 279.6512 | 258.4875 | 238.5967 | 225.3085 | 222.1833 | 230.0586 | 246.8243 | 267.9879 | 287.8787 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 51.0460  | 51.0460  | 51.0460  | 51.0460  | 51.0460  | 51.0460  | 51.0460  | 51.0460  | 51.0460  | 51.0460  | 51.0460  | 51.0460 (69)  |
| Pumps, fans                                                                         | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 3.0000   | 3.0000   | 3.0000 (70)   |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 (71) |
| Water heating gains (Table 5)                                                       | 90.7051  | 88.3722  | 83.8721  | 74.0008  | 67.9550  | 61.6343  | 57.7494  | 60.9555  | 64.7144  | 71.7269  | 81.1890  | 89.4426 (72)  |
| Total internal gains                                                                | 516.8906 | 514.8734 | 498.3304 | 467.2842 | 436.6055 | 405.7941 | 389.3193 | 392.2096 | 408.0115 | 439.1989 | 473.2939 | 503.0382 (73) |

## 6. Solar gains

| [Jan]       |          |          |          |          |            |                                |                                   |                                    |                              |          |              |               |
|-------------|----------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|----------|--------------|---------------|
|             |          |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d |          | Gains<br>W   |               |
| North       |          |          |          |          | 6.0100     | 10.6334                        | 0.7300                            | 0.7000                             | 0.7700                       |          | 22.6308 (74) |               |
| South       |          |          |          |          | 4.5600     | 46.7521                        | 0.7300                            | 0.7000                             | 0.7700                       |          | 75.4953 (78) |               |
|             |          |          |          |          |            |                                |                                   |                                    |                              |          |              |               |
| Solar gains | 98.1261  | 166.8905 | 230.9878 | 296.0505 | 344.5098   | 348.7439                       | 333.3504                          | 295.4765                           | 252.8838                     | 184.8412 | 117.4057     | 84.1010 (83)  |
| Total gains | 615.0167 | 681.7639 | 729.3182 | 763.3347 | 781.1154   | 754.5380                       | 722.6697                          | 687.6862                           | 660.8954                     | 624.0401 | 590.6996     | 587.1392 (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                                                                         | 61.7224      | 61.8848 | 62.0448 | 62.8075 | 62.9523 | 63.6352 | 63.6352 | 63.7633 | 63.3704 | 62.9523 | 62.6601 | 62.3575      |
| alpha                                                                       | 5.1148       | 5.1257  | 5.1363  | 5.1872  | 5.1968  | 5.2423  | 5.2423  | 5.2509  | 5.2247  | 5.1968  | 5.1773  | 5.1572       |
| util living area                                                            | 0.9813       | 0.9672  | 0.9378  | 0.8694  | 0.7397  | 0.5578  | 0.4078  | 0.4459  | 0.6680  | 0.8866  | 0.9660  | 0.9847 (86)  |
| MIT                                                                         | 20.0297      | 20.2046 | 20.4452 | 20.7163 | 20.9031 | 20.9822 | 20.9971 | 20.9955 | 20.9559 | 20.7289 | 20.3347 | 19.9920 (87) |
| Th 2                                                                        | 20.1124      | 20.1146 | 20.1166 | 20.1264 | 20.1283 | 20.1368 | 20.1368 | 20.1384 | 20.1335 | 20.1283 | 20.1246 | 20.1207 (88) |
| util rest of house                                                          | 0.9766       | 0.9593  | 0.9230  | 0.8399  | 0.6885  | 0.4879  | 0.3290  | 0.3642  | 0.5974  | 0.8544  | 0.9564  | 0.9809 (89)  |
| MIT 2                                                                       | 18.9989      | 19.2192 | 19.5173 | 19.8457 | 20.0474 | 20.1262 | 20.1358 | 20.1366 | 20.1038 | 19.8686 | 19.3926 | 18.9578 (90) |
| Living area fraction                                                        | 19.1839      | 19.3960 | 19.6838 | 20.0019 | 20.2010 | 20.2798 | 20.2903 | 20.2907 | 20.2567 | 20.0230 | 19.5617 | 19.1434 (91) |
| MIT                                                                         | 19.0339      | 19.2460 | 19.5338 | 19.8519 | 20.0510 | 20.1298 | 20.1403 | 20.1407 | 20.1067 | 19.8730 | 19.4117 | 18.9934 (93) |
| Temperature adjustment                                                      |              |         |         |         |         |         |         |         |         |         |         | -0.1500      |
| adjusted MIT                                                                |              |         |         |         |         |         |         |         |         |         |         | 18.9934 (93) |

## 8. Space heating requirement

|                                                                                | Jan       | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov      | Dec            |
|--------------------------------------------------------------------------------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|----------|----------------|
| Utilisation                                                                    | 0.9691    | 0.9494   | 0.9113   | 0.8294   | 0.6837   | 0.4873   | 0.3293   | 0.3644   | 0.5951   | 0.8434        | 0.9464   | 0.9742 (94)    |
| Useful gains                                                                   | 596.0061  | 647.2848 | 664.5964 | 633.0796 | 534.0236 | 367.7143 | 237.9628 | 250.6198 | 393.2998 | 526.3422      | 559.0319 | 572.0106 (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                                                               | 1023.0743 | 993.5268 | 900.3226 | 747.3253 | 568.5343 | 372.4280 | 238.4408 | 251.4309 | 406.2380 | 631.3083      | 842.0895 | 1016.7420 (97) |
| Space heating kWh                                                              | 317.7388  | 232.6746 | 175.3803 | 82.2569  | 25.6760  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 78.0948       | 203.8015 | 330.8802 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |          |          |          |          |          |          |          |          |               |          | 1446.5031      |
| 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                                                              | 317.7388  | 232.6746 | 175.3803 | 82.2569  | 25.6760  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 78.0948       | 203.8015 | 330.8802 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |          |          |          |          |          |          |          |          |               |          | 1446.5031      |
| Space heating per m2                                                           |           |          |          |          |          |          |          |          |          | (98c) / (4) = |          | 20.1071 (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 %)                      | 88.7000 (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                                             | 317.7388      | 232.6746 | 175.3803 | 82.2569  | 25.6760  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 78.0948  | 203.8015 | 330.8802 (98)  |
| Space heating efficiency (main heating system 1)                      | 88.7000       | 88.7000  | 88.7000  | 88.7000  | 88.7000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 88.7000  | 88.7000  | 88.7000 (210)  |
| Space heating fuel (main heating system)                              | 358.2173      | 262.3164 | 197.7230 | 92.7361  | 28.9470  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 88.0438  | 229.7649 | 373.0329 (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                                             | 203.1316      | 178.7597 | 187.8406 | 160.3946 | 152.2064 | 133.6017 | 129.3554 | 136.5325 | 140.2712 | 160.6461 | 175.9637 | 200.3051 (64)  |
| Efficiency of water heater                                            | 83.4599       | 82.9012  | 81.8826  | 80.1686  | 77.9605  | 76.4000  | 76.4000  | 76.4000  | 76.4000  | 80.0302  | 82.5426  | 76.4000 (216)  |
| Fuel for water heating, kWh/month                                     | 243.3882      | 215.6299 | 229.4024 | 200.0717 | 195.2354 | 174.8713 | 169.3134 | 178.7074 | 183.6011 | 200.7319 | 213.1792 | 239.5327 (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)   |

# Full SAP Calculation Printout



|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |                  |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------------------|
| Lighting                                                                                             | 21.9933  | 17.6439  | 15.8864  | 11.6390  | 8.9903   | 7.3452   | 8.2013   | 10.6603  | 13.8467  | 18.1676  | 20.5203  | 22.6046 (232)    |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |                  |
| (233a)m                                                                                              | -22.2542 | -32.7449 | -49.1800 | -57.8285 | -64.5019 | -60.9914 | -60.2074 | -55.7392 | -48.2263 | -38.5059 | -24.9337 | -19.0769 (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   | (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   | (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   | (235c)           |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |                  |
| (233b)m                                                                                              | -9.0499  | -19.4926 | -39.7864 | -61.4040 | -82.7998 | -83.8297 | -82.6998 | -69.1195 | -49.5632 | -28.2727 | -12.1974 | -7.1192 (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   | (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   | (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   | (235d)           |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |                  |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 1630.7814 (211)  |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)     |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)     |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 76.4000          |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          | 2443.6647 (219)  |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (221)     |
| Electricity for pumps and fans:                                                                      |          |          |          |          |          |          |          |          |          |          |          |                  |
| central heating pump                                                                                 |          |          |          |          |          |          |          |          |          |          |          | 41.0000 (230c)   |
| main heating flue fan                                                                                |          |          |          |          |          |          |          |          |          |          |          | 45.0000 (230e)   |
| Total electricity for the above, kWh/year                                                            |          |          |          |          |          |          |          |          |          |          |          | 86.0000 (231)    |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |          |          |          |          |          |          |          |          | 177.4988 (232)   |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |          |          |          |          |          |          |          |          |                  |
| PV generation                                                                                        |          |          |          |          |          |          |          |          |          |          |          | -1079.5246 (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                                                                  |          |          |          |          |          |          |          |          |          |          |          | 3258.4203 (238)  |

## 10a. Fuel costs - using BEDF prices (554)

|                                             | Fuel<br>kWh/year | Fuel price<br>p/kWh | Fuel cost<br>£/year |
|---------------------------------------------|------------------|---------------------|---------------------|
| Space heating - main system 1               | 1630.7814        | 5.6000              | 91.3238 (240)       |
| Total CO2 associated with community systems |                  |                     | 0.0000 (473)        |
| Water heating (other fuel)                  | 2443.6647        | 5.6000              | 136.8452 (247)      |
| Energy for instantaneous electric shower(s) | 0.0000           | 26.0600             | 0.0000 (247a)       |
| Pumps, fans and electric keep-hot           | 86.0000          | 26.0600             | 22.4116 (249)       |
| Energy for lighting                         | 177.4988         | 26.0600             | 46.2562 (250)       |
| Additional standing charges                 |                  |                     | 99.0000 (251)       |
| Energy saving/generation technologies       |                  |                     |                     |
| PV Unit electricity used in dwelling        | -534.1903        | 26.0600             | -139.2100           |
| PV Unit electricity exported                | -545.3343        | 5.8100              | -31.6839            |
| Total                                       |                  |                     | -170.8939 (252)     |
| Total energy cost                           |                  |                     | 224.9429 (255)      |

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

|                                             | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|---------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1               | 1630.7814          | 0.2100                        | 342.4641 (261)           |
| Total CO2 associated with community systems |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                  | 2443.6647          | 0.2100                        | 513.1696 (264)           |
| Space and water heating                     |                    |                               | 855.6337 (265)           |
| Pumps, fans and electric keep-hot           | 86.0000            | 0.1387                        | 11.9293 (267)            |
| Energy for lighting                         | 177.4988           | 0.1443                        | 25.6186 (268)            |
| Energy saving/generation technologies       |                    |                               |                          |
| PV Unit electricity used in dwelling        | -534.1903          | 0.1337                        | -71.4146                 |
| PV Unit electricity exported                | -545.3343          | 0.1252                        | -68.2559                 |
| Total                                       |                    |                               | -139.6705 (269)          |
| Total CO2, kg/year                          |                    |                               | 753.5110 (272)           |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 1630.7814          | 1.1300                              | 1842.7830 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2443.6647          | 1.1300                              | 2761.3411 (278)            |
| Space and water heating                     |                    |                                     | 4604.1240 (279)            |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008 (281)             |
| Energy for lighting                         | 177.4988           | 1.5338                              | 272.2537 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -534.1903          | 1.4940                              | -798.0994                  |
| PV Unit electricity exported                | -545.3343          | 0.4594                              | -250.5261                  |
| Total                                       |                    |                                     | -1048.6255 (283)           |
| Total Primary energy kWh/year               |                    |                                     | 3957.8530 (286)            |

## SAP 10 EPC IMPROVEMENTS

# Full SAP Calculation Printout



Current energy efficiency rating:  
Current environmental impact rating:

A 92  
B 91

N Solar water heating SAP increase too small  
U Solar photovoltaic panels Already installed  
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change  
(none)

Measures omitted - SAP change or cost saving too small:  
N Solar water heating + 0.7 -£ 22 -145 kg (19.2%)

Recommended measures Typical annual savings Energy Environmental  
(none) efficiency impact  
Total Savings £0 0.00 kg/m²

Potential energy efficiency rating: A 92  
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 554 TEST (31 Oct 2024)  
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, East Pennines):

|                          | Current    | Potential  | Saving     |
|--------------------------|------------|------------|------------|
| Electricity              | £69        | £69        | £0         |
| Mains gas                | £327       | £327       | £0         |
| Space heating            | £213       | £213       | £0         |
| Water heating            | £137       | £137       | £0         |
| Lighting                 | £46        | £46        | £0         |
| Generated (PV)           | -£171      | -£171      | £0         |
| Total cost of fuels      | £225       | £225       | £0         |
| Total cost of uses       | £225       | £225       | £0         |
| Delivered energy         | 45 kWh/m²  | 45 kWh/m²  | 0 kWh/m²   |
| Carbon dioxide emissions | 0.8 tonnes | 0.8 tonnes | 0.0 tonnes |
| CO2 emissions per m²     | 10 kg/m²   | 10 kg/m²   | 0 kg/m²    |
| Primary energy           | 55 kWh/m²  | 55 kWh/m²  | 0 kWh/m²   |

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

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m²) | Storey height<br>(m)              | Volume<br>(m³)        |
|--------------------------------------------------------|--------------|-----------------------------------|-----------------------|
| Ground floor                                           | 35.9700 (1b) | x 2.4000 (2b)                     | = 86.3280 (1b) - (3b) |
| First floor                                            | 35.9700 (1c) | x 2.6300 (2c)                     | = 94.6011 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 71.9400      |                                   | (4)                   |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 180.9291 (5)          |

## 2. Ventilation rate

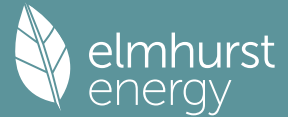
|                                                    | m³ per hour           |
|----------------------------------------------------|-----------------------|
| Number of open chimneys                            | 0 * 80 = 0.0000 (6a)  |
| Number of open flues                               | 0 * 20 =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

|                                                                                                    |                             |             |
|----------------------------------------------------------------------------------------------------|-----------------------------|-------------|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 30.0000 / (5) =             | 0.1658 (8)  |
| Pressure test                                                                                      | Yes                         |             |
| Pressure Test Method                                                                               | Blower Door                 |             |
| Measured/design AP50                                                                               | 4.0000 (17)                 |             |
| Infiltration rate                                                                                  | 0.3658 (18)                 |             |
| Number of sides sheltered                                                                          | 2 (19)                      |             |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = | 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) =        | 0.3109 (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 | 0.3964 | 0.3887 | 0.3809 | 0.3420 | 0.3343 | 0.2954 | 0.2954 | 0.2876 | 0.3109 | 0.3343 | 0.3498 | 0.3654 (22b) |
| Effective ac    | 0.5786 | 0.5755 | 0.5725 | 0.5585 | 0.5559 | 0.5436 | 0.5436 | 0.5414 | 0.5483 | 0.5559 | 0.5612 | 0.5667 (25)  |

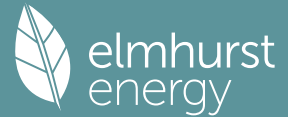
## 3. Heat losses and heat loss parameter

# Full SAP Calculation Printout



| 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   |                 |                 |                    |                 |                 |               |
|-------------------------------------------------------------------------------------|-----------------|-----------------|-----------------|-----------------------|-----------------|----------------------------------------|-----------------|-----------------|-----------------|--------------------|-----------------|-----------------|---------------|
| Front door                                                                          |                 |                 | 2.1400          | 1.1000                | 2.3540          |                                        |                 | (26)            |                 |                    |                 |                 |               |
| Windows (Uw = 1.30)                                                                 |                 |                 | 10.5700         | 1.2357                | 13.0618         |                                        |                 | (27)            |                 |                    |                 |                 |               |
| Heatloss Floor 1                                                                    |                 |                 | 35.9700         | 0.1300                | 4.6761          | 110.0000                               | 3956.7000       | (28a)           |                 |                    |                 |                 |               |
| Brick wall                                                                          | 43.9600         | 12.7100         | 31.2500         | 0.1900                | 5.9375          | 110.0000                               | 3437.5000       | (29a)           |                 |                    |                 |                 |               |
| Plane roof                                                                          | 35.9700         |                 | 35.9700         | 0.0900                | 3.2373          | 9.0000                                 | 323.7300        | (30)            |                 |                    |                 |                 |               |
| Total net area of external elements Aum(A, m2)                                      |                 |                 | 115.9000        |                       |                 |                                        |                 | (31)            |                 |                    |                 |                 |               |
| Fabric heat loss, W/K = Sum (A x U)                                                 |                 |                 |                 | (26)... (30) + (32) = | 29.2667         |                                        |                 | (33)            |                 |                    |                 |                 |               |
| Party Wall 1                                                                        |                 |                 | 82.7900         | 0.0000                | 0.0000          | 70.0000                                | 5795.3000       | (32)            |                 |                    |                 |                 |               |
| Internal Wall 2                                                                     |                 |                 | 104.9400        |                       |                 | 9.0000                                 | 944.4600        | (32c)           |                 |                    |                 |                 |               |
| Internal Floor                                                                      |                 |                 | 35.9700         |                       |                 | 18.0000                                | 647.4600        | (32d)           |                 |                    |                 |                 |               |
| Internal Ceiling 1                                                                  |                 |                 | 35.9700         |                       |                 | 9.0000                                 | 323.7300        | (32e)           |                 |                    |                 |                 |               |
| Heat capacity Cm = Sum(A x k)                                                       |                 |                 |                 |                       |                 | (28)... (30) + (32) + (32a)... (32e) = | 15428.8800      | (34)            |                 |                    |                 |                 |               |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K                                   |                 |                 |                 |                       |                 |                                        | 214.4687        | (35)            |                 |                    |                 |                 |               |
| List of Thermal Bridges                                                             |                 |                 |                 |                       |                 |                                        |                 |                 |                 |                    |                 |                 |               |
| K1 Element                                                                          |                 |                 |                 | Length                | Psi-value       | Total                                  |                 |                 |                 |                    |                 |                 |               |
| E2 Other lintels (including other steel lintels)                                    |                 |                 |                 | 8.2500                | 0.0240          | 0.1980                                 |                 |                 |                 |                    |                 |                 |               |
| E3 Sill                                                                             |                 |                 |                 | 5.6500                | 0.0220          | 0.1243                                 |                 |                 |                 |                    |                 |                 |               |
| E4 Jamb                                                                             |                 |                 |                 | 21.3000               | 0.0170          | 0.3621                                 |                 |                 |                 |                    |                 |                 |               |
| E5 Ground floor (normal)                                                            |                 |                 |                 | 8.7400                | 0.0920          | 0.8041                                 |                 |                 |                 |                    |                 |                 |               |
| E6 Intermediate floor within a dwelling                                             |                 |                 |                 | 8.7400                | 0.0010          | 0.0087                                 |                 |                 |                 |                    |                 |                 |               |
| E18 Party wall between dwellings                                                    |                 |                 |                 | 20.1200               | 0.0400          | 0.8048                                 |                 |                 |                 |                    |                 |                 |               |
| P1 Party wall - Ground floor                                                        |                 |                 |                 | 16.4600               | 0.0690          | 1.1357                                 |                 |                 |                 |                    |                 |                 |               |
| P2 Party wall - Intermediate floor within a dwelling                                |                 |                 |                 | 16.4600               | 0.0000          | 0.0000                                 |                 |                 |                 |                    |                 |                 |               |
| P4 Party wall - Roof (insulation at ceiling level)                                  |                 |                 |                 | 16.4600               | 0.1010          | 1.6625                                 |                 |                 |                 |                    |                 |                 |               |
| E10 Eaves (insulation at ceiling level)                                             |                 |                 |                 | 8.7400                | 0.0600          | 0.5244                                 |                 |                 |                 |                    |                 |                 |               |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                          |                 |                 |                 |                       |                 |                                        | 5.6246          | (36)            |                 |                    |                 |                 |               |
| Point Thermal bridges                                                               |                 |                 |                 |                       |                 | (36a) =                                | 0.0000          |                 |                 |                    |                 |                 |               |
| Total fabric heat loss                                                              |                 |                 |                 |                       |                 | (33) + (36) + (36a) =                  | 34.8913         | (37)            |                 |                    |                 |                 |               |
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)                 |                 |                 |                 |                       |                 |                                        |                 |                 |                 |                    |                 |                 |               |
| (38)m                                                                               | Jan<br>34.5454  | Feb<br>34.3632  | Mar<br>34.1846  | Apr<br>33.3457        | May<br>33.1888  | Jun<br>32.4582                         | Jul<br>32.4582  | Aug<br>32.3229  | Sep<br>32.7396  | Oct<br>33.1888     | Nov<br>33.5063  | Dec<br>33.8382  | (38)          |
| Heat transfer coeff                                                                 | 69.4367         | 69.2545         | 69.0759         | 68.2370               | 68.0801         | 67.3495                                | 67.3495         | 67.2142         | 67.6309         | 68.0801            | 68.3976         | 68.7295         | (39)          |
| Average = Sum(39)m / 12 =                                                           |                 |                 |                 |                       |                 |                                        |                 |                 |                 |                    |                 | 68.2363         |               |
| HLP                                                                                 | Jan<br>0.9652   | Feb<br>0.9627   | Mar<br>0.9602   | Apr<br>0.9485         | May<br>0.9463   | Jun<br>0.9362                          | Jul<br>0.9362   | Aug<br>0.9343   | Sep<br>0.9401   | Oct<br>0.9463      | Nov<br>0.9508   | Dec<br>0.9554   | (40)          |
| HLP (average)                                                                       |                 |                 |                 |                       |                 |                                        |                 |                 |                 |                    |                 | 0.9485          |               |
| Days in mont                                                                        | 31              | 28              | 31              | 30                    | 31              | 30                                     | 31              | 31              | 30              | 31                 | 30              | 31              |               |
| -----                                                                               |                 |                 |                 |                       |                 |                                        |                 |                 |                 |                    |                 |                 |               |
| 4. Water heating energy requirements (kWh/year)                                     |                 |                 |                 |                       |                 |                                        |                 |                 |                 |                    |                 |                 |               |
| -----                                                                               |                 |                 |                 |                       |                 |                                        |                 |                 |                 |                    |                 |                 |               |
| Assumed occupancy                                                                   |                 |                 |                 |                       |                 |                                        |                 |                 |                 |                    |                 |                 | 2.2923 (42)   |
| Hot water usage for mixer showers                                                   |                 |                 |                 |                       |                 |                                        |                 |                 |                 |                    |                 |                 |               |
| 62.6538                                                                             | 61.7122         | 60.3402         | 57.7150         | 55.7777               | 53.6172         | 52.3892                                | 53.7509         | 55.2435         | 57.5632         | 60.2448            | 62.4137         | 62.4137         | (42a)         |
| Hot water usage for baths                                                           |                 |                 |                 |                       |                 |                                        |                 |                 |                 |                    |                 |                 |               |
| 27.0664                                                                             | 26.6644         | 26.0984         | 25.0546         | 24.2731               | 23.4065         | 22.9384                                | 23.5005         | 24.1126         | 25.0399         | 26.1051            | 26.9749         | 26.9749         | (42b)         |
| Hot water usage for other uses                                                      |                 |                 |                 |                       |                 |                                        |                 |                 |                 |                    |                 |                 |               |
| 38.1053                                                                             | 36.7197         | 35.3340         | 33.9484         | 32.5627               | 31.1771         | 31.1771                                | 32.5627         | 33.9484         | 35.3340         | 36.7197            | 38.1053         | 38.1053         | (42c)         |
| Average daily hot water use (litres/day)                                            |                 |                 |                 |                       |                 |                                        |                 |                 |                 |                    |                 |                 | 117.5007 (43) |
| Daily hot water use                                                                 | Jan<br>127.8255 | Feb<br>125.0963 | Mar<br>121.7725 | Apr<br>116.7180       | May<br>112.6135 | Jun<br>108.2008                        | Jul<br>106.5048 | Aug<br>109.8142 | Sep<br>113.3045 | Oct<br>117.9371    | Nov<br>123.0695 | Dec<br>127.4939 | (44)          |
| Energy conte                                                                        | 202.4443        | 178.1355        | 187.1599        | 159.7811              | 151.5995        | 133.0456                               | 128.8083        | 135.9729        | 139.7158        | 160.0395           | 175.3350        | 199.6247        | (45)          |
| Energy content (annual)                                                             |                 |                 |                 |                       |                 |                                        |                 |                 |                 | Total = Sum(45)m = | 1951.6620       |                 |               |
| Distribution loss (46)m = 0.15 x (45)m                                              |                 |                 |                 |                       |                 |                                        |                 |                 |                 |                    |                 |                 |               |
| 30.3666                                                                             | 26.7203         | 28.0740         | 23.9672         | 22.7399               | 19.9568         | 19.3212                                | 20.3959         | 20.9574         | 24.0059         | 26.3003            | 29.9437         | 29.9437         | (46)          |
| Water storage loss:                                                                 |                 |                 |                 |                       |                 |                                        |                 |                 |                 |                    |                 |                 |               |
| Total storage loss                                                                  | 0.0000          | 0.0000          | 0.0000          | 0.0000                | 0.0000          | 0.0000                                 | 0.0000          | 0.0000          | 0.0000          | 0.0000             | 0.0000          | 0.0000          | (56)          |
| If cylinder contains dedicated solar storage                                        | 0.0000          | 0.0000          | 0.0000          | 0.0000                | 0.0000          | 0.0000                                 | 0.0000          | 0.0000          | 0.0000          | 0.0000             | 0.0000          | 0.0000          | (57)          |
| Primary loss                                                                        | 0.0000          | 0.0000          | 0.0000          | 0.0000                | 0.0000          | 0.0000                                 | 0.0000          | 0.0000          | 0.0000          | 0.0000             | 0.0000          | 0.0000          | (59)          |
| Combi loss                                                                          | 0.6873          | 0.6242          | 0.6807          | 0.6134                | 0.6069          | 0.5561                                 | 0.5472          | 0.5596          | 0.5555          | 0.6066             | 0.6286          | 0.6804          | (61)          |
| Total heat required for water heating calculated for each month                     |                 |                 |                 |                       |                 |                                        |                 |                 |                 |                    |                 |                 |               |
| 203.1316                                                                            | 178.7597        | 187.8406        | 160.3946        | 152.2064              | 133.6017        | 129.3554                               | 136.5325        | 140.2712        | 160.6461        | 175.9637           | 200.3051        | 200.3051        | (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                                                                     | 203.1316        | 178.7597        | 187.8406        | 160.3946              | 152.2064        | 133.6017                               | 129.3554        | 136.5325        | 140.2712        | 160.6461           | 175.9637        | 200.3051        | (64)          |
| Electric shower(s)                                                                  | 0.0000          | 0.0000          | 0.0000          | 0.0000                | 0.0000          | 0.0000                                 | 0.0000          | 0.0000          | 0.0000          | 0.0000             | 0.0000          | 0.0000          | (64a)         |
| Heat gains from water heating, kWh/month                                            | 67.4846         | 59.3861         | 62.4008         | 53.2806               | 50.5586         | 44.3767                                | 42.9655         | 45.3509         | 46.5944         | 53.3648            | 58.4561         | 66.5453         | (65)          |
| -----                                                                               |                 |                 |                 |                       |                 |                                        |                 |                 |                 |                    |                 |                 |               |
| 5. Internal gains (see Table 5 and 5a)                                              |                 |                 |                 |                       |                 |                                        |                 |                 |                 |                    |                 |                 |               |
| -----                                                                               |                 |                 |                 |                       |                 |                                        |                 |                 |                 |                    |                 |                 |               |
| Metabolic gains (Table 5), Watts                                                    |                 |                 |                 |                       |                 |                                        |                 |                 |                 |                    |                 |                 |               |
| (66)m                                                                               | 137.5372        | 137.5372        | 137.5372        | 137.5372              | 137.5372        | 137.5372                               | 137.5372        | 137.5372        | 137.5372        | 137.5372           | 137.5372        | 137.5372        | (66)          |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 25.1268         | 22.3174         | 18.1497         | 13.7405               | 10.2712         | 8.6714                                 | 9.3697          | 12.1791         | 16.3468         | 20.7560            | 24.2253         | 25.8251         | (67)          |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 301.1670        | 304.2921        | 296.4168        | 279.6512              | 258.4875        | 238.5967                               | 225.3085        | 222.1833        | 230.0586        | 246.8243           | 267.9879        | 287.8787        | (68)          |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 51.0460         | 51.0460         | 51.0460         | 51.0460               | 51.0460         | 51.0460                                | 51.0460         | 51.0460         | 51.0460         | 51.0460            | 51.0460         | 51.0460         | (69)          |
| Pumps, fans                                                                         | 3.0000          | 3.0000          | 3.0000          | 3.0000                | 3.0000          | 3.0000                                 | 3.0000          | 3.0000          | 3.0000          | 3.0000             | 3.0000          | 3.0000          | (70)          |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -91.6915        | -91.6915        | -91.6915        | -91.6915              | -91.6915        | -91.6915                               | -91.6915        | -91.6915        | -91.6915        | -91.6915           | -91.6915        | -91.6915        | (71)          |
| Water heating gains (Table 5)                                                       | 90.7051         | 88.3722         | 83.8721         | 74.0008               | 67.9550         | 61.6343                                | 57.7494         | 60.9555         | 64.7144         | 71.7269            | 81.1890         | 89.4426         | (72)          |
| Total internal gains                                                                | 516.8906        | 514.8734        | 498.3304        | 467.2842              | 436.6055        | 405.7941                               | 389.3193        | 392.2096        | 408.0115        | 439.1989           | 473.2939        | 503.0382        | (73)          |

# Full SAP Calculation Printout



## 6. Solar gains

| [Jan]       |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W |          |
|-------------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|------------|----------|
| North       |          |          | 6.0100     | 10.6334                        | 0.7300                            | 0.7000                             | 0.7700                       | 22.6308    | (74)     |
| South       |          |          | 4.5600     | 46.7521                        | 0.7300                            | 0.7000                             | 0.7700                       | 75.4953    | (78)     |
| Solar gains | 98.1261  | 166.8905 | 230.9878   | 296.0505                       | 344.5098                          | 348.7439                           | 333.3504                     | 295.4765   | 252.8838 |
| Total gains | 615.0167 | 681.7639 | 729.3182   | 763.3347                       | 781.1154                          | 754.5380                           | 722.6697                     | 687.6862   | 660.8954 |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |              |
| tau                                                                         | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| alpha                                                                       | 61.7224 | 61.8848 | 62.0448 | 62.8075 | 62.9523 | 63.6352 | 63.6352 | 63.7633 | 63.3704 | 62.9523 | 62.6601 | 62.3575      |
| util living area                                                            | 5.1148  | 5.1257  | 5.1363  | 5.1872  | 5.1968  | 5.2423  | 5.2423  | 5.2509  | 5.2247  | 5.1968  | 5.1773  | 5.1572       |
|                                                                             | 0.9813  | 0.9672  | 0.9378  | 0.8694  | 0.7397  | 0.5578  | 0.4078  | 0.4459  | 0.6680  | 0.8866  | 0.9660  | 0.9847 (86)  |
| MIT                                                                         | 20.0297 | 20.2046 | 20.4452 | 20.7163 | 20.9031 | 20.9822 | 20.9971 | 20.9955 | 20.9559 | 20.7289 | 20.3347 | 19.9920 (87) |
| Th 2                                                                        | 20.1124 | 20.1146 | 20.1166 | 20.1264 | 20.1283 | 20.1368 | 20.1368 | 20.1384 | 20.1335 | 20.1283 | 20.1246 | 20.1207 (88) |
| util rest of house                                                          | 0.9766  | 0.9593  | 0.9230  | 0.8399  | 0.6885  | 0.4879  | 0.3290  | 0.3642  | 0.5974  | 0.8544  | 0.9564  | 0.9809 (89)  |
| MIT 2                                                                       | 18.9989 | 19.2192 | 19.5173 | 19.8457 | 20.0474 | 20.1262 | 20.1358 | 20.1366 | 20.1038 | 19.8686 | 19.3926 | 18.9578 (90) |
| Living area fraction                                                        | 19.1839 | 19.3960 | 19.6838 | 20.0019 | 20.2010 | 20.2798 | 20.2903 | 20.2907 | 20.2567 | 20.0230 | 19.5617 | 19.1434 (92) |
| MIT                                                                         | 19.0339 | 19.2460 | 19.5338 | 19.8519 | 20.0510 | 20.1298 | 20.1403 | 20.1407 | 20.1067 | 19.8730 | 19.4117 | 18.9934 (93) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | -0.1500      |
| adjusted MIT                                                                |         |         |         |         |         |         |         |         |         |         |         |              |

## 8. Space heating requirement

|                                                                                |           |          |          |          |          |          |          |          |          |               |          |                |
|--------------------------------------------------------------------------------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|----------|----------------|
| Utilisation                                                                    | Jan       | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov      | Dec            |
|                                                                                | 0.9691    | 0.9494   | 0.9113   | 0.8294   | 0.6837   | 0.4873   | 0.3293   | 0.3644   | 0.5951   | 0.8434        | 0.9464   | 0.9742 (94)    |
| Useful gains                                                                   | 596.0061  | 647.2848 | 664.5964 | 633.0796 | 534.0236 | 367.7143 | 237.9628 | 250.6198 | 393.2998 | 526.3422      | 559.0319 | 572.0106 (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                                                               | 1023.0743 | 993.5268 | 900.3226 | 747.3253 | 568.5343 | 372.4280 | 238.4408 | 251.4309 | 406.2380 | 631.3083      | 842.0895 | 1016.7420 (97) |
| Space heating kWh                                                              | 317.7388  | 232.6746 | 175.3803 | 82.2569  | 25.6760  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 78.0948       | 203.8015 | 330.8802 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |          |          |          |          |          |          |          |          |               |          | 1446.5031      |
| 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                                                              | 317.7388  | 232.6746 | 175.3803 | 82.2569  | 25.6760  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 78.0948       | 203.8015 | 330.8802 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |          |          |          |          |          |          |          |          |               |          | 1446.5031      |
| Space heating per m2                                                           |           |          |          |          |          |          |          |          |          | (98c) / (4) = |          | 20.1071 (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 %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 88.7000 (206)   |
| Efficiency of main space heating system 2 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                              |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
| Space heating requirement                                                                            | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
|                                                                                                      | 317.7388 | 232.6746 | 175.3803 | 82.2569  | 25.6760  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 78.0948  | 203.8015 | 330.8802 (98)   |
| Space heating efficiency (main heating system 1)                                                     | 88.7000  | 88.7000  | 88.7000  | 88.7000  | 88.7000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 88.7000  | 88.7000  | 88.7000 (210)   |
| Space heating fuel (main heating system)                                                             | 358.2173 | 262.3164 | 197.7230 | 92.7361  | 28.9470  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 88.0438  | 229.7649 | 373.0329 (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                                                                            | 203.1316 | 178.7597 | 187.8406 | 160.3946 | 152.2064 | 133.6017 | 129.3554 | 136.5325 | 140.2712 | 160.6461 | 175.9637 | 200.3051 (64)   |
| Efficiency of water heater                                                                           | 83.4599  | 82.9012  | 81.8826  | 80.1686  | 77.9605  | 76.4000  | 76.4000  | 76.4000  | 76.4000  | 80.0302  | 82.5426  | 76.4000 (216)   |
| Fuel for water heating, kWh/month                                                                    | 243.3882 | 215.6299 | 229.4024 | 200.0717 | 195.2354 | 174.8713 | 169.3134 | 178.7074 | 183.6011 | 200.7319 | 213.1792 | 239.5327 (219)  |
| Space cooling fuel requirement                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                                         | 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                                                                                             | 21.9933  | 17.6439  | 15.8864  | 11.6390  | 8.9903   | 7.3452   | 8.2013   | 10.6603  | 13.8467  | 18.1676  | 20.5203  | 22.6046 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -22.2542 | -32.7449 | -49.1800 | -57.8285 | -64.5019 | -60.9914 | -60.2074 | -55.7392 | -48.2263 | -38.5059 | -24.9337 | -19.0769 (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -9.0499  | -19.4926 | -39.7864 | -61.4040 | -82.7998 | -83.8297 | -82.6998 | -69.1195 | -49.5632 | -28.2727 | -12.1974 | -7.1192 (233b)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |



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10a. Fuel costs - using Table 12 prices

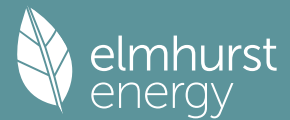
11a. SAP rating - Individual heating systems12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

## 1. Overall dwelling characteristics

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2. Ventilation rate

# Full SAP Calculation Printout



|                                                      |                                                       |        |        |        |        |        |        |        |        |        |                             |              |
|------------------------------------------------------|-------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-----------------------------|--------------|
|                                                      |                                                       |        |        |        |        |        |        |        |        |        | m3 per hour                 |              |
| Number of open chimneys                              |                                                       |        |        |        |        |        |        |        |        |        | 0 * 80 =                    | 0.0000 (6a)  |
| Number of open flues                                 |                                                       |        |        |        |        |        |        |        |        |        | 0 * 20 =                    | 0.0000 (6b)  |
| Number of chimneys / flues attached to closed fire   |                                                       |        |        |        |        |        |        |        |        |        | 0 * 10 =                    | 0.0000 (6c)  |
| Number of flues attached to solid fuel boiler        |                                                       |        |        |        |        |        |        |        |        |        | 0 * 20 =                    | 0.0000 (6d)  |
| Number of flues attached to other heater             |                                                       |        |        |        |        |        |        |        |        |        | 0 * 35 =                    | 0.0000 (6e)  |
| Number of blocked chimneys                           |                                                       |        |        |        |        |        |        |        |        |        | 0 * 20 =                    | 0.0000 (6f)  |
| Number of intermittent extract fans                  |                                                       |        |        |        |        |        |        |        |        |        | 3 * 10 =                    | 30.0000 (7a) |
| Number of passive vents                              |                                                       |        |        |        |        |        |        |        |        |        | 0 * 10 =                    | 0.0000 (7b)  |
| Number of flueless gas fires                         |                                                       |        |        |        |        |        |        |        |        |        | 0 * 40 =                    | 0.0000 (7c)  |
|                                                      |                                                       |        |        |        |        |        |        |        |        |        | Air changes per hour        |              |
| Infiltration due to chimneys, flues and fans         | = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = |        |        |        |        |        |        |        |        |        | 30.0000 / (5) =             | 0.1658 (8)   |
| Pressure test                                        |                                                       |        |        |        |        |        |        |        |        |        | Yes                         |              |
| Pressure Test Method                                 |                                                       |        |        |        |        |        |        |        |        |        | Blower Door                 |              |
| Measured/design AP50                                 |                                                       |        |        |        |        |        |        |        |        |        | 4.0000                      | (17)         |
| Infiltration rate                                    |                                                       |        |        |        |        |        |        |        |        |        | 0.3658                      | (18)         |
| Number of sides sheltered                            |                                                       |        |        |        |        |        |        |        |        |        | 2                           | (19)         |
| Shelter factor                                       |                                                       |        |        |        |        |        |        |        |        |        | (20) = 1 - [0.075 x (19)] = | 0.8500 (20)  |
| Infiltration rate adjusted to include shelter factor |                                                       |        |        |        |        |        |        |        |        |        | (21) = (18) x (20) =        | 0.3109 (21)  |
| -----                                                |                                                       |        |        |        |        |        |        |        |        |        |                             |              |
| Wind speed                                           | Jan                                                   | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov                         | Dec          |
| Wind factor                                          | 5.1000                                                | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000                      | 4.7000 (22)  |
| Adj infilt rate                                      | 1.2750                                                | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250                      | 1.1750 (22a) |
|                                                      | 0.3964                                                | 0.3887 | 0.3809 | 0.3420 | 0.3343 | 0.2954 | 0.2954 | 0.2876 | 0.3109 | 0.3343 | 0.3498                      | 0.3654 (22b) |
| Effective ac                                         | 0.5786                                                | 0.5755 | 0.5725 | 0.5585 | 0.5559 | 0.5436 | 0.5436 | 0.5414 | 0.5483 | 0.5559 | 0.5612                      | 0.5667 (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   |
|---------------------------------------------------|-------------|----------------|---------------|--------------------------------------|--------------|-------------------|-----------------|
| Front door                                        |             |                | 2.1400        | 1.1000                               | 2.3540       |                   | (26)            |
| Windows (Uw = 1.30)                               |             |                | 10.5700       | 1.2357                               | 13.0618      |                   | (27)            |
| Heatloss Floor 1                                  |             |                | 35.9700       | 0.1300                               | 4.6761       | 110.0000          | 3956.7000 (28a) |
| Brick wall                                        | 43.9600     | 12.7100        | 31.2500       | 0.1900                               | 5.9375       | 110.0000          | 3437.5000 (29a) |
| Plane roof                                        | 35.9700     |                | 35.9700       | 0.0900                               | 3.2373       | 9.0000            | 323.7300 (30)   |
| Total net area of external elements Aum(A, m2)    |             |                | 115.9000      |                                      |              |                   | (31)            |
| Fabric heat loss, W/K = Sum (A x U)               |             |                |               | (26)...(30) + (32) =                 | 29.2667      |                   | (33)            |
| Party Wall 1                                      |             |                | 82.7900       | 0.0000                               | 0.0000       | 70.0000           | 5795.3000 (32)  |
| Internal Wall 2                                   |             |                | 104.9400      |                                      |              | 9.0000            | 944.4600 (32c)  |
| Internal Floor                                    |             |                | 35.9700       |                                      |              | 18.0000           | 647.4600 (32d)  |
| Internal Ceiling 1                                |             |                | 35.9700       |                                      |              | 9.0000            | 323.7300 (32e)  |
| Heat capacity Cm = Sum(A x k)                     |             |                |               | (28)...(30) + (32) + (32a)...(32e) = |              |                   | 15428.8800 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K |             |                |               |                                      |              |                   | 214.4687 (35)   |

## List of Thermal Bridges

| K1 Element                                                 | Length  | Psi-value | Total                              |
|------------------------------------------------------------|---------|-----------|------------------------------------|
| E2 Other lintels (including other steel lintels)           | 8.2500  | 0.0240    | 0.1980                             |
| E3 Sill                                                    | 5.6500  | 0.0220    | 0.1243                             |
| E4 Jamb                                                    | 21.3000 | 0.0170    | 0.3621                             |
| E5 Ground floor (normal)                                   | 8.7400  | 0.0920    | 0.8041                             |
| E6 Intermediate floor within a dwelling                    | 8.7400  | 0.0010    | 0.0087                             |
| E18 Party wall between dwellings                           | 20.1200 | 0.0400    | 0.8048                             |
| P1 Party wall - Ground floor                               | 16.4600 | 0.0690    | 1.1357                             |
| P2 Party wall - Intermediate floor within a dwelling       | 16.4600 | 0.0000    | 0.0000                             |
| P4 Party wall - Roof (insulation at ceiling level)         | 16.4600 | 0.1010    | 1.6625                             |
| E10 Eaves (insulation at ceiling level)                    | 8.7400  | 0.0600    | 0.5244                             |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |         |           | 5.6246 (36)                        |
| Point Thermal Bridges                                      |         |           | (36a) = 0.0000                     |
| Total fabric heat loss                                     |         |           | (33) + (36) + (36a) = 34.8913 (37) |

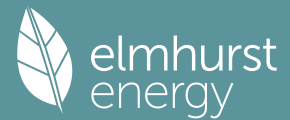
## Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

|                           |         |         |         |         |         |         |         |         |         |         |         |         |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| (38)m                     | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |
| Heat transfer coeff       | 34.5454 | 34.3632 | 34.1846 | 33.3457 | 33.1888 | 32.4582 | 32.4582 | 32.3229 | 32.7396 | 33.1888 | 33.5063 | 33.8382 |
| Average = Sum(39)m / 12 = | 69.4367 | 69.2545 | 69.0759 | 68.2370 | 68.0801 | 67.3495 | 67.3495 | 67.2142 | 67.6309 | 68.0801 | 68.3976 | 68.7295 |
|                           |         |         |         |         |         |         |         |         |         |         |         | 68.2363 |
| HLP                       | 0.9652  | 0.9627  | 0.9602  | 0.9485  | 0.9463  | 0.9362  | 0.9362  | 0.9343  | 0.9401  | 0.9463  | 0.9508  | 0.9554  |
| HLP (average)             |         |         |         |         |         |         |         |         |         |         |         | 0.9485  |
| Days in mont              | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31      |

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

|                                                                 |          |          |          |          |          |          |          |          |          |          |          |             |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-------------|
| Assumed occupancy                                               |          |          |          |          |          |          |          |          |          |          |          | 2.2923 (42) |
| Hot water usage for mixer showers                               |          |          |          |          |          |          |          |          |          |          |          |             |
|                                                                 | 62.6538  | 61.7122  | 60.3402  | 57.7150  | 55.7777  | 53.6172  | 52.3892  | 53.7509  | 55.2435  | 57.5632  | 60.2448  | 62.4137     |
| Hot water usage for baths                                       | 27.0664  | 26.6644  | 26.0984  | 25.0546  | 24.2731  | 23.4065  | 22.9384  | 23.5005  | 24.1126  | 25.0399  | 26.1051  | 26.9749     |
| Hot water usage for other uses                                  | 38.1053  | 36.7197  | 35.3340  | 33.9484  | 32.5627  | 31.1771  | 31.1771  | 32.5627  | 33.9484  | 35.3340  | 36.7197  | 38.1053     |
| Average daily hot water use (litres/day)                        |          |          |          |          |          |          |          |          |          |          |          | 117.5007    |
|                                                                 |          |          |          |          |          |          |          |          |          |          |          | (43)        |
| Daily hot water use                                             | 127.8255 | 125.0963 | 121.7725 | 116.7180 | 112.6135 | 108.2008 | 106.5048 | 109.8142 | 113.3045 | 117.9371 | 123.0695 | 127.4939    |
| Energy conte                                                    | 202.4443 | 178.1355 | 187.1599 | 159.7811 | 151.5995 | 133.0456 | 128.8083 | 135.9729 | 139.7158 | 160.0395 | 175.3350 | 199.6247    |
| Energy content (annual)                                         |          |          |          |          |          |          |          |          |          |          |          | 1951.6620   |
| Distribution loss (46)m = 0.15 x (45)m                          | 30.3666  | 26.7203  | 28.0740  | 23.9672  | 22.7399  | 19.9568  | 19.3212  | 20.3959  | 20.9574  | 24.0059  | 26.3003  | 29.9437     |
| Water storage loss:                                             |          |          |          |          |          |          |          |          |          |          |          |             |
| Total storage loss                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000      |
| 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      |
| 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      |
| Combi loss                                                      | 0.6873   | 0.6242   | 0.6807   | 0.6134   | 0.6069   | 0.5561   | 0.5472   | 0.5596   | 0.5555   | 0.6066   | 0.6286   | 0.6804      |
| Total heat required for water heating calculated for each month |          |          |          |          |          |          |          |          |          |          |          | (61)        |

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|                                          |          |          |          |          |          |          |          |          |          |          |          |               |
|------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| WWHRS                                    | 203.1316 | 178.7597 | 187.8406 | 160.3946 | 152.2064 | 133.6017 | 129.3554 | 136.5325 | 140.2712 | 160.6461 | 175.9637 | 200.3051 (62) |
| PV diverter                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63a)  |
| Solar input                              | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000 (63b) |
| FGHRS                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63c)  |
| Output from w/h                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63d)  |
|                                          | 203.1316 | 178.7597 | 187.8406 | 160.3946 | 152.2064 | 133.6017 | 129.3554 | 136.5325 | 140.2712 | 160.6461 | 175.9637 | 200.3051 (64) |
| Electric shower(s)                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (64a)  |
| Heat gains from water heating, kWh/month | 67.4846  | 59.3861  | 62.4008  | 53.2806  | 50.5586  | 44.3767  | 42.9655  | 45.3509  | 46.5944  | 53.3648  | 58.4561  | 66.5453 (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      |      |
| (66m)                                                                               | 137.5372 | 137.5372 | 137.5372 | 137.5372 | 137.5372 | 137.5372 | 137.5372 | 137.5372 | 137.5372 | 137.5372 | 137.5372 | 137.5372 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 25.1268  | 22.3174  | 18.1497  | 13.7405  | 10.2712  | 8.6714   | 9.3697   | 12.1791  | 16.3468  | 20.7560  | 24.2253  | 25.8251  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 301.1670 | 304.2921 | 296.4168 | 279.6512 | 258.4875 | 238.5967 | 225.3085 | 222.1833 | 230.0586 | 246.8243 | 267.9879 | 287.8787 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 51.0460  | 51.0460  | 51.0460  | 51.0460  | 51.0460  | 51.0460  | 51.0460  | 51.0460  | 51.0460  | 51.0460  | 51.0460  | 51.0460  | (69) |
| Pumps, fans                                                                         | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 3.0000   | 3.0000   | 3.0000   | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | -91.6915 | (71) |
| Water heating gains (Table 5)                                                       | 90.7051  | 88.3722  | 83.8721  | 74.0008  | 67.9550  | 61.6343  | 57.7494  | 60.9555  | 64.7144  | 71.7269  | 81.1890  | 89.4426  | (72) |
| Total internal gains                                                                | 516.8906 | 514.8734 | 498.3304 | 467.2842 | 436.6055 | 405.7941 | 389.3193 | 392.2096 | 408.0115 | 439.1989 | 473.2939 | 503.0382 | (73) |

## 6. Solar gains

| [Jan]       |          |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c |          |          | Access<br>factor<br>Table 6d |               |  | Gains<br>W   |
|-------------|----------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|----------|----------|------------------------------|---------------|--|--------------|
| North       |          |          |          |          | 6.0100     | 10.6334                        | 0.7300                            | 0.7000                             |          |          | 0.7700                       |               |  | 22.6308 (74) |
| South       |          |          |          |          | 4.5600     | 46.7521                        | 0.7300                            | 0.7000                             |          |          | 0.7700                       |               |  | 75.4953 (78) |
|             |          |          |          |          |            |                                |                                   |                                    |          |          |                              |               |  |              |
| Solar gains | 98.1261  | 166.8905 | 230.9878 | 296.0505 | 344.5098   | 348.7439                       | 333.3504                          | 295.4765                           | 252.8838 | 184.8412 | 117.4057                     | 84.1010 (83)  |  |              |
| Total gains | 615.0167 | 681.7639 | 729.3182 | 763.3347 | 781.1154   | 754.5380                       | 722.6697                          | 687.6862                           | 660.8954 | 624.0401 | 590.6996                     | 587.1392 (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                                                                         | 61.7224 | 61.8848 | 62.0448 | 62.8075 | 62.9523 | 63.6352 | 63.6352 | 63.7633 | 63.3704                   | 62.9523 | 62.6601 | 62.3575 |              |
| alpha                                                                       | 5.1148  | 5.1257  | 5.1363  | 5.1872  | 5.1968  | 5.2423  | 5.2423  | 5.2509  | 5.2247                    | 5.1968  | 5.1773  | 5.1572  |              |
| util living area                                                            | 0.9813  | 0.9672  | 0.9378  | 0.8694  | 0.7397  | 0.5578  | 0.4078  | 0.4459  | 0.6680                    | 0.8866  | 0.9660  | 0.9847  | (86)         |
| MIT                                                                         | 20.0297 | 20.2046 | 20.4452 | 20.7163 | 20.9031 | 20.9822 | 20.9971 | 20.9955 | 20.9559                   | 20.7289 | 20.3347 | 19.9920 | (87)         |
| Th 2                                                                        | 20.1124 | 20.1146 | 20.1166 | 20.1264 | 20.1283 | 20.1368 | 20.1368 | 20.1384 | 20.1335                   | 20.1283 | 20.1246 | 20.1207 | (88)         |
| util rest of house                                                          | 0.9766  | 0.9593  | 0.9230  | 0.8399  | 0.6885  | 0.4879  | 0.3290  | 0.3642  | 0.5974                    | 0.8544  | 0.9564  | 0.9809  | (89)         |
| MIT 2                                                                       | 18.9989 | 19.2192 | 19.5173 | 19.8457 | 20.0474 | 20.1262 | 20.1358 | 20.1366 | 20.1038                   | 19.8686 | 19.3926 | 18.9578 | (90)         |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         | 0.1795  | (91)         |
| MIT                                                                         | 19.1839 | 19.3960 | 19.6838 | 20.0019 | 20.2010 | 20.2798 | 20.2903 | 20.2907 | 20.2567                   | 20.0230 | 19.5617 | 19.1434 | (92)         |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | -0.1500 |              |
| adjusted MIT                                                                | 19.0339 | 19.2460 | 19.5338 | 19.8519 | 20.0510 | 20.1298 | 20.1403 | 20.1407 | 20.1067                   | 19.8730 | 19.4117 | 18.9934 | (93)         |

## 8. Space heating requirement

|                                                                                |           |          |          |          |          |          |          |          |          |          |          |           |       |
|--------------------------------------------------------------------------------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-------|
| Utilisation                                                                    | Jan       | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec       |       |
| Useful gains                                                                   | 0.9691    | 0.9494   | 0.9113   | 0.8294   | 0.6837   | 0.4873   | 0.3293   | 0.3644   | 0.5951   | 0.8434   | 0.9464   | 0.9742    | (94)  |
| Ext temp.                                                                      | 596.0061  | 647.2848 | 664.5964 | 633.0796 | 534.0236 | 367.7143 | 237.9628 | 250.6198 | 393.2998 | 526.3422 | 559.0319 | 572.0106  | (95)  |
| Heat loss rate W                                                               | 4.3000    | 4.9000   | 6.5000   | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000  | 7.1000   | 4.2000    | (96)  |
| Space heating kWh                                                              | 1023.0743 | 993.5268 | 900.3226 | 747.3253 | 568.5343 | 372.4280 | 238.4408 | 251.4309 | 406.2380 | 631.3083 | 842.0895 | 1016.7420 | (97)  |
| Space heating requirement - total per year (kWh/year)                          | 317.7388  | 232.6746 | 175.3803 | 82.2569  | 25.6760  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 78.0948  | 203.8015 | 330.8802  | (98a) |
| Solar heating kWh                                                              | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (98b) |
| Solar heating contribution - total per year (kWh/year)                         | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (98c) |
| Space heating kWh                                                              | 317.7388  | 232.6746 | 175.3803 | 82.2569  | 25.6760  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 78.0948  | 203.8015 | 330.8802  | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |          |          |          |          |          |          |          |          |          |          | 1446.5031 | (99)  |
| Space heating per m2                                                           |           |          |          |          |          |          |          |          |          |          |          | 20.1071   | (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 %)                      |     |     |     |     |     |     |     |     |     |     |     |     | 88.7000 (206) |
| Efficiency of main space heating system 2 (in %)                      |     |     |     |     |     |     |     |     |     |     |     |     | 0.0000 (207)  |
| Efficiency of secondary/supplementary heating system, %               |     |     |     |     |     |     |     |     |     |     |     |     | 0.0000 (208)  |
| Space heating requirement                                             | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |               |



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|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |                  |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------------------|
| Space heating efficiency (main heating system 1)                                                     | 317.7388 | 232.6746 | 175.3803 | 82.2569  | 25.6760  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 78.0948  | 203.8015 | 330.8802 (98)    |
| Space heating fuel (main heating system)                                                             | 88.7000  | 88.7000  | 88.7000  | 88.7000  | 88.7000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 88.7000  | 88.7000  | 88.7000 (210)    |
| Space heating efficiency (main heating system 2)                                                     | 358.2173 | 262.3164 | 197.7230 | 92.7361  | 28.9470  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 88.0438  | 229.7649 | 373.0329 (211)   |
| Space heating fuel (main heating system 2)                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)     |
| Space heating fuel (secondary)                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)     |
| Space heating fuel (secondary)                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)     |
| Water heating requirement                                                                            | 203.1316 | 178.7597 | 187.8406 | 160.3946 | 152.2064 | 133.6017 | 129.3554 | 136.5325 | 140.2712 | 160.6461 | 175.9637 | 200.3051 (64)    |
| Efficiency of water heater (217)m                                                                    | 83.4599  | 82.9012  | 81.8826  | 80.1686  | 77.9605  | 76.4000  | 76.4000  | 76.4000  | 76.4000  | 80.0302  | 82.5426  | 76.4000 (216)    |
| Fuel for water heating, kWh/month                                                                    | 243.3882 | 215.6299 | 229.4024 | 200.0717 | 195.2354 | 174.8713 | 169.3134 | 178.7074 | 183.6011 | 200.7319 | 213.1792 | 83.6233 (217)    |
| Space cooling fuel requirement                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)     |
| Pumps and Fa                                                                                         | 7.3041   | 6.5973   | 7.3041   | 7.0685   | 7.3041   | 7.0685   | 7.3041   | 7.0685   | 7.3041   | 7.0685   | 7.3041   | 7.3041 (231)     |
| Lighting                                                                                             | 21.9933  | 17.6439  | 15.8864  | 11.6390  | 8.9903   | 7.3452   | 8.2013   | 10.6603  | 13.8467  | 18.1676  | 20.5203  | 22.6046 (232)    |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -22.2542 | -32.7449 | -49.1800 | -57.8285 | -64.5019 | -60.9914 | -60.2074 | -55.7392 | -48.2263 | -38.5059 | -24.9337 | -19.0769 (233a)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)    |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)    |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)    |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -9.0499  | -19.4926 | -39.7864 | -61.4040 | -82.7998 | -83.8297 | -82.6998 | -69.1195 | -49.5632 | -28.2727 | -12.1974 | -7.1192 (233b)   |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)    |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)    |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)    |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |                  |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 1630.7814 (211)  |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)     |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)     |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 76.4000          |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          | 2443.6647 (219)  |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (221)     |
| Electricity for pumps and fans:                                                                      |          |          |          |          |          |          |          |          |          |          |          |                  |
| central heating pump                                                                                 |          |          |          |          |          |          |          |          |          |          |          | 41.0000 (230c)   |
| main heating flue fan                                                                                |          |          |          |          |          |          |          |          |          |          |          | 45.0000 (230e)   |
| Total electricity for the above, kWh/year                                                            |          |          |          |          |          |          |          |          |          |          |          | 86.0000 (231)    |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |          |          |          |          |          |          |          |          | 177.4988 (232)   |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |          |          |          |          |          |          |          |          |                  |
| PV generation                                                                                        |          |          |          |          |          |          |          |          |          |          |          | -1079.5246 (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                                                                  |          |          |          |          |          |          |          |          |          |          |          | 3258.4203 (238)  |

## 10a. Fuel costs - using BEDF prices (554)

|                                             | Fuel kWh/year | Fuel price p/kWh | Fuel cost £/year |  |
|---------------------------------------------|---------------|------------------|------------------|--|
| Space heating - main system 1               | 1630.7814     | 5.6000           | 91.3238 (240)    |  |
| Total CO2 associated with community systems |               |                  | 0.0000 (473)     |  |
| Water heating (other fuel)                  | 2443.6647     | 5.6000           | 136.8452 (247)   |  |
| Energy for instantaneous electric shower(s) | 0.0000        | 26.0600          | 0.0000 (247a)    |  |
| Pumps, fans and electric keep-hot           | 86.0000       | 26.0600          | 22.4116 (249)    |  |
| Energy for lighting                         | 177.4988      | 26.0600          | 46.2562 (250)    |  |
| Additional standing charges                 |               |                  | 99.0000 (251)    |  |
| Energy saving/generation technologies       |               |                  |                  |  |
| PV Unit electricity used in dwelling        | -534.1903     | 26.0600          | -139.2100        |  |
| PV Unit electricity exported                | -545.3343     | 5.8100           | -31.6839         |  |
| Total                                       |               |                  | -170.8939 (252)  |  |
| Total energy cost                           |               |                  | 224.9429 (255)   |  |

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

|                                             | Energy kWh/year | Emission factor kg CO2/kWh | Emissions kg CO2/year |  |
|---------------------------------------------|-----------------|----------------------------|-----------------------|--|
| Space heating - main system 1               | 1630.7814       | 0.2100                     | 342.4641 (261)        |  |
| Total CO2 associated with community systems |                 |                            | 0.0000 (373)          |  |
| Water heating (other fuel)                  | 2443.6647       | 0.2100                     | 513.1696 (264)        |  |
| Space and water heating                     |                 |                            | 855.6337 (265)        |  |
| Pumps, fans and electric keep-hot           | 86.0000         | 0.1387                     | 11.9293 (267)         |  |
| Energy for lighting                         | 177.4988        | 0.1443                     | 25.6186 (268)         |  |
| Energy saving/generation technologies       |                 |                            |                       |  |
| PV Unit electricity used in dwelling        | -534.1903       | 0.1337                     | -71.4146              |  |
| PV Unit electricity exported                | -545.3343       | 0.1252                     | -68.2559              |  |
| Total                                       |                 |                            | -139.6705 (269)       |  |
| Total CO2, kg/year                          |                 |                            | 753.5110 (272)        |  |

## 13a. Primary energy - Individual heating systems including micro-CHP

|  | Energy kWh/year | Primary energy factor kg CO2/kWh | Primary energy kWh/year |  |
|--|-----------------|----------------------------------|-------------------------|--|
|--|-----------------|----------------------------------|-------------------------|--|

# Full SAP Calculation Printout



|                                             |           |        |                  |
|---------------------------------------------|-----------|--------|------------------|
| Space heating - main system 1               | 1630.7814 | 1.1300 | 1842.7830 (275)  |
| Total CO2 associated with community systems |           |        | 0.0000 (473)     |
| Water heating (other fuel)                  | 2443.6647 | 1.1300 | 2761.3411 (278)  |
| Space and water heating                     |           |        | 4604.1240 (279)  |
| Pumps, fans and electric keep-hot           | 86.0000   | 1.5128 | 130.1008 (281)   |
| Energy for lighting                         | 177.4988  | 1.5338 | 272.2537 (282)   |
| Energy saving/generation technologies       |           |        |                  |
| PV Unit electricity used in dwelling        | -534.1903 | 1.4940 | -798.0994        |
| PV Unit electricity exported                | -545.3343 | 0.4594 | -250.5261        |
| Total                                       |           |        | -1048.6255 (283) |
| Total Primary energy kWh/year               |           |        | 3957.8530 (286)  |

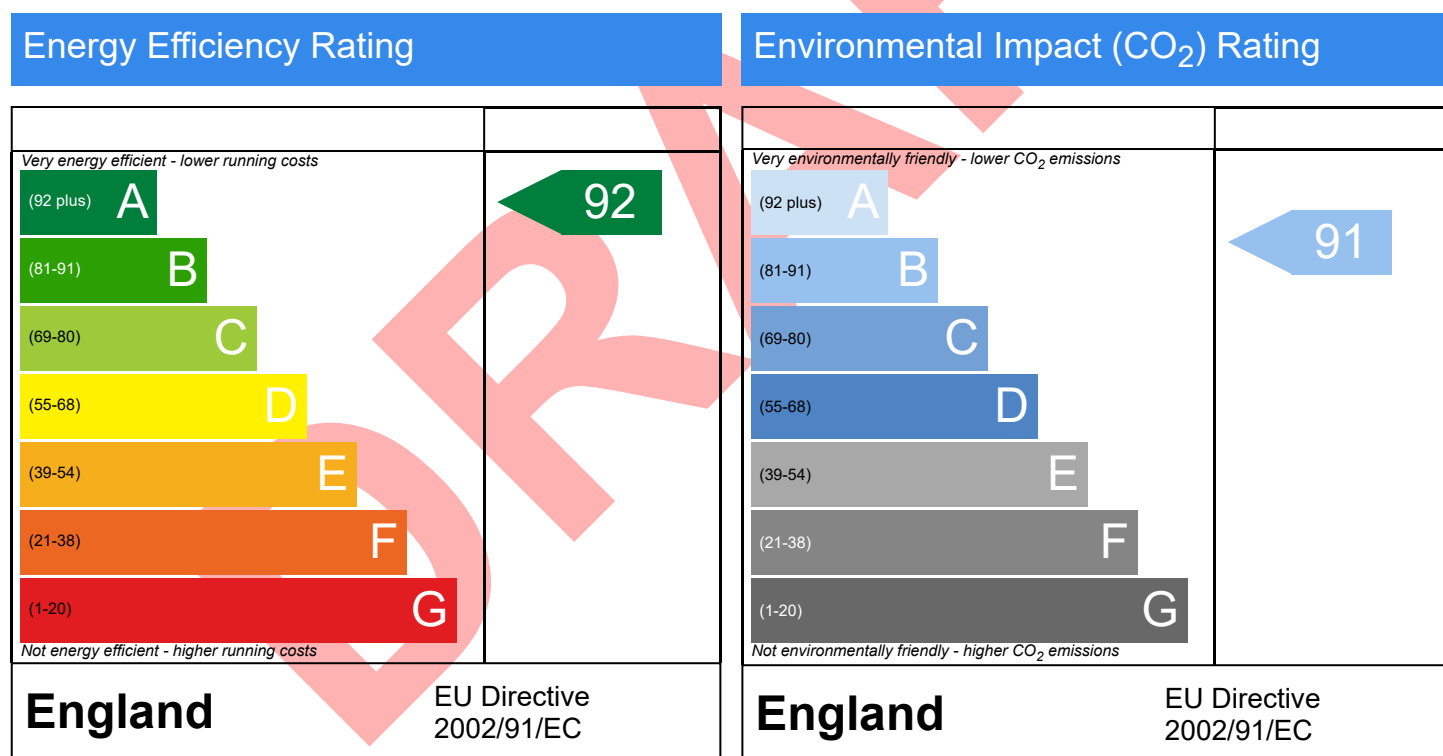
# Predicted Energy Assessment



Dwelling type: House, Mid-Terrace  
Date of assessment: 15/11/2024  
Produced by: Victoria Gartside  
Total floor area: 71.94 m<sup>2</sup>  
DRRN:

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO<sub>2</sub>) emissions.



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO<sub>2</sub>) emissions. The higher the rating the less impact it has on the environment.