

ENERGY STATEMENT



**Arthede Revived,
Sheepwash Lane,
Wolverley,
DY11 5SE.**

April 2024

Report Reference: 113606

Revision: -

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Appendix 1 – SAP Reports

Disclaimer

The performances of renewable systems, especially wind and solar, are difficult to predict with any certainty. This is due to the variability of environmental conditions from location to location and from year to year. As such all budget/cost/sizing's, which are based upon the best available information, are to be taken as estimation only and should not be considered as a guarantee. This report relates to pre-planning stage therefore final specification must be provided by an M & E consultant after stage C.

UK Building Compliance disclaims any responsibility to the Client and others in respect of any matters outside the scope of this report. This report is confidential to the Client and UK Building Compliance accepts no responsibility of whatsoever nature to third parties to whom this report, or any part thereof is made known. Any such party relies upon the report at their own risk.

1.0 EXECUTIVE SUMMARY

1.1 UK Building Compliance have been appointed to undertake an Energy Statement on a proposed development at Arthede Revived, Sheepwash Lane, Wolverley, DY11 5SE.

1.2 The development comprises of 1 detached dwelling.

1.3 This document has been produced to satisfy:

- Part L of the England & Wales Building Regulations 2021
- Policy SP.37 of Wyre Forest District Council's Local Plan

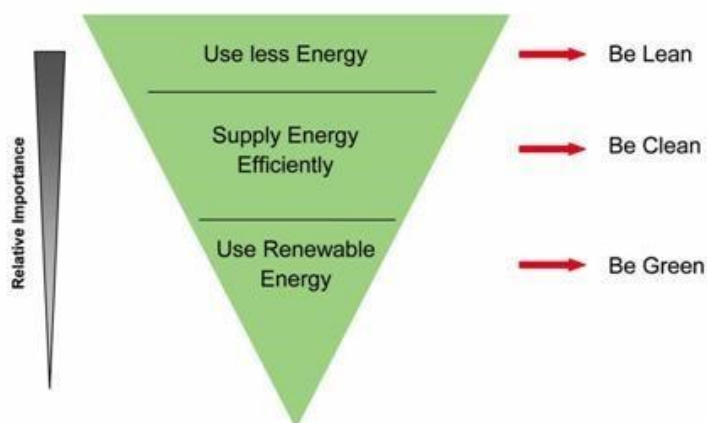
1.4 This document details how the targets are met via:

- Low U-Values
- Low air permeability
- Efficiency Heating Systems

1.5 This document has been written in liaison with the sample SAP for the project which inform the figures referenced. A copy of the sample SAP report will be submitted alongside this document.

2.0 POLICY FRAMEWORK

2.1 The following section outlines the relevant policy frameworks at national, regional, and local level.



2.2 The widely regarded Energy Hierarchy, as shown above, will be followed on this development to ensure best practice is being followed.

2.3 NATIONAL POLICIES

2.4 In June 2022, Part L2A of the Building Regulations England & Wales was updated.

2.5 In addition to tightening of the previous 'Building Emission Rating' criteria, a new compliance metric 'Primary Energy Demand' was also introduced.

2.6 A combination of lower U-Values and the introduction of renewable technology can summarise the main changes between the previous and new Part L standards.

2.7 The new Part L standards ensure a carbon reduction of approximately 35%, compared to the previous version.

2.8 LOCAL POLICIES

Policy SP.37 of Wyre Forest District Council's Local Plan states the following:

"All new developments [...] should consider location, design, siting and orientation to maximise the use of natural heat and light and the potential for renewable energy micro-generation. Where possible, in appropriate locations, solar panels should be fitted."

Developments should incorporate renewable and low carbon energy, to reduce carbon emissions and secure sustainable energy solutions, all new developments over 100 square meters should incorporate the energy from renewable or low carbon sources equivalent to at least 10% of predicted energy demand.

(Source: Wyre Forest District Council. P. 126, *Wyre Forest District Council Local Plan 2016-2036*. [ONLINE] Available at: [Users/UKBC/Downloads/WFDC%20Local%20Plan%20\(2016-2036\)%20-%20Adopted%20April%202022.pdf](Users/UKBC/Downloads/WFDC%20Local%20Plan%20(2016-2036)%20-%20Adopted%20April%202022.pdf) [Accessed April 2024].

3.0 ENERGY EFFICIENCY

3.1 High energy efficiency standards are demonstrated in the table below. Construction Details have been selected to ensure that all fabric U-Values exceed the requirements of Part L of the Building Regulations (2021) and all Heating, Hot Water and Ventilation elements are in compliance with the Domestic Building Services Compliance Guide (2021). The proposed construction details for the residential units are as follows:

| Elements | U Value | Development Notes |
|-----------------------|--|---------------------------|
| External Walls | 0.18 W/m ² /K | |
| Stud Walls | 0.16 W/m ² /K | |
| Pitched Roof (Joists) | 0.11 W/m ² /K | |
| Pitched Roof (Rafter) | 0.15 W/m ² /K | |
| Flat Roof | 0.13 W/m ² /K | |
| Windows/Glazed Doors | 1.20 W/m ² /K | Double Glazed 16mm+ Argon |
| Air Permeability | 5m ³ /hm ² @50Pa | |
| Ventilation | Natural Ventilation | |
| Heating | Air Source Heat Pump | Vaillant Arotherm 10kW |
| Hot Water | Main Heating System | 210L |
| Heating Controls | Time and Temperature Zone Control | |
| Emitters | Radiators/Underfloor Heating | |
| Secondary Heating | No | |
| Thermal Bridging | Constructive Details | |
| Lighting | 100% Low Energy | |
| Renewable Technology | N/A | |

3.2 A full sample SAP Input Data Sheet and SAP L1A Checklist can be found in Appendix 1 to verify the above inputs.

3.3 Following SAP Calculations, the dwelling fabric efficiency at this stage of the hierarchy is as follows:

| SAP 10 Figures | Regulated CO2 Emissions – kg of CO2 per m² | % Improvement on TER |
|---|--|-----------------------------|
| Part L SAP10 Target Fabric Energy Efficiency (TFEE) | 40.52 | |
| After Efficiency Improvements (DFEE) | 40.43 | 0.24% |
| Part L SAP10 Target Emissions Rate (TER) | 7.76 | |
| After Efficiency Improvements (DER) | 3.54 | 54.38% |
| Part L SAP10 Target Primary Energy Rate (TPER) | 41.22 | |
| After Efficiency Improvements (DPER) | 36.66 | 11.06% |

3.4 All efficiency targets of the dwellings meet compliance. This has been achieved through low fabric u-values and an efficient heating system. Improving the fabric energy efficiency is top of the energy hierarchy and should always be addressed before any renewable technologies.

4.0 RENEWABLE CONTRIBUTION

4.1 The table below demonstrates the contribution of renewable energy to the overall primary energy demand of the site.

4.2 Renewable energy is provided by the air source heat pump.

| Dwelling | Energy Demand kWh/year | Renewable Energy kWh/year | Percentage of demand |
|---------------|------------------------|---------------------------|----------------------|
| <i>Plot 1</i> | 5865.93 | 3654.77 | 94.53% |

4.3 A total of 94.53% of the developments overall energy demand will be met via renewable technologies by installing air source heat pumps.

4.4 The figures in this table are confirmed in Appendix 1.

5.0 WATER CONSUMPTION

5.1 The following section outlines the schemes' requirements and proposal for sustainable water consumption.

5.2 NATIONAL POLICIES

Part G of the 2013 England & Wales Building Regulations outlines the following requirement:

"The estimated consumption of wholesome water of a new dwelling should be no more than 125 liters/person/day or 110 liters/person/day where the optional requirement applies. This includes a fixed factor of water for outdoor use of 5 liters/ person/day."

5.3 WATER PROPOSAL

5.4 It is proposed that the 110 liters per person per day target will be achieved through the installment of water efficient appliances.

5.5 Table 1 specifies the requirements for the properties water-based appliances and calculates how this demand reduction will lead to water consumption of below 110 litres per person per day.

5.6 The various flow rates and capacities of the appliances listed in Table 1 should be adhered to when purchasing items for the properties.

5.7 WATER CALCULATIONS

| Installation Type | Unit of Measure | Quantity | Capacity/ Flow Rate | Use factor | Fixed Use | Total L/P/D |
|---|-----------------|----------|------------------------|------------|-----------|----------------|
| WC (single flush) | Flush (L) | 0 | 0.00 | 4.42 | 0.00 | 0.00 |
| WC (dual flush) | Full flush (L) | 4 | 4.80 | 1.46 | 0.00 | 7.01 |
| | Part flush (L) | | 2.40 | 2.96 | 0.00 | 7.10 |
| Taps (excl kitchen/utility) | Flow (L/minute) | 4 | 4.00 | 1.58 | 1.58 | 7.90 |
| Baths | Capacity (L) | 2 | 180.00 | 0.11 | 0.00 | 19.80 |
| Showers | Flow (L/minute) | 3 | 9.00 | 4.37 | 0.00 | 39.33 |
| Kitchen/Utility Room Taps | Flow (L/minute) | 1 | 5.00 | 0.44 | 10.36 | 12.56 |
| Washing Machine | L/kg dry load | 1 | 8.00 | 2.10 | 0.00 | 16.80 |
| Dishwasher | L/place setting | 1 | 1.25 | 3.60 | 0.00 | 4.50 |
| Waste Disposal Unit | L/use | 0 | 0.00 | 3.08 | 0.00 | 0.00 |
| Water Softener | L/P/D | 0 | 0.00 | 1.00 | 0.00 | 0.00 |
| Total calculated use (litres/person/day) | | | | | | 115.00 |
| Contribution from Greywater (litres/person/day) | | | | | | 0.00 |
| Contribution from Rainwater (litres/person/day) | | | | | | 0.00 |
| Normalisation factor | | | | | | 0.91 |
| Total water consumption | | | | | | 104.65 |
| External water use | | | | | | 5.00 |
| Total Water Consumption (Building Regulation 17.K) | | | | | | 109.65 |

5.8 The water consumption for the site in question is calculated to be 109.65 litres per person per day.

6.0 SUSTAINABLE CONSTRUCTION

6.1 The Developer will monitor and record waste produced from site activities to ensure that the maximum possible will be diverted from landfill and reused in line with the waste hierarchy (below). This may be via a SWMP or via a licensed waste contractor.



6.2 All timber will be purchased in line with the Government's Policy for UK Timber Procurement.

6.3 Should the developer and client wish to go further than the mandatory requirements, the following voluntary BREEAM options could be considered when sourcing materials:

- Responsible sourcing certifications e.g. EMS (EMAS, ISO14001).
- Chain of custody and/or BES6001 for key and supply chain processes.
- Legally sourced timber: Chain of custody and certificate (FSC, SFI, PEFC, MTCC, SGS, TFT, Verified etc).

7.0 COOLING AND OVERHEATING

7.1 Approved Document Part O 2021 applies to new residential buildings only. This includes residential dwellings, institutional, other (e.g., student accommodation). Shared communal rooms and common spaces containing more than one residential unit fall within the scope of Part O as do live/work units.

The simplified method is not suitable for buildings with more than one residential unit which use a communal heating or hot water system with significant amounts of horizontal heating or hot water distribution pipework.

An overheating calculation should be carried out on all new residential buildings under the 2021 building regulations.

7.2 There is no active cooling for the project.

8.0 CONCLUSION

8.1 This document is written in accordance with the guidelines and requirements of:

- Part L of the England & Wales Building Regulations 2021
- Policy SP.37 of Wyre Forest District Council's Local Plan

8.2 The development has CO₂ emissions and fabric efficiency that are Part L compliant via passive Energy Efficiency Measures as highlighted in Section 3.

8.3 Renewable technologies contribute to >90% of energy demand.

Appendix 1

Sample SAP Reports

Summary for Input Data



| | | | |
|----------------------|-----------------|----------------|-----------------|
| Property Reference | 113606 - Plot 1 | Issued on Date | 17/04/2024 |
| Assessment Reference | Plot 1 | Prop Type Ref | 113606 - Plot 1 |
| Property | | | |

| | | | | | |
|------------------------------------|----------|---------------|-------|------|-------|
| SAP Rating | 81 B | DER | 3.54 | TER | 7.76 |
| Environmental | 96 A | % DER < TER | | | 54.38 |
| CO ₂ Emissions (t/year) | 0.84 | DFEE | 40.43 | TFEE | 40.52 |
| Compliance Check | See BREL | % DFEE < TFEE | | | 0.24 |
| % DPER < TPER | 11.06 | DPER | 36.66 | TPER | 41.22 |

| | | | |
|------------------|----------------------|-------------|-----------|
| Assessor Details | Ms. Bethany Robinson | Assessor ID | AW36-0001 |
| Client | | | |

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

| | | |
|--------------------------------|---------------------|---------------------|
| Orientation | West | |
| Property Tenture | ND | |
| Transaction Type | 6 | |
| Terrain Type | Rural | |
| 1.0 Property Type | House, Detached | |
| Which Floor | 0 | |
| 2.0 Number of Storeys | 2 | |
| 3.0 Date Built | 2024 | |
| 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 | N/A | kJ/m ² K |
| 7.0 Electricity Tariff | Standard | |
| Smart electricity meter fitted | Yes | |
| Smart gas meter fitted | Yes | |

| 7.0 Measurements | Heat Loss Perimeter | Internal Floor Area | Average Storey Height |
|------------------|---------------------|-----------------------|-----------------------|
| Basement: | 0.00 m | 0.00 m ² | 0.00 m |
| Ground floor: | 47.14 m | 130.43 m ² | 2.50 m |
| 1st Storey: | 47.14 m | 118.51 m ² | 2.82 m |
| 2nd Storey: | 0.00 m | 0.00 m ² | 0.00 m |
| 3rd Storey: | 0.00 m | 0.00 m ² | 0.00 m |
| 4th Storey: | 0.00 m | 0.00 m ² | 0.00 m |
| 5th Storey: | 0.00 m | 0.00 m ² | 0.00 m |
| 6th Storey: | 0.00 m | 0.00 m ² | 0.00 m |
| 7th Storey: | 0.00 m | 0.00 m ² | 0.00 m |

| | | |
|-----------------|-------|----------------|
| 8.0 Living Area | 27.81 | m ² |
|-----------------|-------|----------------|

| 9.0 External Walls | Description | Type | Construction | U-Value (W/m ² K) | Kappa (kJ/m ² K) | Gross Area(m ²) | Nett Area (m ²) | Shelter Res | Shelter | Openings | Area Calculation Type |
|--------------------|-----------------|--------------|---|------------------------------|-----------------------------|-----------------------------|-----------------------------|-------------|---------|----------|-----------------------|
| | External Wall 1 | Cavity Wall | Cavity wall; plasterboard on dabs or battens, lightweight aggregate block, filled cavity, any outside structure | 0.18 | 110.00 | 205.42 | 165.18 | 0.00 | None | 40.24 | Enter Gross Area |
| | Stud | Timber Frame | Timber framed wall (one layer of plasterboard) | 0.16 | 9.00 | 24.67 | 24.67 | 0.00 | None | 0.00 | Enter Gross Area |

| 9.2 Internal Walls | Description | Construction | Kappa (kJ/m ² K) | Area (m ²) |
|--------------------|-----------------|------------------------------|-----------------------------|------------------------|
| | Internal Wall 1 | Plasterboard on timber frame | 9.00 | 362.22 |

| 10.0 External Roofs | Description | Type | Construction | U-Value (W/m ² K) | Kappa (kJ/m ² K) | Gross Area(m ²) | Nett Area (m ²) | Shelter Code | Shelter Factor | Calculation Type | Openings |
|---------------------|-------------|---------------------|--|------------------------------|-----------------------------|-----------------------------|-----------------------------|--------------|----------------|------------------|----------|
| | Warm | External Plane Roof | Plasterboard, insulated at ceiling level | 0.15 | 9.00 | 111.15 | 109.69 | None | 0.00 | Enter Gross Area | 1.46 |
| | Cold | External Plane Roof | Plasterboard, insulated at ceiling level | 0.11 | 9.00 | 11.76 | 11.76 | None | 0.00 | Enter Gross Area | 0.00 |

Summary for Input Data



Flat External Flat Roof Plasterboard, insulated flat roof 0.13 9.00 33.52 33.52 None 0.00 Enter Gross Area 0.00

10.2 Internal Ceilings

| Description | Storey | Construction | Area (m ²) |
|--------------------|-----------------|--|------------------------|
| Internal Ceiling 1 | Lowest occupied | Plasterboard ceiling, carpeted chipboard floor | 118.51 |

11.0 Heat Loss Floors

| Description | Type | Storey Index | Construction | U-Value (W/m ² K) | Shelter Code | Shelter Factor | Kappa (kJ/m ² K) | Area (m ²) |
|-------------|----------------------|-----------------|--|------------------------------|--------------|----------------|-----------------------------|------------------------|
| GF | Ground Floor - Solid | Lowest occupied | Slab on ground, screed over insulation | 0.12 | None | 0.00 | 110.00 | 130.43 |

11.2 Internal Floors

| Description | Storey Index | Construction | Kappa (kJ/m ² K) | Area (m ²) |
|------------------|--------------|--|-----------------------------|------------------------|
| Internal Floor 1 | | Plasterboard ceiling, carpeted chipboard floor | 9.00 | 118.51 |

12.0 Opening Types

| Description | Data Source | Type | Glazing | Glazing Gap | Filling Type | G-value | Frame Type | Frame Factor | U Value (W/m ² K) |
|-------------|--------------|-------------|------------------------|-------------|--------------|---------|------------|--------------|------------------------------|
| GLAZING | Manufacturer | Window | Double Low-E Soft 0.05 | | Air Filled | 0.63 | Wood | 0.70 | 1.20 |
| SOLID | Manufacturer | Solid Door | | | Air Filled | 0.00 | Wood | 0.70 | 1.00 |
| RL | Manufacturer | Roof Window | Double Low-E Soft 0.05 | | Air Filled | 0.63 | Wood | 0.70 | 1.20 |

13.0 Openings

| Name | Opening Type | Location | Orientation | Area (m ²) | Pitch |
|------|--------------|-----------------|-------------|------------------------|-------|
| S | GLAZING | External Wall 1 | South | 4.64 | 0 |
| W | SOLID | External Wall 1 | West | 3.41 | 0 |
| W | GLAZING | External Wall 1 | West | 20.81 | 0 |
| W RL | RL | Warm | West | 1.46 | 40 |
| E | GLAZING | External Wall 1 | East | 11.38 | 0 |

14.0 Conservatory

None

15.0 Draught Proofing

100 %

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

| Bridge Type | Source Type | Length | Psi | Adjusted Reference: | Imported |
|--|------------------------|--------|-------|---------------------|----------|
| E2 Other lintels (including other steel lintels) | Independently assessed | 25.89 | 0.02 | 0.02 | No |
| E3 Sill | Independently assessed | 16.24 | 0.02 | 0.02 | No |
| E4 Jamb | Independently assessed | 40.69 | 0.02 | 0.02 | No |
| E5 Ground floor (normal) | Independently assessed | 47.14 | 0.06 | 0.06 | No |
| E6 Intermediate floor within a dwelling | Independently assessed | 47.14 | 0.00 | 0.00 | No |
| E10 Eaves (insulation at ceiling level) | Independently assessed | 11.85 | 0.06 | 0.06 | No |
| E11 Eaves (insulation at rafter level) | Independently assessed | 14.41 | 0.02 | 0.02 | No |
| E12 Gable (insulation at ceiling level) | Independently assessed | 4.70 | 0.04 | 0.04 | No |
| E13 Gable (insulation at rafter level) | Independently assessed | 24.95 | 0.03 | 0.03 | No |
| E14 Flat roof | Table K1 - Default | 17.32 | 0.16 | 0.16 | No |
| E16 Corner (normal) | Independently assessed | 25.85 | 0.04 | 0.04 | No |
| E17 Corner (inverted – internal area greater than external area) | Independently assessed | 7.62 | -0.08 | -0.08 | No |
| R1 Head of roof window | Table K1 - Default | 1.62 | 0.24 | 0.24 | No |
| R2 Sill of roof window | Table K1 - Default | 1.62 | 0.24 | 0.24 | No |
| R3 Jamb of roof window | Table K1 - Default | 1.80 | 0.24 | 0.24 | No |
| R4 Ridge (vaulted ceiling) | Table K1 - Default | 16.64 | 0.12 | 0.12 | No |
| R5 Ridge (inverted) | Table K1 - Default | 6.08 | 0.12 | 0.12 | No |
| R8 Roof to wall (rafter) | Table K1 - Default | 4.51 | 0.12 | 0.12 | No |
| R9 Roof to wall (flat ceiling) | Table K1 - Default | 11.48 | 0.32 | 0.32 | No |

Y-value 0.03 W/m²K

18.0 Pressure Testing

Yes

Designed AP₅₀ 5.00 m²/(h.m²) @ 50 Pa

Property Tested? Yes

Test Method Blower Door

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present No

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System

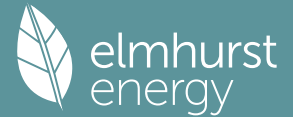
No

22.0 Lighting

No Fixed Lighting No

| Name | Efficacy | Power | Capacity | Count |
|------------|----------|-------|----------|-------|
| Lighting 1 | 85.00 | 10 | 850 | 12 |

Summary for Input Data



24.0 Main Heating 1

| | | |
|------------------------|----------------------------|---|
| Database | Database | |
| Percentage of Heat | 100.00 | % |
| Database Ref. No. | 103786 | |
| Fuel Type | Electricity | |
| SAP Code | 0 | |
| In Winter | 266.46 | |
| In Summer | 169.50 | |
| Model Name | aroTHERM 10kW | |
| Manufacturer | Vaillant Group UK Ltd | |
| System Type | Heat Pump | |
| Controls SAP Code | 2207 | |
| Delayed Start Stat | No | |
| HETAS approved System | No | |
| Oil Pump Inside | No | |
| FI Case | 0.00 | |
| Flue Type | None or Unknown | |
| Fan Assisted Flue | No | |
| Is MHS Pumped | Pump in heated space | |
| Heating Pump Age | 2013 or later | |
| Heat Emitter | Underfloor | |
| Underfloor Heating | Yes - Pipes in thin screed | |
| Flow Temperature | Enter value | |
| Flow Temperature Value | 55.00 | |
| Boiler Interlock | No | |
| Combi boiler type | No Combi | |
| Combi keep hot type | None | |

25.0 Main Heating 2

None

26.0 Heat Networks

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 |
| Solar Panel | No |
| Water use <= 125 litres/person/day | Yes |
| Summer Immersion | No |
| Cold Water Source | From mains |
| Bath Count | 1 |
| Supplementary Immersion | No |
| Immersion Only Heating Hot Water | Yes |

28.1 Showers

| Description | Shower Type | Flow Rate [l/min] | Rated Power [kW] | Connected | Connected To |
|-------------|-------------------------|-------------------|------------------|-----------|--------------|
| SHOWER | Vented hot water system | 7.00 | | No | |

28.3 Waste Water Heat Recovery System

29.0 Hot Water Cylinder

Hot Water Cylinder

Summary for Input Data

| | | |
|--------------------------|---|---------|
| Cylinder Stat | <input type="text" value="Yes"/> | |
| Cylinder In Heated Space | <input type="text" value="Yes"/> | |
| Independent Time Control | <input type="text" value="Yes"/> | |
| Insulation Type | <input type="text" value="Measured Loss"/> | |
| Cylinder Volume | <input type="text" value="210.00"/> | L |
| Loss | <input type="text" value="1.70"/> | kWh/day |
| Pipes insulation | <input type="text" value="Fully insulated primary pipework"/> | |
| In Airing Cupboard | <input type="text" value="No"/> | |

31.0 Thermal Store

Recommendations

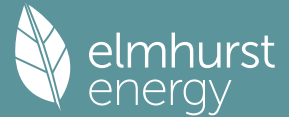
Lower cost measures

None

Further measures to achieve even higher standards

None

Full SAP Calculation Printout



| | | | | | |
|------------------------------------|----------------------|---------------|-----------------|-------------|-----------|
| Property Reference | 113606 - Plot 1 | | Issued on Date | 17/04/2024 | |
| Assessment Reference | Plot 1 | Prop Type Ref | 113606 - Plot 1 | | |
| Property | | | | | |
| SAP Rating | 81 B | DER | 3.54 | TER | 7.76 |
| Environmental | 96 A | % DER < TER | | 54.38 | |
| CO ₂ Emissions (t/year) | 0.84 | DFEE | 40.43 | TFEE | 40.52 |
| Compliance Check | See BREL | % DFEE < TFEE | | 0.24 | |
| % DPER < TPER | 11.06 | DPER | 36.66 | TPER | 41.22 |
| Assessor Details | Ms. Bethany Robinson | | | Assessor ID | AW36-0001 |
| 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 (m ²) | Storey height (m) | Volume (m ³) |
|--|------------------------|---------------------------------|--------------------------|
| Ground floor | 130.4300 (1b) | 2.5000 (2b) | 326.0750 (1b) - (3b) |
| First floor | 118.5100 (1c) | 2.8200 (2c) | 334.1982 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 248.9400 | | (4) |
| Dwelling volume | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | 660.2732 (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 | 6 * 10 = | | | | | | | | | | | 60.0000 (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) = | | | | | | | | | | | 60.0000 / (5) = | 0.0909 (8) |
| Pressure test | | | | | | | | | | | | Yes | |
| Pressure Test Method | | | | | | | | | | | | Blower Door | |
| Measured/design AP50 | | | | | | | | | | | | 5.0000 (17) | |
| Infiltration rate | | | | | | | | | | | | 0.3409 (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) = | | | | | | | | | | | 0.2897 (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 | 0.3694 | 0.3622 | 0.3549 | 0.3187 | 0.3115 | 0.2753 | 0.2753 | 0.2680 | 0.2897 | 0.3115 | 0.3260 | 0.3404 (22b) | |
| | 0.5682 | 0.5656 | 0.5630 | 0.5508 | 0.5485 | 0.5379 | 0.5379 | 0.5359 | 0.5420 | 0.5485 | 0.5531 | 0.5580 (25) | |

3. Heat losses and heat loss parameter

| Element | Gross m ² | Openings m ² | NetArea m ² | U-value W/m ² K | A x U W/K | K-value kJ/m ² K | A x K kJ/K |
|--|----------------------|-------------------------|------------------------|----------------------------|----------------------|-----------------------------|--------------------------------------|
| GLAZING (Uw = 1.20) | | | 36.8300 | 1.1450 | 42.1718 | | (27) |
| SOLID | | | 3.4100 | 1.0000 | 3.4100 | | (26) |
| W RL | | | 1.4600 | 1.1450 | 1.6718 | | (27a) |
| CF | | | 130.4300 | 0.1200 | 15.6516 | 110.0000 | 14347.3000 (28a) |
| External Wall 1 | 205.4200 | 40.2400 | 165.1800 | 0.1800 | 29.7324 | 110.0000 | 18169.8000 (29a) |
| Stud | 24.6700 | | 24.6700 | 0.1600 | 3.9472 | 9.0000 | 222.0300 (29a) |
| Warm | 111.1500 | 1.4600 | 109.6900 | 0.1500 | 16.4535 | 9.0000 | 987.2100 (30) |
| Cold | 11.7600 | | 11.7600 | 0.1100 | 1.2936 | 9.0000 | 105.8400 (30) |
| Flat | 33.5200 | | 33.5200 | 0.1300 | 4.3576 | 9.0000 | 301.6800 (30) |
| Total net area of external elements Aum(A, m ²) | | | 516.9500 | | | | (31) |
| Fabric heat loss, W/K = Sum (A x U) | | | | | (26)...(30) + (32) = | 118.6894 | (33) |
| Internal Wall 1 | | | 362.2200 | | | 9.0000 | 3259.9800 (32c) |
| Internal Floor 1 | | | 118.5100 | | | 18.0000 | 2133.1800 (32d) |
| Internal Ceiling 1 | | | 118.5100 | | | 9.0000 | 1066.5900 (32e) |
| Heat capacity Cm = Sum(A x k) | | | | | | | (28)...(30) + (32) + (32a)...(32e) = |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K | | | | | | | 40593.6100 (34) |
| List of Thermal Bridges | | | | | | | 163.0658 (35) |
| K1 Element | | | | Length | Psi-value | | Total |

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| | | | |
|--|---------|---------|---------|
| E2 Other lintels (including other steel lintels) | 25.8900 | 0.0200 | 0.5178 |
| E3 Sill | 16.2400 | 0.0230 | 0.3735 |
| E4 Jamb | 40.6900 | 0.0180 | 0.7324 |
| E5 Ground floor (normal) | 47.1400 | 0.0600 | 2.8284 |
| E6 Intermediate floor within a dwelling | 47.1400 | 0.0010 | 0.0471 |
| E10 Eaves (insulation at ceiling level) | 11.8500 | 0.0550 | 0.6517 |
| E11 Eaves (insulation at rafter level) | 14.4100 | 0.0180 | 0.2594 |
| E12 Gable (insulation at ceiling level) | 4.7000 | 0.0370 | 0.1739 |
| E13 Gable (insulation at rafter level) | 24.9500 | 0.0330 | 0.8234 |
| E14 Flat roof | 17.3200 | 0.1600 | 2.7712 |
| E16 Corner (normal) | 25.8500 | 0.0400 | 1.0340 |
| E17 Corner (inverted - internal area greater than external area) | 7.6200 | -0.0820 | -0.6248 |
| R1 Head of roof window | 1.6200 | 0.2400 | 0.3888 |
| R2 Sill of roof window | 1.6200 | 0.2400 | 0.3888 |
| R3 Jamb of roof window | 1.8000 | 0.2400 | 0.4320 |
| R4 Ridge (vaulted ceiling) | 16.6400 | 0.1200 | 1.9968 |
| R5 Ridge (inverted) | 6.0800 | 0.1200 | 0.7296 |
| R8 Roof to wall (rafter) | 4.5100 | 0.1200 | 0.5412 |
| R9 Roof to wall (flat ceiling) | 11.4800 | 0.3200 | 3.6736 |

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
 Point Thermal bridges (36a) = 17.7388 (36)
 Total fabric heat loss (33) + (36) + (36a) = 136.4282 (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 | |
|---------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| (38)m | 123.8129 | 123.2356 | 122.6697 | 120.0116 | 119.5143 | 117.1993 | 117.1993 | 116.7705 | 118.0910 | 119.5143 | 120.5204 | 121.5721 | (38) |
| Heat transfer coeff | 260.2411 | 259.6638 | 259.0979 | 256.4399 | 255.9425 | 253.6275 | 253.6275 | 253.1988 | 254.5192 | 255.9425 | 256.9486 | 258.0004 | (39) |
| Average = Sum(39)m / 12 = | | | | | | | | | | | | 256.4375 | |

| HLP | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| HLP | 1.0454 | 1.0431 | 1.0408 | 1.0301 | 1.0281 | 1.0188 | 1.0188 | 1.0171 | 1.0224 | 1.0281 | 1.0322 | 1.0364 | (40) |
| HLP (average) | | | | | | | | | | | | 1.0301 | |
| Days in mont | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | |

4. Water heating energy requirements (kWh/year)

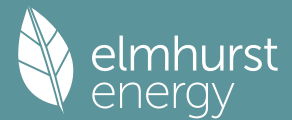
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|--|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Assumed occupancy | | | | | | | | | | | | | 3.0656 (42) |
| Hot water usage for mixer showers | 75.6191 | 74.4827 | 72.8267 | 69.6583 | 67.3201 | 64.7126 | 63.2305 | 64.8739 | 66.6754 | 69.4751 | 72.7116 | 75.3294 | (42a) |
| Hot water usage for baths | 32.6419 | 32.1571 | 31.4745 | 30.2157 | 29.2732 | 28.2281 | 27.6636 | 28.3415 | 29.0796 | 30.1979 | 31.4826 | 32.5316 | (42b) |
| Hot water usage for other uses | 46.0243 | 44.3507 | 42.6771 | 41.0035 | 39.3299 | 37.6563 | 37.6563 | 39.3299 | 41.0035 | 42.6771 | 44.3507 | 46.0243 | (42c) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | | 141.8228 (43) |
| Daily hot water use | 154.2853 | 150.9905 | 146.9783 | 140.8776 | 135.9232 | 130.5970 | 128.5504 | 132.5453 | 136.7585 | 142.3501 | 148.5448 | 153.8853 | (44) |
| Energy content (annual) | 244.3503 | 215.0085 | 225.9002 | 192.8543 | 182.9788 | 160.5842 | 155.4705 | 164.1188 | 168.6369 | 193.1678 | 211.6294 | 240.9471 | (45) |
| Distribution loss (46)m = 0.15 x (45)m | 36.6525 | 32.2513 | 33.8850 | 28.9282 | 27.4468 | 24.0876 | 23.3206 | 24.6178 | 25.2955 | 28.9752 | 31.7444 | 36.1421 | (46) |
| Water storage loss: | | | | | | | | | | | | | |
| Store volume | | | | | | | | | | | | | 210.0000 (47) |
| a) If manufacturer declared loss factor is known (kWh/day): | | | | | | | | | | | | | 1.7000 (48) |
| Temperature factor from Table 2b | | | | | | | | | | | | | 0.5400 (49) |
| Enter (49) or (54) in (55) | | | | | | | | | | | | | 0.9180 (55) |
| Total storage loss | 28.4580 | 25.7040 | 28.4580 | 27.5400 | 28.4580 | 27.5400 | 28.4580 | 28.4580 | 27.5400 | 28.4580 | 27.5400 | 28.4580 | (56) |
| If cylinder contains dedicated solar storage | 28.4580 | 25.7040 | 28.4580 | 27.5400 | 28.4580 | 27.5400 | 28.4580 | 28.4580 | 27.5400 | 28.4580 | 27.5400 | 28.4580 | (57) |
| Primary loss | 23.2624 | 21.0112 | 23.2624 | 22.5120 | 23.2624 | 22.5120 | 23.2624 | 23.2624 | 22.5120 | 23.2624 | 22.5120 | 23.2624 | (59) |
| Combi loss | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (61) |
| Total heat required for water heating calculated for each month | 296.0707 | 261.7237 | 277.6206 | 242.9063 | 234.6992 | 210.6362 | 207.1909 | 215.8392 | 218.6889 | 244.8882 | 261.6814 | 292.6675 | (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 | 296.0707 | 261.7237 | 277.6206 | 242.9063 | 234.6992 | 210.6362 | 207.1909 | 215.8392 | 218.6889 | 244.8882 | 261.6814 | 292.6675 | (64) |
| Total per year (kWh/year) | | | | | | | | | | | | | 2964.6128 (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 | 122.6228 | 108.8625 | 116.4881 | 104.1657 | 102.2168 | 93.4359 | 93.0703 | 95.9458 | 96.1134 | 105.6046 | 110.4084 | 121.4912 | (65) |

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

| Metabolic gains (Table 5), Watts | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------|
| (66)m | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 220.0179 | 243.5913 | 220.0179 | 227.3519 | 220.0179 | 227.3519 | 220.0179 | 220.0179 | 227.3519 | 220.0179 | 227.3519 | 220.0179 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 415.4652 | 419.7765 | 408.9123 | 385.7838 | 356.5882 | 329.1485 | 310.8171 | 306.5058 | 317.3700 | 340.4985 | 369.6941 | 397.1338 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | (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) | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | (71) |
| Water heating gains (Table 5) | 164.8156 | 161.9978 | 156.5701 | 144.6745 | 137.3881 | 129.7720 | 125.0944 | 128.9594 | 133.4908 | 141.9417 | 153.3449 | 163.2947 | (72) |
| Total internal gains | 869.2820 | 894.3488 | 854.4836 | 826.7935 | 782.9776 | 755.2557 | 724.9127 | 724.4665 | 747.1959 | 771.4414 | 819.3742 | 849.4297 | (73) |

6. Solar gains

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| [Jan] | | Area m2 | Solar flux Table 6a W/m2 | g Specific data or Table 6b | FF Specific data or Table 6c | Access factor Table 6d | Gains W |
|-------|--|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|---------------|
| East | | 11.3800 | 19.6403 | 0.6300 | 0.7000 | 0.7700 | 68.3064 (76) |
| South | | 4.6400 | 46.7521 | 0.6300 | 0.7000 | 0.7700 | 66.2965 (78) |
| West | | 20.8100 | 19.6403 | 0.6300 | 0.7000 | 0.7700 | 124.9083 (80) |
| West | | 1.4600 | 26.2379 | 0.6300 | 0.7000 | 1.0000 | 15.2042 (82) |

| | | | | | | | | | | | | |
|-------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
| Solar gains | 274.7154 | 517.0647 | 813.0035 | 1143.4891 | 1375.5682 | 1399.4285 | 1335.7096 | 1162.6097 | 930.2024 | 602.3307 | 338.5961 | 228.5920 (83) |
| Total gains | 1143.9974 | 1411.4135 | 1667.4871 | 1970.2826 | 2158.5457 | 2154.6841 | 2060.6223 | 1887.0761 | 1677.3983 | 1373.7721 | 1157.9703 | 1078.0217 (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 | 43.3291 | 43.4254 | 43.5202 | 43.9713 | 44.0568 | 44.4589 | 44.4589 | 44.5342 | 44.3031 | 44.0568 | 43.8843 | 43.7054 |
| alpha | 3.8886 | 3.8950 | 3.9013 | 3.9314 | 3.9371 | 3.9639 | 3.9639 | 3.9689 | 3.9535 | 3.9371 | 3.9256 | 3.9137 |
| util living area | 0.9959 | 0.9903 | 0.9762 | 0.9315 | 0.8345 | 0.6732 | 0.5186 | 0.5789 | 0.8160 | 0.9628 | 0.9918 | 0.9968 (86) |
| Living | 19.4538 | 19.6471 | 19.9458 | 20.3394 | 20.6556 | 20.8426 | 20.9004 | 20.8889 | 20.7437 | 20.3063 | 19.8092 | 19.4265 |
| Non living | 18.2068 | 18.4549 | 18.8359 | 19.3333 | 19.7082 | 19.9104 | 19.9574 | 19.9520 | 19.8174 | 19.3017 | 18.6699 | 18.1773 |
| 24 / 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 24 / 9 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16 / 9 | 28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| MIT | 20.2090 | 19.6471 | 19.9458 | 20.3394 | 20.6556 | 20.8426 | 20.9004 | 20.8889 | 20.7437 | 20.3063 | 19.8092 | 19.6466 (87) |
| Th 2 | 20.0457 | 20.0476 | 20.0495 | 20.0583 | 20.0600 | 20.0677 | 20.0677 | 20.0691 | 20.0647 | 20.0600 | 20.0566 | 20.0531 (88) |
| util rest of house | 0.9949 | 0.9881 | 0.9705 | 0.9146 | 0.7939 | 0.5986 | 0.4183 | 0.4768 | 0.7565 | 0.9505 | 0.9896 | 0.9960 (89) |
| MIT 2 | 19.3126 | 18.4549 | 18.8359 | 19.3333 | 19.7082 | 19.9104 | 19.9574 | 19.9520 | 19.8174 | 19.3017 | 18.6699 | 18.5153 (90) |
| Living area fraction | | | | | | | | | fLA = Living area / (4) = | | | 0.1117 (91) |
| MIT | 19.4127 | 18.5881 | 18.9599 | 19.4457 | 19.8141 | 20.0145 | 20.0627 | 20.0567 | 19.9209 | 19.4140 | 18.7972 | 18.6417 (92) |
| Temperature adjustment | | | | | | | | | | | | 0.0000 |
| adjusted MIT | 19.4127 | 18.5881 | 18.9599 | 19.4457 | 19.8141 | 20.0145 | 20.0627 | 20.0567 | 19.9209 | 19.4140 | 18.7972 | 18.6417 (93) |

8. Space heating requirement

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|-----------|---------------|-----------|-----------------|
| Utilisation | 0.9942 | 0.9833 | 0.9618 | 0.9011 | 0.7818 | 0.5939 | 0.4178 | 0.4754 | 0.7458 | 0.9393 | 0.9853 | 0.9944 (94) |
| Useful gains | 1137.3178 | 1387.8439 | 1603.7385 | 1775.4089 | 1687.4720 | 1279.7554 | 860.8454 | 897.0963 | 1251.0362 | 1290.3439 | 1140.9781 | 1072.0332 (95) |
| Ext temp. | 4.3000 | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000 | 16.6000 | 14.1000 | 14.1000 | 10.6000 | 7.1000 | 4.2000 (96) |
| Heat loss rate W | 3932.9500 | 3554.3074 | 3228.3316 | 2704.3345 | 2076.7358 | 1373.2738 | 878.2454 | 925.8728 | 1481.5202 | 2255.8678 | 3005.5676 | 3725.9683 (97) |
| Space heating kWh | 2079.9504 | 1455.8635 | 1208.6973 | 668.8264 | 289.6123 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 718.3498 | 1342.5044 | 1974.5277 (98a) |
| Space heating requirement - total per year (kWh/year) | | | | | | | | | | | | 9738.3317 |
| 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 | 2079.9504 | 1455.8635 | 1208.6973 | 668.8264 | 289.6123 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 718.3498 | 1342.5044 | 1974.5277 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) | | | | | | | | | | | | 9738.3317 |
| Space heating per m2 | | | | | | | | | | (98c) / (4) = | | 39.1192 (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 %) 266.4551 (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 | 2079.9504 | 1455.8635 | 1208.6973 | 668.8264 | 289.6123 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 718.3498 | 1342.5044 | 1974.5277 (98) |
| Space heating efficiency (main heating system 1) | 266.4551 | 266.4551 | 266.4551 | 266.4551 | 266.4551 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 266.4551 | 266.4551 | 266.4551 (210) |
| Space heating fuel (main heating system) | 780.6006 | 546.3822 | 453.6213 | 251.0090 | 108.6908 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 269.5950 | 503.8388 | 741.0357 (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 | 296.0707 | 261.7237 | 277.6206 | 242.9063 | 234.6992 | 210.6362 | 207.1909 | 215.8392 | 218.6889 | 244.8882 | 261.6814 | 292.6675 (64) |
| Efficiency of water heater | | | | | | | | | | | | 169.5000 (216) |
| (217)m | 169.5000 | 169.5000 | 169.5000 | 169.5000 | 169.5000 | 169.5000 | 169.5000 | 169.5000 | 169.5000 | 169.5000 | 169.5000 | 169.5000 (217) |
| Fuel for water heating, kWh/month | 174.6730 | 154.4093 | 163.7879 | 143.3076 | 138.4656 | 124.2692 | 122.2365 | 127.3387 | 129.0200 | 144.4768 | 154.3843 | 172.6652 (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 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (231) |
| Lighting | 57.2603 | 45.9364 | 41.3606 | 30.3026 | 23.4066 | 19.1234 | 21.3523 | 27.7545 | 36.0503 | 47.3000 | 53.4252 | 58.8518 (232) |
| Electricity generated by PVs (Appendix M) (negative quantity) | | | | | | | | | | | | |
| (233a)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 (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 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (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) |

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| | | | | | | | | | | | | |
|--|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-----------|--------|
| 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 | | | | | | | | | | | 3654.7734 | (211) |
| Space heating fuel - main system 2 | | | | | | | | | | | 0.0000 | (213) |
| Space heating fuel - secondary | | | | | | | | | | | 0.0000 | (215) |
| Efficiency of water heater | | | | | | | | | | | 169.5000 | |
| Water heating fuel used | | | | | | | | | | | 1749.0341 | (219) |
| Space cooling fuel | | | | | | | | | | | 0.0000 | (221) |
| Electricity for pumps and fans: | | | | | | | | | | | | |
| Total electricity for the above, kWh/year | | | | | | | | | | | 0.0000 | (231) |
| Electricity for lighting (calculated in Appendix L) | | | | | | | | | | | 462.1237 | (232) |
| Energy saving/generation technologies (Appendices M ,N and Q) | | | | | | | | | | | | |
| PV generation | | | | | | | | | | | 0.0000 | (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 | | | | | | | | | | | 5865.9312 | (238) |

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 | 3654.7734 | 0.1554 | 567.8380 (261) |
| Total CO2 associated with community systems | | | 0.0000 (373) |
| Water heating (other fuel) | 1749.0341 | 0.1410 | 246.5954 (264) |
| Space and water heating | | | 814.4334 (265) |
| Pumps, fans and electric keep-hot | 0.0000 | 0.0000 | 0.0000 (267) |
| Energy for lighting | 462.1237 | 0.1443 | 66.6987 (268) |
| Total CO2, kg/year | | | 881.1321 (272) |
| EPC Dwelling Carbon Dioxide Emission Rate (DER) | | | 3.5400 (273) |

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

| | Energy kWh/year | Primary energy factor kg CO2/kWh | Primary energy kWh/year |
|---|-----------------|----------------------------------|-------------------------|
| Space heating - main system 1 | 3654.7734 | 1.5752 | 5756.9271 (275) |
| Total CO2 associated with community systems | | | 0.0000 (473) |
| Water heating (other fuel) | 1749.0341 | 1.5213 | 2660.8623 (278) |
| Space and water heating | | | 8417.7894 (279) |
| Pumps, fans and electric keep-hot | 0.0000 | 0.0000 | 0.0000 (281) |
| Energy for lighting | 462.1237 | 1.5338 | 708.8208 (282) |
| Total Primary energy kWh/year | | | 9126.6103 (286) |
| Dwelling Primary energy Rate (DPER) | | | 36.6600 (287) |

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

1. Overall dwelling characteristics

| | Area (m2) | Storey height (m) | Volume (m3) |
|--|---------------|---------------------------------|------------------------|
| Ground floor | 130.4300 (1b) | x 2.5000 (2b) | = 326.0750 (1b) - (3b) |
| First floor | 118.5100 (1c) | x 2.8200 (2c) | = 334.1982 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 248.9400 | | (4) |
| Dwelling volume | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 660.2732 (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 | 4 * 10 = | 40.0000 (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) = | 40.0000 / (5) = 0.0606 (8) |
| Pressure test | | Yes |
| Pressure Test Method | | Blower Door |
| Measured/design AP50 | | 5.0000 (17) |
| Infiltration rate | | 0.3106 (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) = | 0.2640 (21) |

Full SAP Calculation Printout



| | 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 | | | | | | | | | | | | |
| Effective ac | 0.3366 | 0.3300 | 0.3234 | 0.2904 | 0.2838 | 0.2508 | 0.2508 | 0.2442 | 0.2640 | 0.2838 | 0.2970 | 0.3102 (22b) |
| | 0.5566 | 0.5544 | 0.5523 | 0.5422 | 0.5403 | 0.5314 | 0.5314 | 0.5298 | 0.5348 | 0.5403 | 0.5441 | 0.5481 (25) |

3. Heat losses and heat loss parameter

| Element | Gross m2 | Openings m2 | NetArea m2 | U-value W/m2K | A x U W/K | K-value kJ/m2K | A x K kJ/K |
|---|----------|-------------|------------|---------------|----------------------|----------------|---------------|
| TER Opaque door | | | 3.4100 | 1.0000 | 3.4100 | | (26) |
| TER Opening Type (Uw = 1.20) | | | 36.8300 | 1.1450 | 42.1718 | | (27) |
| W RL | | | 1.4600 | 1.5038 | 2.1955 | | (27a) |
| GF | | | 130.4300 | 0.1300 | 16.9559 | | (28a) |
| External Wall 1 | 205.4200 | 40.2400 | 165.1800 | 0.1800 | 29.7324 | | (29a) |
| Stud | 24.6700 | | 24.6700 | 0.1800 | 4.4406 | | (29a) |
| Warm | 111.1500 | 1.4600 | 109.6900 | 0.1100 | 12.0659 | | (30) |
| Cold | 11.7600 | | 11.7600 | 0.1100 | 1.2936 | | (30) |
| Flat | 33.5200 | | 33.5200 | 0.1100 | 3.6872 | | (30) |
| Total net area of external elements Aum(A, m2) | | | 516.9500 | | | | (31) |
| Fabric heat loss, W/K = Sum (A x U) | | | | | (26)...(30) + (32) = | 115.9528 | (33) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K | | | | | | | 163.0658 (35) |

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

List of Thermal Bridges

| K1 Element | Length | Psi-value | Total |
|--|---------|-----------|---------|
| E2 Other lintels (including other steel lintels) | 25.8900 | 0.0500 | 1.2945 |
| E3 Sill | 16.2400 | 0.0500 | 0.8120 |
| E4 Jamb | 40.6900 | 0.0500 | 2.0345 |
| E5 Ground floor (normal) | 47.1400 | 0.1600 | 7.5424 |
| E6 Intermediate floor within a dwelling | 47.1400 | 0.0000 | 0.0000 |
| E10 Eaves (insulation at ceiling level) | 11.8500 | 0.0600 | 0.7110 |
| E11 Eaves (insulation at rafter level) | 14.4100 | 0.0400 | 0.5764 |
| E12 Gable (insulation at ceiling level) | 4.7000 | 0.0600 | 0.2820 |
| E13 Gable (insulation at rafter level) | 24.9500 | 0.0800 | 1.9960 |
| E14 Flat roof | 17.3200 | 0.0800 | 1.3856 |
| E16 Corner (normal) | 25.8500 | 0.0900 | 2.3265 |
| E17 Corner (inverted - internal area greater than external area) | 7.6200 | -0.0900 | -0.6858 |
| R1 Head of roof window | 1.6200 | 0.0800 | 0.1296 |
| R2 Sill of roof window | 1.6200 | 0.0600 | 0.0972 |
| R3 Jamb of roof window | 1.8000 | 0.0800 | 0.1440 |
| R4 Ridge (vaulted ceiling) | 16.6400 | 0.0800 | 1.3312 |
| R5 Ridge (inverted) | 6.0800 | 0.0400 | 0.2432 |
| R8 Roof to wall (rafter) | 4.5100 | 0.0600 | 0.2706 |
| R9 Roof to wall (flat ceiling) | 11.4800 | 0.0400 | 0.4592 |

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

Point Thermal bridges

Total fabric heat loss (33) + (36) + (36a) = 136.9029 (37)

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

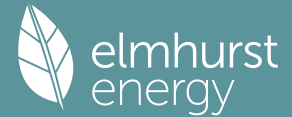
| (38)m | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Heat transfer coeff | 121.2879 | 120.8086 | 120.3388 | 118.1322 | 117.7194 | 115.7975 | 115.7975 | 115.4416 | 116.5378 | 117.7194 | 118.5546 | 119.4277 (38) |
| Average = Sum(39)m / 12 = | 258.1909 | 257.7116 | 257.2418 | 255.0352 | 254.6223 | 252.7004 | 252.7004 | 252.3445 | 253.4407 | 254.6223 | 255.4575 | 256.3307 (39) |
| | | | | | | | | | | | | 255.0332 |

| HLP | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
| HLP (average) | 1.0372 | 1.0352 | 1.0333 | 1.0245 | 1.0228 | 1.0151 | 1.0151 | 1.0137 | 1.0181 | 1.0228 | 1.0262 | 1.0297 (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 | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Hot water usage for mixer showers | 75.6191 | 74.4827 | 72.8267 | 69.6583 | 67.3201 | 64.7126 | 63.2305 | 64.8739 | 66.6754 | 69.4751 | 72.7116 | 75.3294 (42a) |
| Hot water usage for baths | 32.6419 | 32.1571 | 31.4745 | 30.2157 | 29.2732 | 28.2281 | 27.6636 | 28.3415 | 29.0796 | 30.1979 | 31.4826 | 32.5316 (42b) |
| Hot water usage for other uses | 46.0243 | 44.3507 | 42.6771 | 41.0035 | 39.3299 | 37.6563 | 37.6563 | 39.3299 | 41.0035 | 42.6771 | 44.3507 | 46.0243 (42c) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 141.8228 (43) |
| Daily hot water use | 154.2853 | 150.9905 | 146.9783 | 140.8776 | 135.9232 | 130.5970 | 128.5504 | 132.5453 | 136.7585 | 142.3501 | 148.5448 | 153.8853 (44) |
| Energy conte | 244.3503 | 215.0085 | 225.9002 | 192.8543 | 182.9788 | 160.5842 | 155.4705 | 164.1188 | 168.6369 | 193.1678 | 211.6294 | 240.9471 (45) |
| Energy content (annual) | | | | | | | | | | | | 2355.6468 |
| Distribution loss (46)m = 0.15 x (45)m | 36.6525 | 32.2513 | 33.8850 | 28.9282 | 27.4468 | 24.0876 | 23.3206 | 24.6178 | 25.2955 | 28.9752 | 31.7444 | 36.1421 (46) |
| Water storage loss: | | | | | | | | | | | | |
| Store volume | | | | | | | | | | | | 210.0000 (47) |
| a) If manufacturer declared loss factor is known (kWh/day): | | | | | | | | | | | | 1.7016 (48) |
| Temperature factor from Table 2b | | | | | | | | | | | | 0.5400 (49) |
| Enter (49) or (54) in (55) | | | | | | | | | | | | 0.9188 (55) |
| Total storage loss | 28.4842 | 25.7277 | 28.4842 | 27.5653 | 28.4842 | 27.5653 | 28.4842 | 28.4842 | 27.5653 | 28.4842 | 27.5653 | 28.4842 (56) |
| If cylinder contains dedicated solar storage | 28.4842 | 25.7277 | 28.4842 | 27.5653 | 28.4842 | 27.5653 | 28.4842 | 28.4842 | 27.5653 | 28.4842 | 27.5653 | 28.4842 (57) |
| Primary loss | 23.2624 | 21.0112 | 23.2624 | 22.5120 | 23.2624 | 22.5120 | 23.2624 | 23.2624 | 22.5120 | 23.2624 | 22.5120 | 23.2624 (59) |
| Combi loss | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (61) |
| Total heat required for water heating calculated for each month | 296.0969 | 261.7474 | 277.6467 | 242.9317 | 234.7254 | 210.6616 | 207.2171 | 215.8654 | 218.7143 | 244.9144 | 261.7067 | 292.6937 (62) |
| WWHRS | -34.5699 | -30.5739 | -32.0152 | -26.5099 | -24.7063 | -21.1413 | -19.8166 | -21.0730 | -21.8736 | -25.7866 | -29.2131 | -33.9297 (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 | 261.5270 | 231.1735 | 245.6315 | 216.4218 | 210.0191 | 189.5203 | 187.4005 | 194.7924 | 196.8407 | 219.1278 | 232.4936 | 258.7640 (64) |
| Total per year (kWh/year) | | | | | | | | | | | | 2643.7121 (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 | | | | | | | | | | | | 2644 (64) |

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122.6437 108.8814 116.5091 104.1859 102.2377 93.4561 93.0912 95.9668 96.1337 105.6256 110.4286 121.5122 (65)

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

Metabolic gains (Table 5), Watts

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
| (66)m | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 220.0179 | 243.5913 | 220.0179 | 227.3519 | 220.0179 | 227.3519 | 220.0179 | 220.0179 | 227.3519 | 220.0179 | 227.3519 | 220.0179 (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 415.4652 | 419.7765 | 408.9123 | 385.7838 | 356.5882 | 329.1485 | 310.8171 | 306.5058 | 317.3700 | 340.4985 | 369.6941 | 397.1338 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 (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) | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 (71) |
| Water heating gains (Table 5) | 164.8437 | 162.0259 | 156.5982 | 144.7027 | 137.4163 | 129.8002 | 125.1226 | 128.9876 | 133.5190 | 141.9698 | 153.3731 | 163.3228 (72) |
| Total internal gains | 872.3102 | 897.3769 | 857.5117 | 829.8216 | 786.0057 | 755.2838 | 724.9409 | 724.4946 | 747.2241 | 774.4695 | 822.4023 | 852.4579 (73) |

6. Solar gains

| [Jan] | Area m ² | Solar flux Table 6a W/m ² | Specific data or Table 6b | g | Specific data or Table 6c | FF | Access factor Table 6d | Gains W | | | | |
|-------------|------------------------|--|------------------------------|-----------|------------------------------|-----------|------------------------------|------------|-----------|-----------|-----------|----------------|
| East | 11.3800 | 19.6403 | 0.6300 | 0.7000 | 0.7700 | 0.7700 | 68.3064 (76) | | | | | |
| South | 4.6400 | 46.7521 | 0.6300 | 0.7000 | 0.7700 | 0.7700 | 66.2965 (78) | | | | | |
| West | 20.8100 | 19.6403 | 0.6300 | 0.7000 | 0.7700 | 0.7700 | 124.9083 (80) | | | | | |
| West | 1.4600 | 26.2379 | 0.6300 | 0.7000 | 1.0000 | 1.0000 | 15.2042 (82) | | | | | |
| Solar gains | 274.7154 | 517.0647 | 813.0035 | 1143.4891 | 1375.5682 | 1399.4285 | 1335.7096 | 1162.6097 | 930.2024 | 602.3307 | 338.5961 | 228.5920 (83) |
| Total gains | 1147.0256 | 1414.4417 | 1670.5152 | 1973.3107 | 2161.5739 | 2154.7123 | 2060.6505 | 1887.1043 | 1677.4265 | 1376.8003 | 1160.9985 | 1081.0499 (84) |

7. Mean internal temperature (heating season)

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Utilisation factor for gains for living area, nil,m (see Table 9a) | 0.9959 | 0.9902 | 0.9759 | 0.9307 | 0.8327 | 0.6718 | 0.5171 | 0.5775 | 0.8149 | 0.9623 | 0.9918 | 0.9967 (86) |
| tau | 43.6731 | 43.7543 | 43.8343 | 44.2135 | 44.2220 | 44.6220 | 44.6220 | 44.6850 | 44.4917 | 44.2852 | 44.1404 | 43.9901 |
| alpha | 3.9115 | 3.9170 | 3.9223 | 3.9476 | 3.9523 | 3.9748 | 3.9748 | 3.9790 | 3.9661 | 3.9523 | 3.9427 | 3.9327 |
| util living area | 0.9959 | 0.9902 | 0.9759 | 0.9307 | 0.8327 | 0.6718 | 0.5171 | 0.5775 | 0.8149 | 0.9623 | 0.9918 | 0.9967 (86) |
| MIT | 19.0628 | 19.3193 | 19.7154 | 20.2339 | 20.6516 | 20.8957 | 20.9716 | 20.9564 | 20.7655 | 20.1883 | 19.5293 | 19.0227 (87) |
| Th 2 | 20.0525 | 20.0541 | 20.0556 | 20.0630 | 20.0644 | 20.0708 | 20.0708 | 20.0720 | 20.0683 | 20.0644 | 20.0616 | 20.0587 (88) |
| util rest of house | 0.9949 | 0.9880 | 0.9701 | 0.9137 | 0.7921 | 0.5973 | 0.4173 | 0.4758 | 0.7554 | 0.9500 | 0.9895 | 0.9960 (89) |
| MIT 2 | 17.7577 | 18.0862 | 18.5904 | 19.2416 | 19.7357 | 19.9955 | 20.0572 | 20.0493 | 19.8748 | 19.1969 | 18.3609 | 17.7104 (90) |
| Living area fraction | 17.9035 | 18.2239 | 18.7161 | 19.3524 | 19.8380 | 20.0961 | 20.1594 | 20.1507 | 19.9743 | 19.3077 | 18.4914 | 17.8570 (92) |
| MIT | 17.9035 | 18.2239 | 18.7161 | 19.3524 | 19.8380 | 20.0961 | 20.1594 | 20.1507 | 19.9743 | 19.3077 | 18.4914 | 17.8570 (92) |
| Temperature adjustment | | | | | | | | | | | | 0.0000 |
| adjusted MIT | 17.9035 | 18.2239 | 18.7161 | 19.3524 | 19.8380 | 20.0961 | 20.1594 | 20.1507 | 19.9743 | 19.3077 | 18.4914 | 17.8570 (93) |

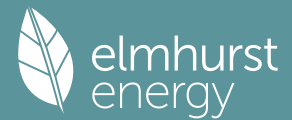
8. Space heating requirement

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|-----------|-----------|-----------|----------------------------|
| Utilisation | 0.9915 | 0.9815 | 0.9589 | 0.8977 | 0.7809 | 0.5995 | 0.4272 | 0.4850 | 0.7484 | 0.9363 | 0.9838 | 0.9932 (94) |
| Useful gains | 1137.2855 | 1388.3285 | 1601.8209 | 1771.3520 | 1687.9060 | 1291.7821 | 880.3636 | 915.1664 | 1255.4426 | 1289.1445 | 1142.1624 | 1073.6729 (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 | 3512.3066 | 3433.7327 | 3142.4862 | 2665.7419 | 2072.1148 | 1388.8626 | 899.4598 | 946.4608 | 1488.7861 | 2217.1697 | 2910.0284 | 3500.7192 (97) |
| Space heating kWh | 1767.0157 | 1374.5116 | 1146.2549 | 643.9607 | 285.8513 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 690.4508 | 1272.8635 | 1805.7225 (98a) |
| Space heating requirement - total per year (kWh/year) | | | | | | | | | | | | 8986.6310 |
| 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 | 1767.0157 | 1374.5116 | 1146.2549 | 643.9607 | 285.8513 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 690.4508 | 1272.8635 | 1805.7225 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) | | | | | | | | | | | | 8986.6310 |
| Space heating per m ² | | | | | | | | | | | | (98c) / (4) = 36.0996 (99) |

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|-----------|-----------|-----------|----------|----------|--------|--------|--------|--------|----------|-----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11) | | | | | | | | | | | | 0.0000 (201) |
| Fraction of space heat from main system(s) | | | | | | | | | | | | 1.0000 (202) |
| Efficiency of main space heating system 1 (in %) | | | | | | | | | | | | 92.3000 (206) |
| Efficiency of main space heating system 2 (in %) | | | | | | | | | | | | 0.0000 (207) |
| Efficiency of secondary/supplementary heating system, % | | | | | | | | | | | | 0.0000 (208) |
| Space heating requirement | 1767.0157 | 1374.5116 | 1146.2549 | 643.9607 | 285.8513 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 690.4508 | 1272.8635 | 1805.7225 (98) |
| Space heating efficiency (main heating system 1) | 92.3000 | 92.3000 | 92.3000 | 92.3000 | 92.3000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 92.3000 | 92.3000 | 92.3000 (210) |
| Space heating fuel (main heating system) | 1914.4265 | 1489.1783 | 1241.8797 | 697.6822 | 309.6981 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 748.0507 | 1379.0504 | 1956.3624 (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) | | | | | | | | | | | | |

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| | | | | | | | | | | | | | | |
|--|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|------------|--------|
| | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (215) |
| Water heating | | | | | | | | | | | | | | |
| Water heating requirement | 261.5270 | 231.1735 | 245.6315 | 216.4218 | 210.0191 | 189.5203 | 187.4005 | 194.7924 | 196.8407 | 219.1278 | 232.4936 | 258.7640 | 258.7640 | (64) |
| Efficiency of water heater | | | | | | | | | | | | | | (216) |
| (217)m | 87.5273 | 87.3812 | 87.0671 | 86.3503 | 84.7516 | 79.8000 | 79.8000 | 79.8000 | 79.8000 | 86.4511 | 87.2797 | 87.5622 | 87.5622 | (217) |
| Fuel for water heating, kWh/month | 298.7946 | 264.5576 | 282.1175 | 250.6324 | 247.8054 | 237.4941 | 234.8377 | 244.1007 | 246.6675 | 253.4703 | 266.3776 | 295.5202 | 295.5202 | (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 | 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 | 7.3041 | (231) |
| Lighting | 45.7154 | 36.6746 | 33.0214 | 24.1929 | 18.6873 | 15.2677 | 17.0472 | 22.1585 | 28.7818 | 37.7632 | 42.6535 | 46.9860 | 46.9860 | (232) |
| Electricity generated by PVs (Appendix M) (negative quantity) | | | | | | | | | | | | | | |
| (233a)m | -104.0023 | -138.2962 | -187.4947 | -198.2533 | -203.4904 | -186.0373 | -183.3632 | -177.7552 | -166.9259 | -151.5256 | -111.1636 | -90.8903 | -90.8903 | (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity) | | | | | | | | | | | | | | |
| (234a)m | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (234a) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) | | | | | | | | | | | | | | |
| (235a)m | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (235a) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | | | | | | | | | | | | | | |
| (235c)m | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (235c) |
| Electricity generated by PVs (Appendix M) (negative quantity) | | | | | | | | | | | | | | |
| (233b)m | -86.9729 | -178.7850 | -348.1018 | -512.8549 | -669.0009 | -669.2356 | -661.6782 | -564.6238 | -419.5636 | -252.6348 | -115.0484 | -69.1317 | -69.1317 | (233b) |
| Electricity generated by wind turbines (Appendix M) (negative quantity) | | | | | | | | | | | | | | |
| (234b)m | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (234b) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) | | | | | | | | | | | | | | |
| (235b)m | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (235b) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | | | | | | | | | | | | | | |
| (235d)m | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (235d) |
| Annual totals kWh/year | | | | | | | | | | | | | | |
| Space heating fuel - main system 1 | | | | | | | | | | | | | 9736.3283 | (211) |
| Space heating fuel - main system 2 | | | | | | | | | | | | | 0.0000 | (213) |
| Space heating fuel - secondary | | | | | | | | | | | | | 0.0000 | (215) |
| Efficiency of water heater | | | | | | | | | | | | | 79.8000 | |
| Water heating fuel used | | | | | | | | | | | | | 3122.3755 | (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) | | | | | | | | | | | | | 368.9493 | (232) |
| Energy saving/generation technologies (Appendices M ,N and Q) | | | | | | | | | | | | | | |
| PV generation | | | | | | | | | | | | | -6446.8295 | (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 | | | | | | | | | | | | | 6866.8236 | (238) |

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 | 9736.3283 | 0.2100 | 2044.6289 (261) |
| Total CO2 associated with community systems | | | 0.0000 (373) |
| Water heating (other fuel) | 3122.3755 | 0.2100 | 655.6989 (264) |
| Space and water heating | | | 2700.3278 (265) |
| Pumps, fans and electric keep-hot | 86.0000 | 0.1387 | 11.9293 (267) |
| Energy for lighting | 368.9493 | 0.1443 | 53.2508 (268) |
| Energy saving/generation technologies | | | |
| PV Unit electricity used in dwelling | -1899.1980 | 0.1359 | -258.1371 |
| PV Unit electricity exported | -4547.6315 | 0.1265 | -575.1027 |
| Total | | | -833.2397 (269) |
| Total CO2, kg/year | | | 1932.2681 (272) |
| EPC Target Carbon Dioxide Emission Rate (TER) | | | 7.7600 (273) |

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

| | Energy kWh/year | Primary energy factor kg CO2/kWh | Primary energy kWh/year |
|---|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1 | 9736.3283 | 1.1300 | 11002.0510 (275) |
| Total CO2 associated with community systems | | | 0.0000 (473) |
| Water heating (other fuel) | 3122.3755 | 1.1300 | 3528.2843 (278) |
| Space and water heating | | | 14530.3353 (279) |
| Pumps, fans and electric keep-hot | 86.0000 | 1.5128 | 130.1008 (281) |
| Energy for lighting | 368.9493 | 1.5338 | 565.9068 (282) |
| Energy saving/generation technologies | | | |
| PV Unit electricity used in dwelling | -1899.1980 | 1.5024 | -2853.3681 |
| PV Unit electricity exported | -4547.6315 | 0.4642 | -2111.1322 |
| Total | | | -4964.5003 (283) |
| Total Primary energy kWh/year | | | 10261.8425 (286) |
| Target Primary Energy Rate (TPER) | | | 41.2200 (287) |

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| | | | | | |
|------------------------------------|----------------------|---------------|-----------------|-------------|-----------|
| Property Reference | 113606 - Plot 1 | | Issued on Date | 17/04/2024 | |
| Assessment Reference | Plot 1 | Prop Type Ref | 113606 - Plot 1 | | |
| Property | | | | | |
| SAP Rating | 81 B | DER | 3.54 | TER | 7.76 |
| Environmental | 96 A | % DER < TER | | 54.38 | |
| CO ₂ Emissions (t/year) | 0.84 | DFEE | 40.43 | TFEE | 40.52 |
| Compliance Check | See BREEL | % DFEE < TFEE | | 0.24 | |
| % DPER < TPER | 11.06 | DPER | 36.66 | TPER | 41.22 |
| Assessor Details | Ms. Bethany Robinson | | | Assessor ID | AW36-0001 |
| Client | | | | | |

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

1. Overall dwelling characteristics

| | Area (m ²) | Storey height (m) | Volume (m ³) |
|--|------------------------|---------------------------------|--------------------------|
| Ground floor | 130.4300 (1b) | 2.5000 (2b) | 326.0750 (1b) - (3b) |
| First floor | 118.5100 (1c) | 2.8200 (2c) | 334.1982 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 248.9400 | | (4) |
| Dwelling volume | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | 660.2732 (5) |

2. Ventilation rate

| | m ³ 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 | 4 * 10 = | | | | | | | | | | | 40.0000 (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) = | 40.0000 / (5) = | | | | | | | | | | | 0.0606 (8) | |
| Pressure test | Yes | | | | | | | | | | | | |
| Pressure Test Method | Blower Door | | | | | | | | | | | | |
| Measured/design AP50 | 5.0000 | | | | | | | | | | | (17) | |
| Infiltration rate | 0.3106 | | | | | | | | | | | (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) = | | | | | | | | | | | 0.2640 (21) | |
| Wind speed | Jan 5.1000 | Feb 5.0000 | Mar 4.9000 | Apr 4.4000 | May 4.3000 | Jun 3.8000 | Jul 3.8000 | Aug 3.7000 | Sep 4.0000 | Oct 4.3000 | Nov 4.5000 | Dec 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 | 0.3366 | 0.3300 | 0.3234 | 0.2904 | 0.2838 | 0.2508 | 0.2508 | 0.2442 | 0.2640 | 0.2838 | 0.2970 | 0.3102 | (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 | 0.5566 | 0.5544 | 0.5523 | 0.5422 | 0.5403 | 0.5314 | 0.5314 | 0.5298 | 0.5348 | 0.5403 | 0.5441 | 0.5481 | (25) |

3. Heat losses and heat loss parameter

| Element | Gross m ² | Openings m ² | NetArea m ² | U-value W/m ² K | A x U W/K | K-value kJ/m ² K | A x K kJ/K |
|--|----------------------|-------------------------|------------------------|----------------------------|----------------------|-----------------------------|--|
| GLAZING (Uw = 1.20) | | | 36.8300 | 1.1450 | 42.1718 | | (27) |
| SOLID | | | 3.4100 | 1.0000 | 3.4100 | | (26) |
| W RL | | | 1.4600 | 1.1450 | 1.6718 | | (27a) |
| GF | | | 130.4300 | 0.1200 | 15.6516 | 110.0000 | 14347.3000 (28a) |
| External Wall 1 | 205.4200 | 40.2400 | 165.1800 | 0.1800 | 29.7324 | 110.0000 | 18169.8000 (29a) |
| Stud | 24.6700 | | 24.6700 | 0.1600 | 3.9472 | 9.0000 | 222.0300 (29a) |
| Warm | 111.1500 | 1.4600 | 109.6900 | 0.1500 | 16.4535 | 9.0000 | 987.2100 (30) |
| Cold | 11.7600 | | 11.7600 | 0.1100 | 1.2936 | 9.0000 | 105.8400 (30) |
| Flat | 33.5200 | | 33.5200 | 0.1300 | 4.3576 | 9.0000 | 301.6800 (30) |
| Total net area of external elements Aum(A, m ²) | | | 516.9500 | | | | (31) |
| Fabric heat loss, W/K = Sum (A x U) | | | | | (26)...(30) + (32) = | 118.6894 | (33) |
| Internal Wall 1 | | | 362.2200 | | | 9.0000 | 3259.9800 (32c) |
| Internal Floor 1 | | | 118.5100 | | | 18.0000 | 2133.1800 (32d) |
| Internal Ceiling 1 | | | 118.5100 | | | 9.0000 | 1066.5900 (32e) |
| Heat capacity Cm = Sum(A x k) | | | | | | | (28)...(30) + (32) + (32a)...(32e) = 40593.6100 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K | | | | | | | 163.0658 (35) |

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List of Thermal Bridges

| | Length | Psi-value | Total |
|--|---------|-----------|-------------------------------------|
| K1 Element | | | |
| E2 Other lintels (including other steel lintels) | 25.8900 | 0.0200 | 0.5178 |
| E3 Sill | 16.2400 | 0.0230 | 0.3735 |
| E4 Jamb | 40.6900 | 0.0180 | 0.7324 |
| E5 Ground floor (normal) | 47.1400 | 0.0600 | 2.8284 |
| E6 Intermediate floor within a dwelling | 47.1400 | 0.0010 | 0.0471 |
| E10 Eaves (insulation at ceiling level) | 11.8500 | 0.0550 | 0.6517 |
| E11 Eaves (insulation at rafter level) | 14.4100 | 0.0180 | 0.2594 |
| E12 Gable (insulation at ceiling level) | 4.7000 | 0.0370 | 0.1739 |
| E13 Gable (insulation at rafter level) | 24.9500 | 0.0330 | 0.8234 |
| E14 Flat roof | 17.3200 | 0.1600 | 2.7712 |
| E16 Corner (normal) | 25.8500 | 0.0400 | 1.0340 |
| E17 Corner (inverted - internal area greater than external area) | 7.6200 | -0.0820 | -0.6248 |
| R1 Head of roof window | 1.6200 | 0.2400 | 0.3888 |
| R2 Sill of roof window | 1.6200 | 0.2400 | 0.3888 |
| R3 Jamb of roof window | 1.8000 | 0.2400 | 0.4320 |
| R4 Ridge (vaulted ceiling) | 16.6400 | 0.1200 | 1.9968 |
| R5 Ridge (inverted) | 6.0800 | 0.1200 | 0.7296 |
| R8 Roof to wall (rafter) | 4.5100 | 0.1200 | 0.5412 |
| R9 Roof to wall (flat ceiling) | 11.4800 | 0.3200 | 3.6736 |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | 17.7388 (36) |
| Point Thermal bridges | | | 0.0000 |
| Total fabric heat loss | | | (33) + (36) + (36a) = 136.4282 (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 | 121.2879 | 120.8086 | 120.3388 | 118.1322 | 117.7194 | 115.7975 | 115.7975 | 115.4416 | 116.5378 | 117.7194 | 118.5546 | 119.4277 (38) |
| Average = Sum(39)m / 12 = | 257.7162 | 257.2369 | 256.7671 | 254.5605 | 254.1476 | 252.2257 | 252.2257 | 251.8698 | 252.9660 | 254.1476 | 254.9828 | 255.8560 (39) |

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
| HLP | 1.0353 | 1.0333 | 1.0314 | 1.0226 | 1.0209 | 1.0132 | 1.0132 | 1.0118 | 1.0162 | 1.0209 | 1.0243 | 1.0278 (40) |
| HLP (average) | | | | | | | | | | | | 1.0226 |
| Days in mont | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 |

4. Water heating energy requirements (kWh/year)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|----------|----------|----------|---------|---------|---------|---------|---------|---------|---------|----------|---------------|
| Assumed occupancy | | | | | | | | | | | | 3.0656 (42) |
| Hot water usage for mixer showers | | | | | | | | | | | | |
| Hot water usage for baths | 32.6419 | 32.1571 | 31.4745 | 30.2157 | 29.2732 | 28.2281 | 27.6636 | 28.3415 | 29.0796 | 30.1979 | 31.4826 | 32.5316 (42b) |
| Hot water usage for other uses | 46.0243 | 44.3507 | 42.6771 | 41.0035 | 39.3299 | 37.6563 | 37.6563 | 39.3299 | 41.0035 | 42.6771 | 44.3507 | 46.0243 (42c) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 72.1045 (43) |
| Daily hot water use | 78.6662 | 76.5078 | 74.1516 | 71.2192 | 68.6031 | 65.8844 | 65.3199 | 67.6714 | 70.0831 | 72.8750 | 75.8333 | 78.5559 (44) |
| Energy content (annual) | 124.5881 | 108.9461 | 113.9682 | 97.4956 | 92.3530 | 81.0125 | 78.9987 | 83.7913 | 86.4195 | 98.8907 | 108.0384 | 122.9995 (45) |
| Distribution loss (46)m = 0.15 x (45)m | | | | | | | | | | | | |
| 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 (46) |
| If cylinder contains dedicated solar storage | | | | | | | | | | | | |
| Primary loss | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (57) |
| Combi loss | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (59) |
| Total heat required for water heating calculated for each month | 105.8999 | 92.6042 | 96.8730 | 82.8712 | 78.5000 | 68.8607 | 67.1489 | 71.2226 | 73.4566 | 84.0571 | 91.8326 | 104.5496 (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 | 105.8999 | 92.6042 | 96.8730 | 82.8712 | 78.5000 | 68.8607 | 67.1489 | 71.2226 | 73.4566 | 84.0571 | 91.8326 | 104.5496 (64) |
| 12Total per year (kWh/year) | | | | | | | | | | | | |
| Electric shower(s) | 60.5583 | 53.9579 | 58.9200 | 56.2266 | 57.2817 | 54.6412 | 56.4626 | 57.2817 | 56.2266 | 58.9200 | 57.8121 | 60.5583 (64a) |
| Heat gains from water heating, kWh/month | 41.6145 | 36.6405 | 38.9482 | 34.7745 | 33.9454 | 30.8755 | 30.9029 | 32.1261 | 32.4208 | 35.7443 | 37.4112 | 41.2770 (65) |

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

| Metabolic gains (Table 5), Watts | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
| (66)m | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 220.0179 | 243.5913 | 220.0179 | 227.3519 | 220.0179 | 227.3519 | 220.0179 | 220.0179 | 227.3519 | 220.0179 | 227.3519 | 220.0179 (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 415.4652 | 419.7765 | 408.9123 | 385.7838 | 356.5882 | 329.1485 | 310.8171 | 306.5058 | 317.3700 | 340.4985 | 369.6941 | 397.1338 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 (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) | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 (71) |
| Water heating gains (Table 5) | 55.9335 | 54.5246 | 52.3498 | 48.2979 | 45.6256 | 42.8826 | 41.5361 | 43.1802 | 45.0289 | 48.0434 | 51.9600 | 55.4798 (72) |
| Total internal gains | 760.4000 | 786.8756 | 750.2633 | 730.4168 | 691.2150 | 668.3662 | 641.3544 | 638.6873 | 658.7340 | 677.5431 | 717.9892 | 741.6148 (73) |

6. Solar gains

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

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| | | | | W/m2 | or Table 6b | or Table 6c | Table 6d | |
|-------|--|--|---------|---------|-------------|-------------|----------|---------------|
| East | | | 11.3800 | 19.6403 | 0.6300 | 0.7000 | 0.7700 | 68.3064 (76) |
| South | | | 4.6400 | 46.7521 | 0.6300 | 0.7000 | 0.7700 | 66.2965 (78) |
| West | | | 20.8100 | 19.6403 | 0.6300 | 0.7000 | 0.7700 | 124.9083 (80) |
| West | | | 1.4600 | 26.2379 | 0.6300 | 0.7000 | 1.0000 | 15.2042 (82) |

| | | | | | | | | | | | | |
|-------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|---------------|
| Solar gains | 274.7154 | 517.0647 | 813.0035 | 1143.4891 | 1375.5682 | 1399.4285 | 1335.7096 | 1162.6097 | 930.2024 | 602.3307 | 338.5961 | 228.5920 (83) |
| Total gains | 1035.1154 | 1303.9404 | 1563.2668 | 1873.9059 | 2066.7832 | 2067.7947 | 1977.0640 | 1801.2969 | 1588.9364 | 1279.8738 | 1056.5853 | 970.2068 (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 | 43.7536 | 43.8351 | 43.9153 | 44.2960 | 44.3679 | 44.7060 | 44.7060 | 44.7692 | 44.5752 | 44.3679 | 44.2226 | 44.0717 |
| alpha | 3.9169 | 3.9223 | 3.9277 | 3.9531 | 3.9579 | 3.9804 | 3.9804 | 3.9846 | 3.9717 | 3.9579 | 3.9482 | 3.9381 |
| util living area | 0.9971 | 0.9926 | 0.9805 | 0.9400 | 0.8480 | 0.6905 | 0.5351 | 0.5987 | 0.8345 | 0.9699 | 0.9941 | 0.9978 (86) |
| MIT | 18.9994 | 19.2581 | 19.6593 | 20.1909 | 20.6251 | 20.8853 | 20.9681 | 20.9507 | 20.7423 | 20.1397 | 19.4706 | 18.9596 (87) |
| Th 2 | 20.0541 | 20.0557 | 20.0572 | 20.0646 | 20.0659 | 20.0723 | 20.0723 | 20.0735 | 20.0699 | 20.0659 | 20.0632 | 20.0602 (88) |
| util rest of house | 0.9965 | 0.9909 | 0.9758 | 0.9248 | 0.8094 | 0.6162 | 0.4332 | 0.4954 | 0.7781 | 0.9597 | 0.9924 | 0.9973 (89) |
| MIT 2 | 18.2021 | 18.4610 | 18.8602 | 19.3841 | 19.7878 | 20.0072 | 20.0604 | 20.0533 | 19.9016 | 19.3433 | 18.6792 | 18.1668 (90) |
| Living area fraction | | | | | | | | | | FLA = Living area / (4) = | | |
| MIT | 18.2911 | 18.5500 | 18.9495 | 19.4743 | 19.8813 | 20.1053 | 20.1618 | 20.1536 | 19.9955 | 19.4323 | 18.7676 | 18.2554 (92) |
| Temperature adjustment | | | | | | | | | | | | 0.0000 |
| adjusted MIT | 18.2911 | 18.5500 | 18.9495 | 19.4743 | 19.8813 | 20.1053 | 20.1618 | 20.1536 | 19.9955 | 19.4323 | 18.7676 | 18.2554 (93) |

8. Space heating requirement

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|-----------|-----------|-----------|-----------------|
| Utilisation | 0.9946 | 0.9870 | 0.9683 | 0.9129 | 0.8007 | 0.6191 | 0.4435 | 0.5049 | 0.7728 | 0.9504 | 0.9891 | 0.9958 (94) |
| Useful gains | 1029.5437 | 1286.9751 | 1513.6939 | 1710.7499 | 1654.8628 | 1280.1749 | 876.7309 | 909.5442 | 1227.9082 | 1216.4229 | 1045.0798 | 966.1302 (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 | 3605.7453 | 3511.2908 | 3196.6106 | 2691.7883 | 2079.2577 | 1388.5694 | 898.3798 | 945.4148 | 1491.3568 | 2244.6953 | 2975.0441 | 3596.1597 (97) |
| Space heating kWh | 1916.6940 | 1494.7402 | 1252.0900 | 706.3476 | 315.7498 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 765.0347 | 1389.5743 | 1956.7419 (98a) |
| Space heating requirement - total per year (kWh/year) | | | | | | | | | | | | 9796.9726 |
| 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 | 1916.6940 | 1494.7402 | 1252.0900 | 706.3476 | 315.7498 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 765.0347 | 1389.5743 | 1956.7419 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) | | | | | | | | | | | | 9796.9726 |
| Space heating per m2 | | | | | | | | | | | | (98c) / (4) = |
| | | | | | | | | | | | | 39.3548 (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 | 2370.9216 | 1866.4702 | 1914.2105 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (100) |
| Utilisation | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.7850 | 0.8574 | 0.8147 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (101) |
| Useful loss | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1861.1371 | 1600.2363 | 1559.4650 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (102) |
| Total gains | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 2289.3484 | 2188.6442 | 1990.4298 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (103) |
| Space cooling kWh | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 308.3122 | 437.7755 | 320.6378 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (104) |
| Cooled fraction | | | | | | | | | fc = cooled area / (4) = | | | |
| Intermittency factor (Table 10b) | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 (106) |
| Space cooling kWh | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 77.0780 | 109.4439 | 80.1595 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (107) |
| Space cooling requirement | | | | | | | | | | | | 266.6814 (107) |
| Energy for space heating | | | | | | | | | | | | 39.3548 (99) |
| Energy for space cooling | | | | | | | | | | | | 1.0713 (108) |
| Total | | | | | | | | | | | | 40.4260 (109) |
| Fabric Energy Efficiency (DFEE) | | | | | | | | | | | | 40.4 (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 | 130.4300 (1b) | x 2.5000 (2b) | = 326.0750 (1b) - (3b) |
| First floor | 118.5100 (1c) | x 2.8200 (2c) | = 334.1982 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 248.9400 | | (4) |
| Dwelling volume | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 660.2732 (5) |

2. Ventilation rate

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| | | | | | | | | | | | | | |
|---|---|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-----------------------------|--------------|
| | | | | | | | | | | | | 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 | | | | | | | | | | | | 4 * 10 = | 40.0000 (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) = | | | | | | | | | | | 40.0000 / (5) = | 0.0606 (8) |
| Pressure test | | | | | | | | | | | | Yes | |
| Pressure Test Method | | | | | | | | | | | | Blower Door | |
| Measured/design AP50 | | | | | | | | | | | | 5.0000 (17) | |
| Infiltration rate | | | | | | | | | | | | 0.3106 (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) = | 0.2640 (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 | 0.3366 | 0.3300 | 0.3234 | 0.2904 | 0.2838 | 0.2508 | 0.2508 | 0.2442 | 0.2640 | 0.2838 | 0.2970 | 0.3102 | (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 | 0.5566 | 0.5544 | 0.5523 | 0.5422 | 0.5403 | 0.5314 | 0.5314 | 0.5298 | 0.5348 | 0.5403 | 0.5441 | 0.5481 | (25) |

3. Heat losses and heat loss parameter

| Element | Gross m2 | Openings m2 | NetArea m2 | U-value W/m2K | A x U W/K | K-value kJ/m2K | A x K kJ/K | |
|--|-------------|----------------|---------------|------------------|----------------------|-------------------|---------------|-------|
| TER Opaque door | | | 3.4100 | 1.0000 | 3.4100 | | | (26) |
| TER Opening Type (Uw = 1.20) | | | 36.8300 | 1.1450 | 42.1718 | | | (27) |
| W RL | | | 1.4600 | 1.5038 | 2.1955 | | | (27a) |
| GF | | | 130.4300 | 0.1300 | 16.9559 | | | (28a) |
| External Wall 1 | 205.4200 | 40.2400 | 165.1800 | 0.1800 | 29.7324 | | | (29a) |
| Stud | 24.6700 | | 24.6700 | 0.1800 | 4.4406 | | | (29a) |
| Warm | 111.1500 | 1.4600 | 109.6900 | 0.1100 | 12.0659 | | | (30) |
| Cold | 11.7600 | | 11.7600 | 0.1100 | 1.2936 | | | (30) |
| Flat | 33.5200 | | 33.5200 | 0.1100 | 3.6872 | | | (30) |
| Total net area of external elements Aum(A, m2) | | | | | 516.9500 | | | (31) |
| Fabric heat loss, W/K = Sum (A x U) | | | | | (26)...(30) + (32) = | 115.9528 | | (33) |

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

| List of Thermal Bridges | Length | Psi-value | Total | |
|--|---------|-----------|-----------------------|---------------|
| K1 Element | | | | |
| E2 Other lintels (including other steel lintels) | 25.8900 | 0.0500 | 1.2945 | |
| E3 Sill | 16.2400 | 0.0500 | 0.8120 | |
| E4 Jamb | 40.6900 | 0.0500 | 2.0345 | |
| E5 Ground floor (normal) | 47.1400 | 0.1600 | 7.5424 | |
| E6 Intermediate floor within a dwelling | 47.1400 | 0.0000 | 0.0000 | |
| E10 Eaves (insulation at ceiling level) | 11.8500 | 0.0600 | 0.7110 | |
| E11 Eaves (insulation at rafter level) | 14.4100 | 0.0400 | 0.5764 | |
| E12 Gable (insulation at ceiling level) | 4.7000 | 0.0600 | 0.2820 | |
| E13 Gable (insulation at rafter level) | 24.9500 | 0.0800 | 1.9960 | |
| E14 Flat roof | 17.3200 | 0.0800 | 1.3856 | |
| E16 Corner (normal) | 25.8500 | 0.0900 | 2.3265 | |
| E17 Corner (inverted - internal area greater than external area) | 7.6200 | -0.0900 | -0.6858 | |
| R1 Head of roof window | 1.6200 | 0.0800 | 0.1296 | |
| R2 Sill of roof window | 1.6200 | 0.0600 | 0.0972 | |
| R3 Jamb of roof window | 1.8000 | 0.0800 | 0.1440 | |
| R4 Ridge (vaulted ceiling) | 16.6400 | 0.0800 | 1.3312 | |
| R5 Ridge (inverted) | 6.0800 | 0.0400 | 0.2432 | |
| R8 Roof to wall (rafter) | 4.5100 | 0.0600 | 0.2706 | |
| R9 Roof to wall (flat ceiling) | 11.4800 | 0.0400 | 0.4592 | |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | 20.9501 | (36) |
| Point Thermal bridges | | | (36a) = | 0.0000 |
| Total fabric heat loss | | | (33) + (36) + (36a) = | 136.9029 (37) |

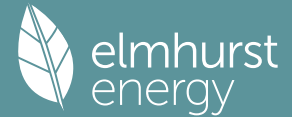
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

| (38)m | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| | 121.2879 | 120.8086 | 120.3388 | 118.1322 | 117.7194 | 115.7975 | 115.7975 | 115.4416 | 116.5378 | 117.7194 | 118.5546 | 119.4277 | (38) |
| Heat transfer coeff | 258.1909 | 257.7116 | 257.2418 | 255.0352 | 254.6223 | 252.7004 | 252.7004 | 252.3445 | 253.4407 | 254.6223 | 255.4575 | 256.3307 | (39) |
| Average = Sum(39)m / 12 = | | | | | | | | | | | | | 255.0332 |
| HLP | 1.0372 | 1.0352 | 1.0333 | 1.0245 | 1.0228 | 1.0151 | 1.0151 | 1.0137 | 1.0181 | 1.0228 | 1.0262 | 1.0297 | (40) |
| HLP (average) | | | | | | | | | | | | | 1.0245 |
| Days in mont | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | |

4. Water heating energy requirements (kWh/year)

| Assumed occupancy | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|--|----------|----------|----------|---------|---------|---------|---------|---------|---------|---------|----------|----------|-------------|
| Hot water usage for mixer showers | | | | | | | | | | | | | 3.0656 (42) |
| Hot water usage for baths | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (42a) |
| Hot water usage for other uses | 32.6419 | 32.1571 | 31.4745 | 30.2157 | 29.2732 | 28.2281 | 27.6636 | 28.3415 | 29.0796 | 30.1979 | 31.4826 | 32.5316 | (42b) |
| Average daily hot water use (litres/day) | 46.0243 | 44.3507 | 42.6771 | 41.0035 | 39.3299 | 37.6563 | 37.6563 | 39.3299 | 41.0035 | 42.6771 | 44.3507 | 46.0243 | (42c) |
| Daily hot water use | 78.6662 | 76.5078 | 74.1516 | 71.2192 | 68.6031 | 65.8844 | 65.3199 | 67.6714 | 70.0831 | 72.8750 | 75.8333 | 78.5559 | (44) |
| Energy content (annual) | 124.5881 | 108.9461 | 113.9682 | 97.4956 | 92.3530 | 81.0125 | 78.9987 | 83.7913 | 86.4195 | 98.8907 | 108.0384 | 122.9995 | (45) |
| Total = Sum(45)m = | | | | | | | | | | | | | 1197.5016 |

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| | | | | | | | | | | | | |
|---|----------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------------|
| 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 | | | | | | | | | | | | |
| Primary loss | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (57) |
| Combi loss | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (59) |
| Total heat required for water heating calculated for each month | | | | | | | | | | | | |
| WWHRS | 105.8999 | 92.6042 | 96.8730 | 82.8712 | 78.5000 | 68.8607 | 67.1489 | 71.2226 | 73.4566 | 84.0571 | 91.8326 | 104.5496 (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 (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 | | | | | | | | | | | | |
| | 105.8999 | 92.6042 | 96.8730 | 82.8712 | 78.5000 | 68.8607 | 67.1489 | 71.2226 | 73.4566 | 84.0571 | 91.8326 | 104.5496 (64) |
| 12Total per year (kWh/year) | | | | | | | | | | | | 1017.8763 (64) |
| Electric shower(s) | | | | | | | | | | | | 1018 (64) |
| | 60.5583 | 53.9579 | 58.9200 | 56.2266 | 57.2817 | 54.6412 | 56.4626 | 57.2817 | 56.2266 | 58.9200 | 57.8121 | 60.5583 (64a) |
| | | | | | | | | | | | | 688.8472 (64a) |
| Heat gains from water heating, kWh/month | | | | | | | | | | | | |
| | 41.6145 | 36.6405 | 38.9482 | 34.7745 | 33.9454 | 30.8755 | 30.9029 | 32.1261 | 32.4208 | 35.7443 | 37.4112 | 41.2770 (65) |

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

| | | | | | | | | | | | | |
|---|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
| Metabolic gains (Table 5), Watts | | | | | | | | | | | | |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| (66)m | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | | | | | | | | | | | | |
| | 220.0179 | 243.5913 | 220.0179 | 227.3519 | 220.0179 | 227.3519 | 220.0179 | 220.0179 | 227.3519 | 220.0179 | 227.3519 | 220.0179 (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | | | | | | | | | | | | |
| | 415.4652 | 419.7765 | 408.9123 | 385.7838 | 356.5882 | 329.1485 | 310.8171 | 306.5058 | 317.3700 | 340.4985 | 369.6941 | 397.1338 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | | | | | | | | | | | | |
| | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 (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) | | | | | | | | | | | | |
| | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 (71) |
| Water heating gains (Table 5) | | | | | | | | | | | | |
| | 55.9335 | 54.5246 | 52.3498 | 48.2979 | 45.6256 | 42.8826 | 41.5361 | 43.1802 | 45.0289 | 48.0434 | 51.9600 | 55.4798 (72) |
| Total internal gains | 760.4000 | 786.8756 | 750.2633 | 730.4168 | 691.2150 | 668.3662 | 641.3544 | 638.6873 | 658.7340 | 677.5431 | 717.9892 | 741.6148 (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 | | | | | | |
| East | | 11.3800 | 19.6403 | 0.6300 | 0.7000 | 0.7700 | 68.3064 (76) | | | | | |
| South | | 4.6400 | 46.7521 | 0.6300 | 0.7000 | 0.7700 | 66.2965 (78) | | | | | |
| West | | 20.8100 | 19.6403 | 0.6300 | 0.7000 | 0.7700 | 124.9083 (80) | | | | | |
| West | | 1.4600 | 26.2379 | 0.6300 | 0.7000 | 1.0000 | 15.2042 (82) | | | | | |
| Solar gains | 274.7154 | 517.0647 | 813.0035 | 1143.4891 | 1375.5682 | 1399.4285 | 1335.7096 | 1162.6097 | 930.2024 | 602.3307 | 338.5961 | 228.5920 (83) |
| Total gains | 1035.1154 | 1303.9404 | 1563.2668 | 1873.9059 | 2066.7832 | 2067.7947 | 1977.0640 | 1801.2969 | 1588.9364 | 1279.8738 | 1056.5853 | 970.2068 (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 | 43.6731 | 43.7543 | 43.8343 | 44.2135 | 44.2852 | 44.6220 | 44.6220 | 44.6850 | 44.4917 | 44.2852 | 44.1404 | 43.9901 |
| alpha | 3.9115 | 3.9170 | 3.9223 | 3.9476 | 3.9523 | 3.9748 | 3.9748 | 3.9790 | 3.9661 | 3.9523 | 3.9427 | 3.9327 |
| util living area | 0.9971 | 0.9926 | 0.9806 | 0.9401 | 0.8484 | 0.6912 | 0.5359 | 0.5995 | 0.8350 | 0.9700 | 0.9941 | 0.9978 (86) |
| MIT | 18.9955 | 19.2543 | 19.6558 | 20.1880 | 20.6231 | 20.8844 | 20.9678 | 20.9502 | 20.7408 | 20.1371 | 19.4673 | 18.9557 (87) |
| Th 2 | 20.0525 | 20.0541 | 20.0556 | 20.0630 | 20.0644 | 20.0708 | 20.0708 | 20.0720 | 20.0683 | 20.0644 | 20.0616 | 20.0587 (88) |
| util rest of house | | | | | | | | | | | | |
| | 0.9965 | 0.9909 | 0.9758 | 0.9249 | 0.8099 | 0.6169 | 0.4337 | 0.4960 | 0.7785 | 0.9598 | 0.9924 | 0.9973 (89) |
| MIT 2 | 18.1971 | 18.4560 | 18.8555 | 19.3801 | 19.7847 | 20.0051 | 20.0587 | 20.0516 | 19.8990 | 19.3396 | 18.6748 | 18.1618 (90) |
| Living area fraction | | | | | | | | | | | | |
| MIT | 18.2863 | 18.5452 | 18.9449 | 19.4703 | 19.8783 | 20.1033 | 20.1603 | 20.1520 | 19.9931 | 19.4287 | 18.7633 | 18.2505 (92) |
| Temperature adjustment | | | | | | | | | | | | 0.0000 |
| adjusted MIT | 18.2863 | 18.5452 | 18.9449 | 19.4703 | 19.8783 | 20.1033 | 20.1603 | 20.1520 | 19.9931 | 19.4287 | 18.7633 | 18.2505 (93) |

8. Space heating requirement

| | | | | | | | | | | | | |
|--|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|-----------|-----------|-----------|----------------------------|
| Utilisation | 0.9946 | 0.9870 | 0.9683 | 0.9131 | 0.8011 | 0.6197 | 0.4440 | 0.5055 | 0.7732 | 0.9505 | 0.9891 | 0.9958 (94) |
| Useful gains | 1029.5356 | 1286.9690 | 1513.7257 | 1711.0035 | 1655.6278 | 1281.3903 | 877.7977 | 910.5659 | 1228.5456 | 1216.4875 | 1045.0729 | 966.1230 (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 | | | | | | | | | | | | |
| | 3611.1315 | 3516.5296 | 3201.3565 | 2695.8022 | 2082.3834 | 1390.6828 | 899.6779 | 946.7856 | 1493.5399 | 2247.9816 | 2979.4855 | 3601.5802 (97) |
| Space heating kWh | 1920.7074 | 1498.2647 | 1255.5973 | 709.0550 | 317.5062 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 767.4316 | 1392.7771 | 1960.7801 (98a) |
| Space heating requirement - total per year (kWh/year) | | | | | | | | | | | | 9822.1195 |
| 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 | 1920.7074 | 1498.2647 | 1255.5973 | 709.0550 | 317.5062 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 767.4316 | 1392.7771 | 1960.7801 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) | | | | | | | | | | | | 9822.1195 |
| Space heating per m2 | | | | | | | | | | | | (98c) / (4) = 39.4558 (99) |

Full SAP Calculation Printout

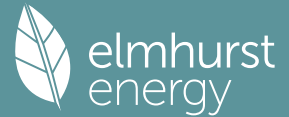


 8c. Space cooling requirement

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 | | | | | | 2375.3839 | 1869.9831 | 1917.8183 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (100) |
| Utilisation | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.7840 | 0.8565 | 0.8137 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (101) |
| Useful loss | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1862.2682 | 1601.6566 | 1560.5768 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (102) |
| Total gains | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 2289.3484 | 2188.6442 | 1990.4298 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (103) |
| Space cooling kWh | | | | | | 307.4978 | 436.7188 | 319.8106 | 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 | | | | | | 76.8744 | 109.1797 | 79.9527 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (107) |
| Space cooling requirement | | | | | | | | | | | | 266.0068 (107) |
| Energy for space heating | | | | | | | | | | | | 39.4558 (99) |
| Energy for space cooling | | | | | | | | | | | | 1.0686 (108) |
| Total | | | | | | | | | | | | 40.5243 (109) |
| Fabric Energy Efficiency (TFEE) | | | | | | | | | | | | 40.5 (109) |

Full SAP Calculation Printout



| | | | | | |
|------------------------------------|----------------------|---------------|-----------------|-------------|-----------|
| Property Reference | 113606 - Plot 1 | | Issued on Date | 17/04/2024 | |
| Assessment Reference | Plot 1 | Prop Type Ref | 113606 - Plot 1 | | |
| Property | | | | | |
| SAP Rating | 81 B | DER | 3.54 | TER | 7.76 |
| Environmental | 96 A | % DER < TER | | 54.38 | |
| CO ₂ Emissions (t/year) | 0.84 | DFEE | 40.43 | TFEE | 40.52 |
| Compliance Check | See BREL | % DFEE < TFEE | | 0.24 | |
| % DPER < TPER | 11.06 | DPER | 36.66 | TPER | 41.22 |
| Assessor Details | Ms. Bethany Robinson | | | Assessor ID | AW36-0001 |
| 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 (m ²) | Storey height (m) | Volume (m ³) |
|--|------------------------|---------------------------------|--------------------------|
| Ground floor | 130.4300 (1b) | 2.5000 (2b) | 326.0750 (1b) - (3b) |
| First floor | 118.5100 (1c) | 2.8200 (2c) | 334.1982 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 248.9400 | | (4) |
| Dwelling volume | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | 660.2732 (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 | 6 * 10 = | | | | | | | | | | | 60.0000 (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) = | | | | | | | | | | | 60.0000 / (5) = | 0.0909 (8) |
| Pressure test | | | | | | | | | | | | Yes | |
| Pressure Test Method | | | | | | | | | | | | Blower Door | |
| Measured/design AP50 | | | | | | | | | | | | 5.0000 (17) | |
| Infiltration rate | | | | | | | | | | | | 0.3409 (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) = | | | | | | | | | | | 0.2897 (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 | 0.3694 | 0.3622 | 0.3549 | 0.3187 | 0.3115 | 0.2753 | 0.2753 | 0.2680 | 0.2897 | 0.3115 | 0.3260 | 0.3404 (22b) | |
| | 0.5682 | 0.5656 | 0.5630 | 0.5508 | 0.5485 | 0.5379 | 0.5379 | 0.5359 | 0.5420 | 0.5485 | 0.5531 | 0.5580 (25) | |

3. Heat losses and heat loss parameter

| Element | Gross m ² | Openings m ² | NetArea m ² | U-value W/m ² K | A x U W/K | K-value kJ/m ² K | A x K kJ/K |
|--|----------------------|-------------------------|------------------------|----------------------------|----------------------|-----------------------------|--------------------------------------|
| GLAZING (Uw = 1.20) | | | 36.8300 | 1.1450 | 42.1718 | | (27) |
| SOLID | | | 3.4100 | 1.0000 | 3.4100 | | (26) |
| W RL | | | 1.4600 | 1.1450 | 1.6718 | | (27a) |
| CF | | | 130.4300 | 0.1200 | 15.6516 | 110.0000 | 14347.3000 (28a) |
| External Wall 1 | 205.4200 | 40.2400 | 165.1800 | 0.1800 | 29.7324 | 110.0000 | 18169.8000 (29a) |
| Stud | 24.6700 | | 24.6700 | 0.1600 | 3.9472 | 9.0000 | 222.0300 (29a) |
| Warm | 111.1500 | 1.4600 | 109.6900 | 0.1500 | 16.4535 | 9.0000 | 987.2100 (30) |
| Cold | 11.7600 | | 11.7600 | 0.1100 | 1.2936 | 9.0000 | 105.8400 (30) |
| Flat | 33.5200 | | 33.5200 | 0.1300 | 4.3576 | 9.0000 | 301.6800 (30) |
| Total net area of external elements Aum(A, m ²) | | | 516.9500 | | | | (31) |
| Fabric heat loss, W/K = Sum (A x U) | | | | | (26)...(30) + (32) = | 118.6894 | (33) |
| Internal Wall 1 | | | 362.2200 | | | 9.0000 | 3259.9800 (32c) |
| Internal Floor 1 | | | 118.5100 | | | 18.0000 | 2133.1800 (32d) |
| Internal Ceiling 1 | | | 118.5100 | | | 9.0000 | 1066.5900 (32e) |
| Heat capacity Cm = Sum(A x k) | | | | | | | (28)...(30) + (32) + (32a)...(32e) = |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K | | | | | | | 40593.6100 (34) |
| List of Thermal Bridges | | | | | | | 163.0658 (35) |
| K1 Element | | | | Length | Psi-value | | Total |

Full SAP Calculation Printout



| | | | |
|--|---------|---------|---------|
| E2 Other lintels (including other steel lintels) | 25.8900 | 0.0200 | 0.5178 |
| E3 Sill | 16.2400 | 0.0230 | 0.3735 |
| E4 Jamb | 40.6900 | 0.0180 | 0.7324 |
| E5 Ground floor (normal) | 47.1400 | 0.0600 | 2.8284 |
| E6 Intermediate floor within a dwelling | 47.1400 | 0.0010 | 0.0471 |
| E10 Eaves (insulation at ceiling level) | 11.8500 | 0.0550 | 0.6517 |
| E11 Eaves (insulation at rafter level) | 14.4100 | 0.0180 | 0.2594 |
| E12 Gable (insulation at ceiling level) | 4.7000 | 0.0370 | 0.1739 |
| E13 Gable (insulation at rafter level) | 24.9500 | 0.0330 | 0.8234 |
| E14 Flat roof | 17.3200 | 0.1600 | 2.7712 |
| E16 Corner (normal) | 25.8500 | 0.0400 | 1.0340 |
| E17 Corner (inverted - internal area greater than external area) | 7.6200 | -0.0820 | -0.6248 |
| R1 Head of roof window | 1.6200 | 0.2400 | 0.3888 |
| R2 Sill of roof window | 1.6200 | 0.2400 | 0.3888 |
| R3 Jamb of roof window | 1.8000 | 0.2400 | 0.4320 |
| R4 Ridge (vaulted ceiling) | 16.6400 | 0.1200 | 1.9968 |
| R5 Ridge (inverted) | 6.0800 | 0.1200 | 0.7296 |
| R8 Roof to wall (rafter) | 4.5100 | 0.1200 | 0.5412 |
| R9 Roof to wall (flat ceiling) | 11.4800 | 0.3200 | 3.6736 |

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
 Point Thermal bridges (36a) = 17.7388 (36)
 Total fabric heat loss (33) + (36) + (36a) = 136.4282 (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 |
|---------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| (38)m | 123.8129 | 123.2356 | 122.6697 | 120.0116 | 119.5143 | 117.1993 | 117.1993 | 116.7705 | 118.0910 | 119.5143 | 120.5204 | 121.5721 |
| Heat transfer coeff | 260.2411 | 259.6638 | 259.0979 | 256.4399 | 255.9425 | 253.6275 | 253.6275 | 253.1988 | 254.5192 | 255.9425 | 256.9486 | 258.0004 |
| Average = Sum(39)m / 12 = | | | | | | | | | | | | 256.4375 |

| HLP | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| HLP | 1.0454 | 1.0431 | 1.0408 | 1.0301 | 1.0281 | 1.0188 | 1.0188 | 1.0171 | 1.0224 | 1.0281 | 1.0322 | 1.0364 |
| HLP (average) | | | | | | | | | | | | 1.0301 |
| Days in mont | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 |

4. Water heating energy requirements (kWh/year)

Assumed occupancy 3.0656 (42)

Hot water usage for mixer showers 75.6191 74.4827 72.8267 69.6583 67.3201 64.7126 63.2305 64.8739 66.6754 69.4751 72.7116 75.3294 (42a)

Hot water usage for baths 32.6419 32.1571 31.4745 30.2157 29.2732 28.2281 27.6636 28.3415 29.0796 30.1979 31.4826 32.5316 (42b)

Hot water usage for other uses 46.0243 44.3507 42.6771 41.0035 39.3299 37.6563 37.6563 39.3299 41.0035 42.6771 44.3507 46.0243 (42c)

Average daily hot water use (litres/day) 141.8228 (43)

| Daily hot water use | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|
| Daily hot water use | 154.2853 | 150.9905 | 146.9783 | 140.8776 | 135.9232 | 130.5970 | 128.5504 | 132.5453 | 136.7585 | 142.3501 | 148.5448 | 153.8853 |
| Energy conte | 244.3503 | 215.0085 | 225.9002 | 192.8543 | 182.9788 | 160.5842 | 155.4705 | 164.1188 | 168.6369 | 193.1678 | 211.6294 | 240.9471 |
| Energy content (annual) | | | | | | | | | | | | |
| Distribution loss (46)m = 0.15 x (45)m | 36.6525 | 32.2513 | 33.8850 | 28.9282 | 27.4468 | 24.0876 | 23.3206 | 24.6178 | 25.2955 | 28.9752 | 31.7444 | 36.1421 |
| Water storage loss: | | | | | | | | | | | | |
| Store volume | | | | | | | | | | | | 210.0000 |
| a) If manufacturer declared loss factor is known (kWh/day): | | | | | | | | | | | | 1.7000 |
| Temperature factor from Table 2b | | | | | | | | | | | | 0.5400 |
| Enter (49) or (54) in (55) | | | | | | | | | | | | 0.9180 |
| Total storage loss | 28.4580 | 25.7040 | 28.4580 | 27.5400 | 28.4580 | 27.5400 | 28.4580 | 28.4580 | 27.5400 | 28.4580 | 27.5400 | 28.4580 |
| If cylinder contains dedicated solar storage | 28.4580 | 25.7040 | 28.4580 | 27.5400 | 28.4580 | 27.5400 | 28.4580 | 28.4580 | 27.5400 | 28.4580 | 27.5400 | 28.4580 |
| Primary loss | 23.2624 | 21.0112 | 23.2624 | 22.5120 | 23.2624 | 22.5120 | 23.2624 | 23.2624 | 22.5120 | 23.2624 | 22.5120 | 23.2624 |
| 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 |
| Total heat required for water heating calculated for each month | 296.0707 | 261.7237 | 277.6206 | 242.9063 | 234.6992 | 210.6362 | 207.1909 | 215.8392 | 218.6889 | 244.8882 | 261.6814 | 292.6675 |
| 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 |
| 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 |
| 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 |
| 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 |
| Output from w/h | 296.0707 | 261.7237 | 277.6206 | 242.9063 | 234.6992 | 210.6362 | 207.1909 | 215.8392 | 218.6889 | 244.8882 | 261.6814 | 292.6675 |
| 12Total per year (kWh/year) | | | | | | | | | | | | 2964.6128 |
| 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 |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = | | | | | | | | | | | | 0.0000 |
| Heat gains from water heating, kWh/month | 122.6228 | 108.8625 | 116.4881 | 104.1657 | 102.2168 | 93.4359 | 93.0703 | 95.9458 | 96.1134 | 105.6046 | 110.4084 | 121.4912 |

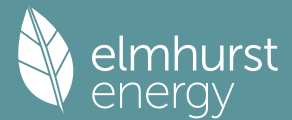
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

| (66)m | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| (66)m | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 220.0179 | 243.5913 | 220.0179 | 227.3519 | 220.0179 | 227.3519 | 220.0179 | 220.0179 | 227.3519 | 220.0179 | 227.3519 | 220.0179 |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 415.4652 | 419.7765 | 408.9123 | 385.7838 | 356.5882 | 329.1485 | 310.8171 | 306.5058 | 317.3700 | 340.4985 | 369.6941 | 397.1338 |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 |
| 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 |
| Losses e.g. evaporation (negative values) (Table 5) | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 |
| Water heating gains (Table 5) | 164.8156 | 161.9978 | 156.5701 | 144.6745 | 137.3881 | 129.7720 | 125.0944 | 128.9594 | 133.4908 | 141.9417 | 153.3449 | 163.2947 |
| Total internal gains | 869.2820 | 894.3488 | 854.4836 | 826.7935 | 782.9776 | 755.2557 | 724.9127 | 724.4665 | 747.1959 | 771.4414 | 819.3742 | 849.4297 |

6. Solar gains

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| [Jan] | | Area m2 | Solar flux Table 6a W/m2 | g Specific data or Table 6b | FF Specific data or Table 6c | Access factor Table 6d | Gains W |
|-------|--|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|---------------|
| East | | 11.3800 | 19.6403 | 0.6300 | 0.7000 | 0.7700 | 68.3064 (76) |
| South | | 4.6400 | 46.7521 | 0.6300 | 0.7000 | 0.7700 | 66.2965 (78) |
| West | | 20.8100 | 19.6403 | 0.6300 | 0.7000 | 0.7700 | 124.9083 (80) |
| West | | 1.4600 | 26.2379 | 0.6300 | 0.7000 | 1.0000 | 15.2042 (82) |

| | | | | | | | | | | | | |
|-------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
| Solar gains | 274.7154 | 517.0647 | 813.0035 | 1143.4891 | 1375.5682 | 1399.4285 | 1335.7096 | 1162.6097 | 930.2024 | 602.3307 | 338.5961 | 228.5920 (83) |
| Total gains | 1143.9974 | 1411.4135 | 1667.4871 | 1970.2826 | 2158.5457 | 2154.6841 | 2060.6223 | 1887.0761 | 1677.3983 | 1373.7721 | 1157.9703 | 1078.0217 (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 | 43.3291 | 43.4254 | 43.5202 | 43.9713 | 44.0568 | 44.4589 | 44.4589 | 44.5342 | 44.3031 | 44.0568 | 43.8843 | 43.7054 |
| alpha | 3.8886 | 3.8950 | 3.9013 | 3.9314 | 3.9371 | 3.9639 | 3.9639 | 3.9689 | 3.9535 | 3.9371 | 3.9256 | 3.9137 |
| util living area | 0.9959 | 0.9903 | 0.9762 | 0.9315 | 0.8345 | 0.6732 | 0.5186 | 0.5789 | 0.8160 | 0.9628 | 0.9918 | 0.9968 (86) |
| Living | 19.4538 | 19.6471 | 19.9458 | 20.3394 | 20.6556 | 20.8426 | 20.9004 | 20.8889 | 20.7437 | 20.3063 | 19.8092 | 19.4265 |
| Non living | 18.2068 | 18.4549 | 18.8359 | 19.3333 | 19.7082 | 19.9104 | 19.9574 | 19.9520 | 19.8174 | 19.3017 | 18.6699 | 18.1773 |
| 24 / 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 24 / 9 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16 / 9 | 28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| MIT | 20.2090 | 19.6471 | 19.9458 | 20.3394 | 20.6556 | 20.8426 | 20.9004 | 20.8889 | 20.7437 | 20.3063 | 19.8092 | 19.4666 (87) |
| Th 2 | 20.0457 | 20.0476 | 20.0495 | 20.0583 | 20.0600 | 20.0677 | 20.0677 | 20.0691 | 20.0647 | 20.0600 | 20.0566 | 20.0531 (88) |
| util rest of house | 0.9949 | 0.9881 | 0.9705 | 0.9146 | 0.7939 | 0.5986 | 0.4183 | 0.4768 | 0.7565 | 0.9505 | 0.9896 | 0.9960 (89) |
| MIT 2 | 19.3126 | 18.4549 | 18.8359 | 19.3333 | 19.7082 | 19.9104 | 19.9574 | 19.9520 | 19.8174 | 19.3017 | 18.6699 | 18.5153 (90) |
| Living area fraction | | | | | | | | | fLA = Living area / (4) = | | | 0.1117 (91) |
| MIT | 19.4127 | 18.5881 | 18.9599 | 19.4457 | 19.8141 | 20.0145 | 20.0627 | 20.0567 | 19.9209 | 19.4140 | 18.7972 | 18.6417 (92) |
| Temperature adjustment | | | | | | | | | | | | 0.0000 |
| adjusted MIT | 19.4127 | 18.5881 | 18.9599 | 19.4457 | 19.8141 | 20.0145 | 20.0627 | 20.0567 | 19.9209 | 19.4140 | 18.7972 | 18.6417 (93) |

8. Space heating requirement

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|-----------|---------------|-----------|-----------------|
| Utilisation | 0.9942 | 0.9833 | 0.9618 | 0.9011 | 0.7818 | 0.5939 | 0.4178 | 0.4754 | 0.7458 | 0.9393 | 0.9853 | 0.9944 (94) |
| Useful gains | 1137.3178 | 1387.8439 | 1603.7385 | 1775.4089 | 1687.4720 | 1279.7554 | 860.8454 | 897.0963 | 1251.0362 | 1290.3439 | 1140.9781 | 1072.0332 (95) |
| Ext temp. | 4.3000 | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000 | 16.6000 | 14.1000 | 14.1000 | 10.6000 | 7.1000 | 4.2000 (96) |
| Heat loss rate W | 3932.9500 | 3554.3074 | 3228.3316 | 2704.3345 | 2076.7358 | 1373.2738 | 878.2454 | 925.8728 | 1481.5202 | 2255.8678 | 3005.5676 | 3725.9683 (97) |
| Space heating kWh | 2079.9504 | 1455.8635 | 1208.6973 | 668.8264 | 289.6123 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 718.3498 | 1342.5044 | 1974.5277 (98a) |
| Space heating requirement - total per year (kWh/year) | | | | | | | | | | | | 9738.3317 |
| 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 | 2079.9504 | 1455.8635 | 1208.6973 | 668.8264 | 289.6123 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 718.3498 | 1342.5044 | 1974.5277 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) | | | | | | | | | | | | 9738.3317 |
| Space heating per m2 | | | | | | | | | | (98c) / (4) = | | 39.1192 (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 %) 266.4551 (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 | 2079.9504 | 1455.8635 | 1208.6973 | 668.8264 | 289.6123 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 718.3498 | 1342.5044 | 1974.5277 (98) |
| Space heating efficiency (main heating system 1) | 266.4551 | 266.4551 | 266.4551 | 266.4551 | 266.4551 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 266.4551 | 266.4551 | 266.4551 (210) |
| Space heating fuel (main heating system) | 780.6006 | 546.3822 | 453.6213 | 251.0090 | 108.6908 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 269.5950 | 503.8388 | 741.0357 (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 | 296.0707 | 261.7237 | 277.6206 | 242.9063 | 234.6992 | 210.6362 | 207.1909 | 215.8392 | 218.6889 | 244.8882 | 261.6814 | 292.6675 (64) |
| Efficiency of water heater | | | | | | | | | | | | 169.5000 (216) |
| (217)m | 169.5000 | 169.5000 | 169.5000 | 169.5000 | 169.5000 | 169.5000 | 169.5000 | 169.5000 | 169.5000 | 169.5000 | 169.5000 | 169.5000 (217) |
| Fuel for water heating, kWh/month | 174.6730 | 154.4093 | 163.7879 | 143.3076 | 138.4656 | 124.2692 | 122.2365 | 127.3387 | 129.0200 | 144.4768 | 154.3843 | 172.6652 (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 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (231) |
| Lighting | 57.2603 | 45.9364 | 41.3606 | 30.3026 | 23.4066 | 19.1234 | 21.3523 | 27.7545 | 36.0503 | 47.3000 | 53.4252 | 58.8518 (232) |
| Electricity generated by PVs (Appendix M) (negative quantity) | | | | | | | | | | | | |
| (233a)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 (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 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (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) |

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| | | | | | | | | | | | | |
|--|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-----------|--------|
| 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 | | | | | | | | | | | 3654.7734 | (211) |
| Space heating fuel - main system 2 | | | | | | | | | | | 0.0000 | (213) |
| Space heating fuel - secondary | | | | | | | | | | | 0.0000 | (215) |
| Efficiency of water heater | | | | | | | | | | | 169.5000 | |
| Water heating fuel used | | | | | | | | | | | 1749.0341 | (219) |
| Space cooling fuel | | | | | | | | | | | 0.0000 | (221) |
| Electricity for pumps and fans: | | | | | | | | | | | | |
| Total electricity for the above, kWh/year | | | | | | | | | | | 0.0000 | (231) |
| Electricity for lighting (calculated in Appendix L) | | | | | | | | | | | 462.1237 | (232) |
| Energy saving/generation technologies (Appendices M ,N and Q) | | | | | | | | | | | | |
| PV generation | | | | | | | | | | | 0.0000 | (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 | | | | | | | | | | | 5865.9312 | (238) |

 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 | 3654.7734 | 0.1554 | 567.8380 (261) |
| Total CO2 associated with community systems | | | 0.0000 (373) |
| Water heating (other fuel) | 1749.0341 | 0.1410 | 246.5954 (264) |
| Space and water heating | | | 814.4334 (265) |
| Pumps, fans and electric keep-hot | 0.0000 | 0.0000 | 0.0000 (267) |
| Energy for lighting | 462.1237 | 0.1443 | 66.6987 (268) |
| Total CO2, kg/year | | | 881.1321 (272) |
| EPC Dwelling Carbon Dioxide Emission Rate (DER) | | | 3.5400 (273) |

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

| | Energy kWh/year | Primary energy factor kg CO2/kWh | Primary energy kWh/year |
|---|-----------------|----------------------------------|-------------------------|
| Space heating - main system 1 | 3654.7734 | 1.5752 | 5756.9271 (275) |
| Total CO2 associated with community systems | | | 0.0000 (473) |
| Water heating (other fuel) | 1749.0341 | 1.5213 | 2660.8623 (278) |
| Space and water heating | | | 8417.7894 (279) |
| Pumps, fans and electric keep-hot | 0.0000 | 0.0000 | 0.0000 (281) |
| Energy for lighting | 462.1237 | 1.5338 | 708.8208 (282) |
| Total Primary energy kWh/year | | | 9126.6103 (286) |
| Dwelling Primary energy Rate (DPER) | | | 36.6600 (287) |

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

 1. Overall dwelling characteristics

| | Area (m2) | Storey height (m) | Volume (m3) |
|--|---------------|---------------------------------|------------------------|
| Ground floor | 130.4300 (1b) | x 2.5000 (2b) | = 326.0750 (1b) - (3b) |
| First floor | 118.5100 (1c) | x 2.8200 (2c) | = 334.1982 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 248.9400 | | (4) |
| Dwelling volume | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 660.2732 (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 | 4 * 10 = | 40.0000 (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) = | 40.0000 / (5) = 0.0606 (8) |
| Pressure test | | Yes |
| Pressure Test Method | | Blower Door |
| Measured/design AP50 | | 5.0000 (17) |
| Infiltration rate | | 0.3106 (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) = | 0.2640 (21) |

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| | 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 | | | | | | | | | | | | |
| Effective ac | 0.3366 | 0.3300 | 0.3234 | 0.2904 | 0.2838 | 0.2508 | 0.2508 | 0.2442 | 0.2640 | 0.2838 | 0.2970 | 0.3102 (22b) |
| | 0.5566 | 0.5544 | 0.5523 | 0.5422 | 0.5403 | 0.5314 | 0.5314 | 0.5298 | 0.5348 | 0.5403 | 0.5441 | 0.5481 (25) |

3. Heat losses and heat loss parameter

| Element | Gross m2 | Openings m2 | NetArea m2 | U-value W/m2K | A x U W/K | K-value kJ/m2K | A x K kJ/K |
|---|----------|-------------|------------|---------------|----------------------|----------------|---------------|
| TER Opaque door | | | 3.4100 | 1.0000 | 3.4100 | | (26) |
| TER Opening Type (Uw = 1.20) | | | 36.8300 | 1.1450 | 42.1718 | | (27) |
| W RL | | | 1.4600 | 1.5038 | 2.1955 | | (27a) |
| GF | | | 130.4300 | 0.1300 | 16.9559 | | (28a) |
| External Wall 1 | 205.4200 | 40.2400 | 165.1800 | 0.1800 | 29.7324 | | (29a) |
| Stud | 24.6700 | | 24.6700 | 0.1800 | 4.4406 | | (29a) |
| Warm | 111.1500 | 1.4600 | 109.6900 | 0.1100 | 12.0659 | | (30) |
| Cold | 11.7600 | | 11.7600 | 0.1100 | 1.2936 | | (30) |
| Flat | 33.5200 | | 33.5200 | 0.1100 | 3.6872 | | (30) |
| Total net area of external elements Aum(A, m2) | | | 516.9500 | | | | (31) |
| Fabric heat loss, W/K = Sum (A x U) | | | | | (26)...(30) + (32) = | 115.9528 | (33) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K | | | | | | | 163.0658 (35) |

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

List of Thermal Bridges

| K1 Element | Length | Psi-value | Total |
|--|---------|-----------|---------|
| E2 Other lintels (including other steel lintels) | 25.8900 | 0.0500 | 1.2945 |
| E3 Sill | 16.2400 | 0.0500 | 0.8120 |
| E4 Jamb | 40.6900 | 0.0500 | 2.0345 |
| E5 Ground floor (normal) | 47.1400 | 0.1600 | 7.5424 |
| E6 Intermediate floor within a dwelling | 47.1400 | 0.0000 | 0.0000 |
| E10 Eaves (insulation at ceiling level) | 11.8500 | 0.0600 | 0.7110 |
| E11 Eaves (insulation at rafter level) | 14.4100 | 0.0400 | 0.5764 |
| E12 Gable (insulation at ceiling level) | 4.7000 | 0.0600 | 0.2820 |
| E13 Gable (insulation at rafter level) | 24.9500 | 0.0800 | 1.9960 |
| E14 Flat roof | 17.3200 | 0.0800 | 1.3856 |
| E16 Corner (normal) | 25.8500 | 0.0900 | 2.3265 |
| E17 Corner (inverted - internal area greater than external area) | 7.6200 | -0.0900 | -0.6858 |
| R1 Head of roof window | 1.6200 | 0.0800 | 0.1296 |
| R2 Sill of roof window | 1.6200 | 0.0600 | 0.0972 |
| R3 Jamb of roof window | 1.8000 | 0.0800 | 0.1440 |
| R4 Ridge (vaulted ceiling) | 16.6400 | 0.0800 | 1.3312 |
| R5 Ridge (inverted) | 6.0800 | 0.0400 | 0.2432 |
| R8 Roof to wall (rafter) | 4.5100 | 0.0600 | 0.2706 |
| R9 Roof to wall (flat ceiling) | 11.4800 | 0.0400 | 0.4592 |

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

Point Thermal bridges

Total fabric heat loss (33) + (36) + (36a) = 136.9029 (37)

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

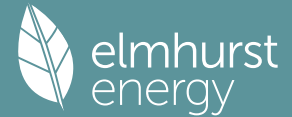
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| (38)m | 121.2879 | 120.8086 | 120.3388 | 118.1322 | 117.7194 | 115.7975 | 115.7975 | 115.4416 | 116.5378 | 117.7194 | 118.5546 | 119.4277 (38) |
| Heat transfer coeff | 258.1909 | 257.7116 | 257.2418 | 255.0352 | 254.6223 | 252.7004 | 252.7004 | 252.3445 | 253.4407 | 254.6223 | 255.4575 | 256.3307 (39) |
| Average = Sum(39)m / 12 = | | | | | | | | | | | | 255.0332 |

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
| HLP | 1.0372 | 1.0352 | 1.0333 | 1.0245 | 1.0228 | 1.0151 | 1.0151 | 1.0137 | 1.0181 | 1.0228 | 1.0262 | 1.0297 (40) |
| HLP (average) | | | | | | | | | | | | 1.0245 |
| Days in mont | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 |

4. Water heating energy requirements (kWh/year)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---|
| Assumed occupancy | | | | | | | | | | | | 3.0656 (42) |
| Hot water usage for mixer showers | 75.6191 | 74.4827 | 72.8267 | 69.6583 | 67.3201 | 64.7126 | 63.2305 | 64.8739 | 66.6754 | 69.4751 | 72.7116 | 75.3294 (42a) |
| Hot water usage for baths | 32.6419 | 32.1571 | 31.4745 | 30.2157 | 29.2732 | 28.2281 | 27.6636 | 28.3415 | 29.0796 | 30.1979 | 31.4826 | 32.5316 (42b) |
| Hot water usage for other uses | 46.0243 | 44.3507 | 42.6771 | 41.0035 | 39.3299 | 37.6563 | 37.6563 | 39.3299 | 41.0035 | 42.6771 | 44.3507 | 46.0243 (42c) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 141.8228 (43) |
| Daily hot water use | 154.2853 | 150.9905 | 146.9783 | 140.8776 | 135.9232 | 130.5970 | 128.5504 | 132.5453 | 136.7585 | 142.3501 | 148.5448 | 153.8853 (44) |
| Energy conte | 244.3503 | 215.0085 | 225.9002 | 192.8543 | 182.9788 | 160.5842 | 155.4705 | 164.1188 | 168.6369 | 193.1678 | 211.6294 | 240.9471 (45) |
| Energy content (annual) | | | | | | | | | | | | Total = Sum(45)m = 2355.6468 |
| Distribution loss (46)m = 0.15 x (45)m | 36.6525 | 32.2513 | 33.8850 | 28.9282 | 27.4468 | 24.0876 | 23.3206 | 24.6178 | 25.2955 | 28.9752 | 31.7444 | 36.1421 (46) |
| Water storage loss: | | | | | | | | | | | | |
| Store volume | | | | | | | | | | | | 210.0000 (47) |
| a) If manufacturer declared loss factor is known (kWh/day): | | | | | | | | | | | | 1.7016 (48) |
| Temperature factor from Table 2b | | | | | | | | | | | | 0.5400 (49) |
| Enter (49) or (54) in (55) | | | | | | | | | | | | 0.9188 (55) |
| Total storage loss | 28.4842 | 25.7277 | 28.4842 | 27.5653 | 28.4842 | 27.5653 | 28.4842 | 28.4842 | 27.5653 | 28.4842 | 27.5653 | 28.4842 (56) |
| If cylinder contains dedicated solar storage | 28.4842 | 25.7277 | 28.4842 | 27.5653 | 28.4842 | 27.5653 | 28.4842 | 28.4842 | 27.5653 | 28.4842 | 27.5653 | 28.4842 (57) |
| Primary loss | 23.2624 | 21.0112 | 23.2624 | 22.5120 | 23.2624 | 22.5120 | 23.2624 | 23.2624 | 22.5120 | 23.2624 | 22.5120 | 23.2624 (59) |
| Combi loss | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (61) |
| Total heat required for water heating calculated for each month | 296.0969 | 261.7474 | 277.6467 | 242.9317 | 234.7254 | 210.6616 | 207.2171 | 215.8654 | 218.7143 | 244.9144 | 261.7067 | 292.6937 (62) |
| WWHRS | -34.5699 | -30.5739 | -32.0152 | -26.5099 | -24.7063 | -21.1413 | -19.8166 | -21.0730 | -21.8736 | -25.7866 | -29.2131 | -33.9297 (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 | 261.5270 | 231.1735 | 245.6315 | 216.4218 | 210.0191 | 189.5203 | 187.4005 | 194.7924 | 196.8407 | 219.1278 | 232.4936 | 258.7640 (64) |
| Total per year (kWh/year) | | | | | | | | | | | | Total per year (kWh/year) = Sum(64)m = 2643.7121 (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 | | | | | | | | | | | | |

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122.6437 108.8814 116.5091 104.1859 102.2377 93.4561 93.0912 95.9668 96.1337 105.6256 110.4286 121.5122 (65)

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

Metabolic gains (Table 5), Watts

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
| (66)m | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 | 153.2776 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 220.0179 | 243.5913 | 220.0179 | 227.3519 | 220.0179 | 227.3519 | 220.0179 | 220.0179 | 227.3519 | 220.0179 | 227.3519 | 220.0179 (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 415.4652 | 419.7765 | 408.9123 | 385.7838 | 356.5882 | 329.1485 | 310.8171 | 306.5058 | 317.3700 | 340.4985 | 369.6941 | 397.1338 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 | 38.3278 (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) | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 | -122.6221 (71) |
| Water heating gains (Table 5) | 164.8437 | 162.0259 | 156.5982 | 144.7027 | 137.4163 | 129.8002 | 125.1226 | 128.9876 | 133.5190 | 141.9698 | 153.3731 | 163.3228 (72) |
| Total internal gains | 872.3102 | 897.3769 | 857.5117 | 829.8216 | 786.0057 | 755.2838 | 724.9409 | 724.4946 | 747.2241 | 774.4695 | 822.4023 | 852.4579 (73) |

6. Solar gains

| [Jan] | Area m ² | Solar flux Table 6a W/m ² | Specific data or Table 6b | g | Specific data or Table 6c | FF | Access factor Table 6d | Gains W | | | | |
|-------------|------------------------|--|------------------------------|-----------|------------------------------|-----------|------------------------------|------------|-----------|-----------|-----------|----------------|
| East | 11.3800 | 19.6403 | 0.6300 | 0.7000 | 0.7700 | 0.7700 | 68.3064 (76) | | | | | |
| South | 4.6400 | 46.7521 | 0.6300 | 0.7000 | 0.7700 | 0.7700 | 66.2965 (78) | | | | | |
| West | 20.8100 | 19.6403 | 0.6300 | 0.7000 | 0.7700 | 0.7700 | 124.9083 (80) | | | | | |
| West | 1.4600 | 26.2379 | 0.6300 | 0.7000 | 1.0000 | 1.0000 | 15.2042 (82) | | | | | |
| Solar gains | 274.7154 | 517.0647 | 813.0035 | 1143.4891 | 1375.5682 | 1399.4285 | 1335.7096 | 1162.6097 | 930.2024 | 602.3307 | 338.5961 | 228.5920 (83) |
| Total gains | 1147.0256 | 1414.4417 | 1670.5152 | 1973.3107 | 2161.5739 | 2154.7123 | 2060.6505 | 1887.1043 | 1677.4265 | 1376.8003 | 1160.9985 | 1081.0499 (84) |

7. Mean internal temperature (heating season)

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Utilisation factor for gains for living area, nil,m (see Table 9a) | | | | | | | | | | | | |
| tau | 43.6731 | 43.7543 | 43.8343 | 44.2135 | 44.2852 | 44.6220 | 44.6220 | 44.6850 | 44.4917 | 44.2852 | 44.1404 | 43.9901 |
| alpha | 3.9115 | 3.9170 | 3.9223 | 3.9476 | 3.9523 | 3.9748 | 3.9748 | 3.9790 | 3.9661 | 3.9523 | 3.9427 | 3.9327 |
| util living area | 0.9959 | 0.9902 | 0.9759 | 0.9307 | 0.8327 | 0.6718 | 0.5171 | 0.5775 | 0.8149 | 0.9623 | 0.9918 | 0.9967 (86) |
| MIT | 19.0628 | 19.3193 | 19.7154 | 20.2339 | 20.6516 | 20.8957 | 20.9716 | 20.9564 | 20.7655 | 20.1883 | 19.5293 | 19.0227 (87) |
| Th 2 | 20.0525 | 20.0541 | 20.0556 | 20.0630 | 20.0644 | 20.0708 | 20.0708 | 20.0720 | 20.0683 | 20.0644 | 20.0616 | 20.0587 (88) |
| util rest of house | 0.9949 | 0.9880 | 0.9701 | 0.9137 | 0.7921 | 0.5973 | 0.4173 | 0.4758 | 0.7554 | 0.9500 | 0.9895 | 0.9960 (89) |
| MIT 2 | 17.7577 | 18.0862 | 18.5904 | 19.2416 | 19.7357 | 19.9955 | 20.0572 | 20.0493 | 19.8748 | 19.1969 | 18.3609 | 17.7104 (90) |
| Living area fraction | 17.9035 | 18.2239 | 18.7161 | 19.3524 | 19.8380 | 20.0961 | 20.1594 | 20.1507 | 19.9743 | 19.3077 | 18.4914 | 17.8570 (92) |
| Temperature adjustment | | | | | | | | | | | | 0.0000 |
| adjusted MIT | 17.9035 | 18.2239 | 18.7161 | 19.3524 | 19.8380 | 20.0961 | 20.1594 | 20.1507 | 19.9743 | 19.3077 | 18.4914 | 17.8570 (93) |

8. Space heating requirement

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|-----------|-----------|-----------|----------------------------|
| Utilisation | 0.9915 | 0.9815 | 0.9589 | 0.8977 | 0.7809 | 0.5995 | 0.4272 | 0.4850 | 0.7484 | 0.9363 | 0.9838 | 0.9932 (94) |
| Useful gains | 1137.2855 | 1388.3285 | 1601.8209 | 1771.3520 | 1687.9060 | 1291.7821 | 880.3636 | 915.1664 | 1255.4426 | 1289.1445 | 1142.1624 | 1073.6729 (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 | 3512.3066 | 3433.7327 | 3142.4862 | 2665.7419 | 2072.1148 | 1388.8626 | 899.4598 | 946.4608 | 1488.7861 | 2217.1697 | 2910.0284 | 3500.7192 (97) |
| Space heating kWh | 1767.0157 | 1374.5116 | 1146.2549 | 643.9607 | 285.8513 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 690.4508 | 1272.8635 | 1805.7225 (98a) |
| Space heating requirement - total per year (kWh/year) | | | | | | | | | | | | 8986.6310 |
| 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 | 1767.0157 | 1374.5116 | 1146.2549 | 643.9607 | 285.8513 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 690.4508 | 1272.8635 | 1805.7225 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) | | | | | | | | | | | | 8986.6310 |
| Space heating per m ² | | | | | | | | | | | | (98c) / (4) = 36.0996 (99) |

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|-----------|-----------|-----------|----------|----------|--------|--------|--------|--------|----------|-----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11) | | | | | | | | | | | | 0.0000 (201) |
| Fraction of space heat from main system(s) | | | | | | | | | | | | 1.0000 (202) |
| Efficiency of main space heating system 1 (in %) | | | | | | | | | | | | 92.3000 (206) |
| Efficiency of main space heating system 2 (in %) | | | | | | | | | | | | 0.0000 (207) |
| Efficiency of secondary/supplementary heating system, % | | | | | | | | | | | | 0.0000 (208) |
| Space heating requirement | 1767.0157 | 1374.5116 | 1146.2549 | 643.9607 | 285.8513 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 690.4508 | 1272.8635 | 1805.7225 (98) |
| Space heating efficiency (main heating system 1) | 92.3000 | 92.3000 | 92.3000 | 92.3000 | 92.3000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 92.3000 | 92.3000 | 92.3000 (210) |
| Space heating fuel (main heating system) | 1914.4265 | 1489.1783 | 1241.8797 | 697.6822 | 309.6981 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 748.0507 | 1379.0504 | 1956.3624 (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) | | | | | | | | | | | | |

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| | | | | | | | | | | | | | | |
|--|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|------------|--------|
| | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (215) |
| Water heating | | | | | | | | | | | | | | |
| Water heating requirement | 261.5270 | 231.1735 | 245.6315 | 216.4218 | 210.0191 | 189.5203 | 187.4005 | 194.7924 | 196.8407 | 219.1278 | 232.4936 | 258.7640 | 258.7640 | (64) |
| Efficiency of water heater | | | | | | | | | | | | | | (216) |
| (217)m | 87.5273 | 87.3812 | 87.0671 | 86.3503 | 84.7516 | 79.8000 | 79.8000 | 79.8000 | 79.8000 | 86.4511 | 87.2797 | 87.5622 | 87.5622 | (217) |
| Fuel for water heating, kWh/month | 298.7946 | 264.5576 | 282.1175 | 250.6324 | 247.8054 | 237.4941 | 234.8377 | 244.1007 | 246.6675 | 253.4703 | 266.3776 | 295.5202 | 295.5202 | (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 | 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 | 7.3041 | (231) |
| Lighting | 45.7154 | 36.6746 | 33.0214 | 24.1929 | 18.6873 | 15.2677 | 17.0472 | 22.1585 | 28.7818 | 37.7632 | 42.6535 | 46.9860 | 46.9860 | (232) |
| Electricity generated by PVs (Appendix M) (negative quantity) | | | | | | | | | | | | | | |
| (233a)m | -104.0023 | -138.2962 | -187.4947 | -198.2533 | -203.4904 | -186.0373 | -183.3632 | -177.7552 | -166.9259 | -151.5256 | -111.1636 | -90.8903 | -90.8903 | (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity) | | | | | | | | | | | | | | |
| (234a)m | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (234a) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) | | | | | | | | | | | | | | |
| (235a)m | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (235a) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | | | | | | | | | | | | | | |
| (235c)m | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (235c) |
| Electricity generated by PVs (Appendix M) (negative quantity) | | | | | | | | | | | | | | |
| (233b)m | -86.9729 | -178.7850 | -348.1018 | -512.8549 | -669.0009 | -669.2356 | -661.6782 | -564.6238 | -419.5636 | -252.6348 | -115.0484 | -69.1317 | -69.1317 | (233b) |
| Electricity generated by wind turbines (Appendix M) (negative quantity) | | | | | | | | | | | | | | |
| (234b)m | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (234b) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) | | | | | | | | | | | | | | |
| (235b)m | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (235b) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | | | | | | | | | | | | | | |
| (235d)m | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (235d) |
| Annual totals kWh/year | | | | | | | | | | | | | | |
| Space heating fuel - main system 1 | | | | | | | | | | | | | 9736.3283 | (211) |
| Space heating fuel - main system 2 | | | | | | | | | | | | | 0.0000 | (213) |
| Space heating fuel - secondary | | | | | | | | | | | | | 0.0000 | (215) |
| Efficiency of water heater | | | | | | | | | | | | | 79.8000 | |
| Water heating fuel used | | | | | | | | | | | | | 3122.3755 | (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) | | | | | | | | | | | | | 368.9493 | (232) |
| Energy saving/generation technologies (Appendices M ,N and Q) | | | | | | | | | | | | | | |
| PV generation | | | | | | | | | | | | | -6446.8295 | (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 | | | | | | | | | | | | | 6866.8236 | (238) |

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 | 9736.3283 | 0.2100 | 2044.6289 (261) |
| Total CO2 associated with community systems | | | 0.0000 (373) |
| Water heating (other fuel) | 3122.3755 | 0.2100 | 655.6989 (264) |
| Space and water heating | | | 2700.3278 (265) |
| Pumps, fans and electric keep-hot | 86.0000 | 0.1387 | 11.9293 (267) |
| Energy for lighting | 368.9493 | 0.1443 | 53.2508 (268) |
| Energy saving/generation technologies | | | |
| PV Unit electricity used in dwelling | -1899.1980 | 0.1359 | -258.1371 |
| PV Unit electricity exported | -4547.6315 | 0.1265 | -575.1027 |
| Total | | | -833.2397 (269) |
| Total CO2, kg/year | | | 1932.2681 (272) |
| EPC Target Carbon Dioxide Emission Rate (TER) | | | 7.7600 (273) |

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

| | Energy kWh/year | Primary energy factor kg CO2/kWh | Primary energy kWh/year |
|---|-----------------|----------------------------------|-------------------------|
| Space heating - main system 1 | 9736.3283 | 1.1300 | 11002.0510 (275) |
| Total CO2 associated with community systems | | | 0.0000 (473) |
| Water heating (other fuel) | 3122.3755 | 1.1300 | 3528.2843 (278) |
| Space and water heating | | | 14530.3353 (279) |
| Pumps, fans and electric keep-hot | 86.0000 | 1.5128 | 130.1008 (281) |
| Energy for lighting | 368.9493 | 1.5338 | 565.9068 (282) |
| Energy saving/generation technologies | | | |
| PV Unit electricity used in dwelling | -1899.1980 | 1.5024 | -2853.3681 |
| PV Unit electricity exported | -4547.6315 | 0.4642 | -2111.1322 |
| Total | | | -4964.5003 (283) |
| Total Primary energy kWh/year | | | 10261.8425 (286) |
| Target Primary Energy Rate (TPER) | | | 41.2200 (287) |