



Development at 236 Henvy Road, Newquay, Cornwall TR7 3EM

Energy Statement

For

Keith Parker Architects

11<sup>th</sup> October 2023

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Low Carbon Consultants have the expertise and necessary qualifications to offer advice in a professional capacity on matters relating to Part L of the Building Regulations and sustainability within the construction sector.

This document contains the following information:

- Energy Statement, SAP Calculations

**Project Ref:** 304391 **Report Date:** 11/10/2023

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## 1. Executive Summary

### 1.1 Overview

The Energy Statement provides a clear assessment of the proposed development's overall energy requirements and subsequent CO<sub>2</sub> emissions.

In formulating designed energy and carbon emissions Elmhurst's SAP10 software has been used to calculate the estimated CO<sub>2</sub> reductions.

The Energy Strategy provides information on proposed energy efficiency measures and other carbon reductions. It also provides a summary of proposed major fabric building materials, waste management and water management. It considers how the development maintains a balance of environmental, economic, and social issues. Steps taken to promote an effective energy hierarchy are detailed.

### 1.2 Key Findings

The Energy Statement concludes that a net zero in carbon emissions can be provided from on-site renewable energy and energy efficient measures. To demonstrate this an efficient ASHP has been proposed with low U values and 10.70 kWp of total Solar PV for flat 1 and 2. The SAP calculations suggest that this will be more than sufficient to meet the necessary requirements.

#### Building Regulations England Part L (BREL) Compliance Report

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

Date: Wed 11 Oct 2023 14:17:39

Project Information			
Assessed By	Kyle Jones	Building Type	Flat, Semi-detached
OCDEA Registration	EES/027281	Assessment Date	2023-10-11

Dwelling Details			
Assessment Type	As designed	Total Floor Area	93 m <sup>2</sup>
Site Reference	709914_Flat 1	Plot Reference	709914_Flat 1
Address	Block 3 236 Henvor Road, Newquay, TR7 3EM		

Client Details	
Name	Keith Parker
Company	Keith Parker Architects
Address	Block 3, 236 Henvor Road, Cornwall, Newquay, TR7 3EM

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

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	7.34 kgCO <sub>2</sub> /m <sup>2</sup>	
Dwelling carbon dioxide emission rate	-0.17 kgCO <sub>2</sub> /m <sup>2</sup>	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	39.56 kWh <sub>pe</sub> /m <sup>2</sup>	
Dwelling primary energy	-3.97 kWh <sub>pe</sub> /m <sup>2</sup>	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	35.9 kWh/m <sup>2</sup>	
Dwelling fabric energy efficiency	34.3 kWh/m <sup>2</sup>	OK

#### Building Regulations England Part L (BREL) Compliance Report

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

Date: Wed 11 Oct 2023 14:17:14

Project Information			
Assessed By	Kyle Jones	Building Type	Flat, Semi-detached
OCDEA Registration	EES/027281	Assessment Date	2023-10-11

Dwelling Details			
Assessment Type	As designed	Total Floor Area	75 m <sup>2</sup>
Site Reference	709914_Flat 2	Plot Reference	709914_Flat 2
Address	Block 3 236 Henvor Road, Newquay, TR7 3EM		

Client Details	
Name	Keith Parker
Company	Keith Parker Architects
Address	Block 3, 236 Henvor Road, Cornwall, Newquay, TR7 3EM

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

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	10.07 kgCO <sub>2</sub> /m <sup>2</sup>	
Dwelling carbon dioxide emission rate	-0.43 kgCO <sub>2</sub> /m <sup>2</sup>	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	53.95 kWh <sub>pe</sub> /m <sup>2</sup>	
Dwelling primary energy	-7.17 kWh <sub>pe</sub> /m <sup>2</sup>	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	43.6 kWh/m <sup>2</sup>	
Dwelling fabric energy efficiency	41.9 kWh/m <sup>2</sup>	OK

RESULTS

SAP Rating:	102 A	CO2 Emission:	-0.08 t/yr	DER:	-0.17 kgCO <sub>2</sub> /yr/m <sup>2</sup>	TER:	7.34 kgCO <sub>2</sub> /yr/m <sup>2</sup>
% DER-TER:	102.32%	Compliance Check:	See BREL	E.I Rating:	100 A	DPER:	-3.97 kWh/m <sup>2</sup> /yr
TPER:	39.56 kWh/m <sup>2</sup> /yr	DPER-TPER:	110.04 %	DFEE:	34.27 kWh/m <sup>2</sup> /yr	TFEE:	35.85 kWh/m <sup>2</sup> /yr
DFEE-TFEE:	4.42 %						

RESULTS

SAP Rating:	104 A	CO2 Emission:	-0.09 t/yr	DER:	-0.43 kgCO <sub>2</sub> /yr/m <sup>2</sup>	TER:	10.07 kgCO <sub>2</sub> /yr/m <sup>2</sup>
% DER-TER:	104.27%	Compliance Check:	See BREL	E.I Rating:	100 A	DPER:	-7.17 kWh/m <sup>2</sup> /yr
TPER:	53.95 kWh/m <sup>2</sup> /yr	DPER-TPER:	113.29 %	DFEE:	41.9 kWh/m <sup>2</sup> /yr	TFEE:	43.63 kWh/m <sup>2</sup> /yr
DFEE-TFEE:	3.97 %						

### 1.3 DER/TER Comparison

	Flat 1	Flat 2
TER (Target Emission Rate)	7.34	10.07
DER (Dwelling Emission Rate)	-0.17	-0.43
% Reduction	102.32	104.27

## 2. Introduction

### 2.1 Background

This Statement has been prepared by Melin Consultants considering *Cornwall Council's Local Plan (2010 – 2030)*.

It is intended to provide a clear and straightforward assessment of the proposed development's energy requirements and subsequent CO<sub>2</sub> emissions.

The *Cornwall Council's Local Plan* requires developments to provide sufficient renewable energy generation and/or energy

efficient measures to reduce the carbon emissions and energy usage.

This Statement assesses expected energy demand at the site, showing how carbon dioxide emissions will be reduced through designing for minimum energy use and installing on-site renewable energy.

### 2.2 Policy Requirements

In writing, this report the following policies and guidance have been adopted.

#### 2.2.1 Cornwall Council's Local Plan (2010 - 2030)

1. To increase use and production of renewable and low carbon energy generation development proposals will be supported that:
  - a. maximise the use of the available resource by deploying installations with the greatest energy output practicable taking into account the provisions of this Plan;
  - b. make use, or offer genuine potential for use, of any waste heat produced; and
  - c. in the case of wind turbines, they are within an area allocated by Neighbourhood Plans for wind power and

- avoid, or adequately mitigate shadow flicker, noise and adverse impact on air traffic operations, radar, and air navigational installations; and
- d. do not have an overshadowing or overbearing effect on nearby habitations.
- e. in the case of solar development, noise, glint, and glare is mitigated adequately.
- 2. Support will be given to renewable and low carbon energy generation developments that:
  - a. are led by, or meet the needs of local communities; and
  - b. create opportunities for co-location of energy producers with energy users, in particular heat, and facilitate renewable and low carbon energy innovation.
- 3. When considering such proposals, regard will be given to the wider benefits of providing energy from renewable sources, as well as the potential effects on the local environment, including any cumulative impact of these proposals.
- 4. In and within the setting of Areas of Outstanding Natural Beauty and undeveloped coast, developments will only be permitted in exceptional circumstances and should generally be very small scale in order that the natural beauty of these areas may be conserved.
- 5. When considering proposals for renewables that impact upon the Area of Outstanding Natural Beauty and its setting and / or the World Heritage Site or other historic assets and their settings, applicants should apply other relevant policies in the Plan.

## 2.2.2 Cornwall Council's Climate Emergency Development Plan (February 2023):

### Policies SEC1 – Sustainable Energy and Construction

Development proposals will be required to demonstrate how they have implemented the principles and requirements set out in the policy below.

#### 1. The Energy Hierarchy

All proposals should embed the Energy Hierarchy within the design of buildings by prioritising fabric first, orientation and landscaping in order to minimise energy demand for heating, lighting, and cooling. All proposals should consider opportunities to provide solar PV and energy storage.

#### 2. A) New Development – Major Non-Residential

Development proposals for major (a floor space of over 1,000m<sup>2</sup>) non-residential development should demonstrate how they achieve BREEAM 'Excellent' or an equivalent or better methodology.

## B) New Development – Residential

Residential development proposals will be required to achieve Net Zero Carbon and submit an 'Energy Statement' that demonstrates how the proposal will achieve:

- Space heating demand less than 30kWh/m<sup>2</sup>/annum;
- Total energy consumption less than 40kWh/m<sup>2</sup>/annum; and
- On-site renewable generation to match the total energy consumption, with a preference for roof mounted solar PV.

Where the use of onsite renewables to match total energy consumption is demonstrated to be not technically feasible (for example with apartments) or economically viable renewable energy generation should be maximised as much as possible; and/or connection made to an existing or proposed low carbon district energy network; or where this is not possible the residual energy (the amount by which total energy demand exceeds the renewable energy generation) is to be offset by a contribution to Cornwall Council's Offset Fund.

Where economic viability or technical constraints prevent policy compliance, proposals should first and foremost strive to meet the space heating and total energy consumption thresholds. Proposals must then benefit as much as possible from renewable energy generation and/or connection to an existing or proposed low carbon district energy network. As a last resort, any residual energy

is to be offset by a contribution to Cornwall Council's Offset Fund, as far as economic viability allows.

While this policy does not require the application of these standards to reserved matters applications that relate to outline planning permissions that predate the adoption of this climate Emergency DPD, developers are encouraged to apply these standards on a voluntary basis, where it is feasible to do so and not within breach of existing permissions.

## 3. Site Analysis

### 3.1 Location

The proposed development is located at 236 Herver Road, Newquay, Cornwall. Figure 1 below highlights the area of the development.

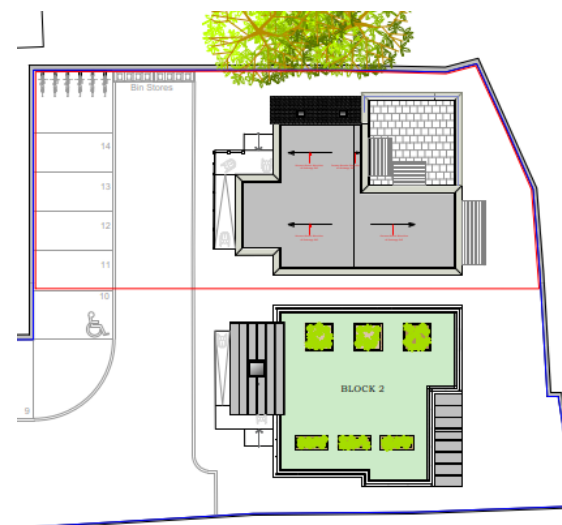
Figure 1 - Map highlighting the location of the site and its surroundings.



The closest train station is Newquay Station, which is approximately 1.5 miles from the development site by road. This train station provides services to Par. Additionally, Redruth train station is 16.6 miles from the site and provides services to Penzance, Cardiff Central, Plymouth & London Paddington.

There is a bus stop located at St Columb Minor, approximately 0.2 miles from the development and provides further links nearby.

### 3.2 The Development



The proposed development will consist of the construction of a new 2 flat building.

Figure 2: Proposed site plan



## 4. Energy Efficient Design Measures

To supplement Cornwall Council's requirements for sustainable construction the design team have considered the three issues that contribute to the proposed developments overall sustainability. These are environmental, economic, and social.

### 4.1 Solar/Daylighting

The proposed development will make good use of glazing to all elevations to help reduce internal lighting loads.

### 4.2 Lighting

It has been assumed within the calculations that all internal lighting will be low energy fittings. To be classified as a low energy light fitting under the Domestic Building Services Guide the fitting must have an efficacy of 75 lumens per circuit watt or higher.

In addition, all external security and safety lighting will be fitted with daylight and movement sensors.

### 4.3 Heating, cooling & DHW strategy

The proposed heating and domestic hot water strategy is likely to be from an efficient air source heat pump with an efficiency of at least 390% along with a 250L hot water cylinder and has therefore been used for the purposes of this report.

### 4.4 Ventilation strategy

A mechanical ventilation with heat recovery system has been specified to provide ventilation for the whole dwelling.

### 4.5 Water use

In order to meet Building Regulations requirements, water usage must not exceed 110 Litres/person/day in line with Enhanced Building Regulations Part G criteria. To achieve this the following fittings will be required:

- WCs – dual flush 4 (full flush), 2.6 (part flush)
- Kitchen taps – 6 litres per minute
- Basin taps – 6 litres per minute
- Baths – 180 litre capacity
- Showers – 8 litres per minute

### 4.6 Materials

Where possible, it is proposed that construction materials will be purchased from sources that minimise carbon emissions and/or come from sustainable sources. The environmental policy and sustainability policy for each manufacturer shall be carefully considered before orders are placed.

Where possible, timber should be sourced that has Forest Stewardship Council (FSC) or Programme for the Endorsement of

Forest Certification PEFC) certification. This is to ensure that the timber is legally and sustainably sourced.

## 4.7 Energy Efficiency Measures

To reduce the energy demand within the dwelling, low U values, independent psi values and low air permeability figures have been used. The U values we have used are as follows:

- Ground Floor – 0.15 W/m<sup>2</sup>K
- External Wall – 0.14 W/m<sup>2</sup>K
- Roof – 0.15/ 0.11 W/m<sup>2</sup>K
- Glazed Doors - 1.20 W/m<sup>2</sup>K
- Windows – 1.20 W/m<sup>2</sup>K
- Roof-lights – 1.20 W/m<sup>2</sup>K
- Thermal bridging: Reference Psi values obtained from Acceptable Construction Details (ROI) and SAP defaults.
- An air test figure of 3.00 m<sup>3</sup>/h/m<sup>2</sup> at 50Pa has been used.

## 4.8 Reducing surface water run-off

All development shall minimise the impact of surface water runoff from the development in the design of the drainage system, and where possible incorporate mitigation and resilience measures for any increases in river flooding levels as a result of climate change.

## 4.9 Renewable technologies

Several low carbon and renewable technologies have been considered for the proposed scheme.

A summary of the suitability of each technology is listed in the following table.

*Table 3 – Summary of renewable technology*

<b>Solar PV</b>
Solar PV lends itself to the proposed development with minimal obstruction and a significant available installation area. The electricity demand of the proposed building is not going to be significant during period of occupation and a reduction in carbon emissions is achievable by using this technology on its own.
<b>Solar thermal</b>
The proposed development would have low to medium hot water demand which, if sized correctly, lends itself too solar thermal. It is likely that a significant reduction in carbon emissions could be achieved with this system alone as a large area of solar thermal panels would be required to achieve this.
<b>Air source heat pumps</b>
Air source technology is a potential technology that could be used on the proposed development. It would require wall or roof mounted plant which may present visual issues. It is likely that a

significant reduction in carbon emissions could be achieved with this system alone

### **Biomass**

Biomass is a potential technology for the site however, space for fuel storage could be an issue within the development. Biomass boilers do not modulate as well as a conventional fuel boiler and would therefore require a constant heat demand to be sized correctly. It is unlikely that a significant reduction in carbon emissions could be achieved with this system alone

### **Ground source heat pumps**

The energy demand of the proposed development would be suitable for ground source technology. Further investigation would be required into the area required for the external works and whether the Geology of the site is suitable. It is likely that a significant reduction in carbon emissions could be achieved with this system alone

### **Water source heat pump**

The energy demand of the proposed development would be suitable for water source technology. Further investigation would be required into the area required for the external works and whether the Geology of the site is suitable. It is likely that a significant reduction in carbon emissions could be achieved with this system alone

### **Wind**

The estimated wind speed for the location and surrounding obstructions do not lend itself to this technology.

### **CHP**

Low to medium electricity demand makes CHP an unviable option for this development.

## 5. Baseline Energy Demand and CO<sub>2</sub> Emissions

### 5.1 Energy Benchmarks

Energy performance benchmarks for the proposed development are taken from 'Energy efficiency in buildings' CIBSE Guide F (2012) and where appropriate data from relevant design team members and thermal modelling calculations.

To demonstrate how the development has reduced carbon emissions by a prescribed amount, technical calculations (SAP10) provide target CO<sub>2</sub> emissions (TER) for a building that is compliant with Part L 2021 (baseline buildings with conventional gas boiler), followed by a final set of calculations that provide the dwelling CO<sub>2</sub> emissions (DER) for a building with renewable technologies.

### 5.2 Reduction in energy usage through on-site renewable technology and energy efficient measures

Several renewable technologies have been considered for the proposed development (Solar Thermal, Solar PV, Wind, ASHP, GSHP, WSHP, CHP and Biomass). An ASHP has been considered the most appropriate method along with Solar PV.

## 5.3 Regulated Energy

All our calculations have been based on regulated energy, which includes all energy used for space and water heating, electricity for lighting and all other fixed items such as pumps and fans.

## 6. Energy Statement for the Chosen Technology

Based on the information provided in the above report, below is a summary of the savings:

Block 3	CO <sub>2</sub> emissions (kg/m <sup>2</sup> pa)	
	Flat 1	Flat 2
TER (Target Emission Rate)	7.34	10.07
DER (Dwelling Emission Rate)	-0.17	-0.43
Reduction in emissions from the use of renewable sources	7.51	10.5
Percentage reduction from the use of renewable sources	102.32%	104.27%
CO <sub>2</sub> emissions	-0.08 tonnes pa	-0.09 tonnes pa

## 7. Energy Efficiency Measures included in Calculations per dwelling.

Element or System	Part L 2021	Proposed
Wall	0.26	0.14
Roof	0.16	0.15 / 0.11 (Sloped/Flat)
Floor	0.18	0.15
Windows	1.60	1.20
Glazed Doors	1.60	1.20
Roof-lights	2.20	1.20
Permeability	8.00	3.00
Ventilation		MVHR: Vent Axia Sentinel Kinetic Plus BS
Heating System		ASHP feeding underfloor heating & radiators: E.g. Ideal Heating Logic Air 8kW
Water Heating		From main system, 250L cylinder
Secondary Heating		None
Energy efficient lighting	Efficacy = 75lm/W	Power = 10W, Efficacy = 75lm/W
Renewables		Solar PV: Flat 1: 5.2kWp PV and 6 kWh battery capacity Flat 2: 5.5kWp PV and 6 kWh battery capacity. Battery Storage > 11.00 kWh

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## 8. Conclusion

With the inclusion of energy efficient measures including low U values, air test figure in addition to an efficient air source heat pump and 10.70 kWp of Solar Photovoltaic panels., the proposed development can demonstrate a potential to achieve net zero carbon emissions over a Part L Building Regulations 2021 target emissions rate as outlined in the table above.

Appendix A:  
Software Outputs  
& Energy Summary  
Tool Check



## 4 - Climate Emergency DPD SEC 1 Policy Check Summary - SAP



DPD Policy SEC1 Criteria			Total Number of Homes Meeting Target
Space Heating	Total Energy	Renewable Energy	
≤ 30	≤ 40	≥ Total Energy	% Homes Meeting Target
Total Area (NIA m2)			168.4
Renewable Energy Deficit (kWh per year)			-103.7
Average (kWh/m2/year):			Site Totals (kWh/year):

1) Space Heating Demand	2) Total Energy Use	3) Renewable Generation
2	2	2
2	2	2
100.0%	100.0%	100.0%
21.6	36.3	37.0
3642.5	6120.1	6223.8

Instructions: This page provides a summary of the key SAP inputs and estimated performance against Climate Emergency DPD Policy SEC1 part 2b. This page is to be included with the Energy Statement submitted for planning permission.

Development location: 0

Red = CE DPD Policy SEC1 threshold not met

Key information				Dwelling Elemental Checks						1) Space Heating Demand	2) Total Energy Use	3) Renewable Generation
Unit Identifier	Number of identical units	Total area (NIA m2)	Part L Improvement (DER / TER)	Air permeability (m3/m2.hr at 50Pa)	Average External Wall U-value (W/m2.K)	Average Roof U-value (W/m2.K)	Average Ground Floor U-value (W/m2.K)	Average Window U-value (W/m2.K)	Ventilation System Type	Predicted. Space Heating Demand (kWh/m2/year)	Predicted Total Energy Use (kWh/m2/year)	Predicted Renewable Generation (kWh/m2/year)
Flat 1	1	93	102%	3	0.14	0.11	0.15	1.2	Balanced with heat recovery	19.3	33.5	33.8
Flat 2	1	75.4	104%	3	0.14	0.11	0	1.2	Balanced with heat recovery	24.6	39.8	40.8

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Client Details	
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Dwelling carbon dioxide emission rate	-0.17 kgCO <sub>2</sub> /m <sup>2</sup>		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	39.56 kWh <sub>PE</sub> /m <sup>2</sup>		
Dwelling primary energy	-3.97 kWh <sub>PE</sub> /m <sup>2</sup>		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	35.9 kWh/m <sup>2</sup>		
Dwelling fabric energy efficiency	34.3 kWh/m <sup>2</sup>		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m <sup>2</sup> K]	Dwelling average U-Value [W/m <sup>2</sup> K]	Element with highest individual U-Value	
External walls	0.26	0.14	Walls (1) (0.14)	OK
Party walls	0.2	0	Party Wall (1) (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	0.15	Ground Floor (0.15)	OK
Roofs	0.16	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	1.6	1.2	NE (1.2)	OK
Rooflights	2.2	N/A	N/A	N/A

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	Net area [m <sup>2</sup> ]	U-Value [W/m <sup>2</sup> K]
Exposed wall: Walls (1)	58.39	0.14 (!)
Party wall: Party Wall (1)	11.2	0 (!)
Ground floor: Ground Floor, Ground Floor	93	0.15
Exposed roof: Roof (1)	19.2	0.11

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m <sup>2</sup> ]	Orientation	Frame factor	U-Value [W/m <sup>2</sup> K]
NE, Window	2.94	North East	0.7	1.2
SW, Window	7.72	South West	0.7	1.2
SW, Glazed Door	7.28	South West	0.7	1.2
SE, Window	0.64	South East	0.7	1.2
NW, Window	3.07	North West	0.7	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Not government-approved scheme	0.004 (!)	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E3: Sill	Not government-approved scheme	0.015 (!)	
External wall	E4: Jamb	Not government-approved scheme	0.026 (!)	
External wall	E5: Ground floor (normal)	Not government-approved scheme	0.072	
External wall	E7: Party floor between dwellings (in blocks of flats)	SAP table default	0.28	
External wall	E14: Flat roof	Not government-approved scheme	0.039 (!)	
External wall	E16: Corner (normal)	Not government-approved scheme	0.032 (!)	
Party wall	P2: Intermediate floor within a dwelling	SAP table default	0 (!)	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	SAP table default	0 (!)	
Party wall	P1: Ground floor	SAP table default	0.32	

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

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

### 4 Space heating

#### Main heating system 1: Heat pump with radiators or underfloor heating - Electricity

Efficiency	396.6%
Emitter type	Radiators
Flow temperature	35°C
System type	Heat Pump
Manufacturer	Atlantic
Model	Logic Air 8kW
Commissioning	

#### Secondary heating system: N/A

Fuel	N/A
Efficiency	N/A
Commissioning	

### 5 Hot water

#### Cylinder/store - type: Cylinder

Capacity	250 litres
Declared heat loss	1.99 kWh/day
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	

#### Waste water heat recovery system 1 - type: N/A

Efficiency	
Manufacturer	
Model	

### 6 Controls

#### Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services

Function	
Ecodesign class	
Manufacturer	
Model	

#### Water heating - type: Cylinder thermostat and HW separately timed

Manufacturer	
Model	

### 7 Lighting

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

8 Mechanical ventilation		
<b>System type:</b> Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	1.5 W/(l/s)	
Specific fan power	0.55 W/(l/s)	OK
Minimum permitted heat recovery efficiency	73%	
Heat recovery efficiency	92%	OK
Manufacturer/Model	Sentinel Kinetic Plus B	
Commissioning		
9 Local generation		
Technology type: <b>Photovoltaic system (1)</b>		
Peak power	5.2 kWp	
Orientation	South West	
Pitch	30°	
Overshading	1 (overshading factor calculated according to MCS)	
Manufacturer		
MCS certificate		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
a. Assessor Declaration		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed:	Assessor ID:	
Name:	Date:	
b. Client Declaration		
N/A		

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Property Reference	709914_Flat 1		Issued on Date	11/10/2023	
Assessment Reference	709914_Flat 1	Prop Type Ref	709914_Flat 1		
Property	Block 3, 236 Henver Road, Newquay, Cornwall, TR7 3EM				
SAP Rating	102 A	DER	-0.17	TER	7.34
Environmental	100 A	% DER < TER			102.32
CO <sub>2</sub> Emissions (t/year)	-0.08	DFEE	34.27	TFEE	35.85
Compliance Check	See BREL	% DFEE < TFEE			4.42
% DPER < TPER	110.04	DPER	-3.97	TPER	39.56
Assessor Details	Mr. Kyle Jones			Assessor ID	AV53-0001
Client	709914, Keith Parker				

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 <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	93.0000 (1b)	2.3000 (2b)	213.9000 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0000		213.9000 (5)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 213.9000 (5)

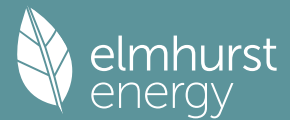
## 2. Ventilation rate

	m <sup>3</sup> per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500 (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	Jan 1.2750, Feb 1.2500, Mar 1.2250, Apr 1.1000, May 1.0750, Jun 0.9500, Jul 0.9500, Aug 0.9250, Sep 1.0000, Oct 1.0750, Nov 1.1250, Dec 1.1750	(22a)
Adj infilt rate	Jan 0.1912, Feb 0.1875, Mar 0.1837, Apr 0.1650, May 0.1612, Jun 0.1425, Jul 0.1425, Aug 0.1388, Sep 0.1500, Oct 0.1612, Nov 0.1687, Dec 0.1762	(22b)
Balanced mechanical ventilation with heat recovery		0.5000 (23a)
If mechanical ventilation		0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		82.8000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		
Effective ac	Jan 0.2772, Feb 0.2735, Mar 0.2698, Apr 0.2510, May 0.2472, Jun 0.2285, Jul 0.2285, Aug 0.2248, Sep 0.2360, Oct 0.2472, Nov 0.2548, Dec 0.2622	(25)

## 3. Heat losses and heat loss parameter

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value KJ/m <sup>2</sup> K	A x K kJ/K
Window (Uw = 1.20)			14.3700	1.1450	16.4542		(27)
Glazed Door (Uw = 1.20)			7.2800	1.1450	8.3359		(27)
Ground Floor			93.0000	0.1500	13.9500	75.0000	6975.0000 (28a)

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External Wall	80.0400	21.6500	58.3900	0.1400	8.1746	70.0000	4087.3000 (29a)
External Flat Roof	19.2000		19.2000	0.1100	2.1120	9.0000	172.8000 (30)
Total net area of external elements Aum(A, m2)			192.2400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.0267		(33)
Party Wall 11.20			11.2000	0.0000	0.0000	70.0000	784.0000 (32)
Party Ceiling			73.8000			30.0000	2214.0000 (32b)
Internal Wall			190.6500			9.0000	1715.8500 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 15948.9500 (34)  
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 171.4941 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	15.5500	0.0040	0.0622
E2 Other lintels (including other steel lintels)	8.3500	0.0150	0.1253
E3 Sill	26.9600	0.0260	0.7010
E4 Jamb	34.8000	0.0720	2.5056
E5 Ground floor (normal)	40.9200	0.2800	11.4576
E7 Party floor between dwellings (in blocks of flats)	16.8000	0.0390	0.6552
E14 Flat roof	11.5000	0.0320	0.3680
E16 Corner (normal)	4.8600	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	4.8600	0.0000	0.0000
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	4.8600	0.0000	0.0000
P1 Party wall - Ground floor	4.8600	0.3200	1.5552

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 17.4300 (36)  
 Point Thermal bridges 0.0000 (36a) =  
 Total fabric heat loss (33) + (36) + (36a) = 66.4567 (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	19.5702	19.3055	19.0408	17.7173	17.4526	16.1291	16.1291	15.8644	16.6585	17.4526	17.9820	18.5114 (38)
Heat transfer coeff	86.0269	85.7622	85.4975	84.1740	83.9093	82.5858	82.5858	82.3211	83.1152	83.9093	84.4387	84.9681 (39)
Average = Sum(39)m / 12 =												84.1078
HLP	0.9250	0.9222	0.9193	0.9051	0.9023	0.8880	0.8880	0.8852	0.8937	0.9023	0.9079	0.9136 (40)
HLP (average)												0.9044
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

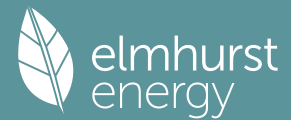
4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.6646 (42)
Hot water usage for mixer showers	103.3445	101.7914	99.5283	95.1982	92.0027	88.4391	86.4136	88.6596	91.1216	94.9478	99.3709	102.9485 (42a)
Hot water usage for baths	29.7509	29.3090	28.6868	27.5396	26.6806	25.7280	25.2135	25.8314	26.5041	27.5233	28.6942	29.6503 (42b)
Hot water usage for other uses	41.9181	40.3938	38.8695	37.3453	35.8210	34.2967	34.2967	35.8210	37.3453	38.8695	40.3938	41.9181 (42c)
Average daily hot water use (litres/day)												160.9713 (43)
Daily hot water use	175.0135	171.4943	167.0846	160.0830	154.5042	148.4638	145.9238	150.3119	154.9710	161.3407	168.4589	174.5169 (44)
Energy conte	277.1786	244.2056	256.8029	219.1457	207.9924	182.5536	176.4821	186.1175	191.0947	218.9378	240.0006	273.2514 (45)
Energy content (annual)												Total = Sum(45)m = 2673.7628
Distribution loss (46)m = 0.15 x (45)m	41.5768	36.6308	38.5204	32.8719	31.1989	27.3830	26.4723	27.9176	28.6642	32.8407	36.0001	40.9877 (46)
Water storage loss:												250.0000 (47)
Store volume												1.9900 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												1.0746 (55)
Enter (49) or (54) in (55)												
Total storage loss	33.3126	30.0888	33.3126	32.2380	33.3126	32.2380	33.3126	33.3126	32.2380	33.3126	32.2380	33.3126 (56)
If cylinder contains dedicated solar storage	33.3126	30.0888	33.3126	32.2380	33.3126	32.2380	33.3126	33.3126	32.2380	33.3126	32.2380	33.3126 (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	333.7536	295.3056	313.3779	273.8957	264.5674	237.3036	233.0571	242.6925	245.8447	275.5128	294.7506	329.8264 (62)
MWHR	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	333.7536	295.3056	313.3779	273.8957	264.5674	237.3036	233.0571	242.6925	245.8447	275.5128	294.7506	329.8264 (64)
12Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m = 3339.8878 (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	137.4219	122.0783	130.6470	116.6659	114.4175	104.4991	103.9403	107.1441	107.3390	118.0568	123.6002	136.1161 (65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Metabolic gains (Table 5), Watts	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299 (66)

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Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	123.3171	136.5297	123.3171	127.4277	123.3171	127.4277	123.3171	127.4277	123.3171	127.4277	123.3171	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.4900	247.0270	240.6338	227.0233	209.8424	193.6949	182.9074	180.3703	186.7636	200.3741	217.5549	233.7024 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	(71)
Water heating gains (Table 5)	184.7068	181.6642	175.6007	162.0360	153.7869	145.1376	139.7047	144.0109	149.0819	158.6785	171.6670	182.9517 (72)
Total internal gains	615.4829	628.1898	602.5206	579.4559	549.9154	529.2291	508.8982	510.6673	526.2421	545.3387	579.6185	602.9402 (73)

## 6. Solar gains

[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						
Northeast	2.9400	11.2829	0.7600	0.7000	0.7700	12.2297 (75)						
Southeast	0.6400	36.7938	0.7600	0.7000	0.7700	8.6816 (77)						
Southwest	7.7200	36.7938	0.7600	0.7000	0.7700	104.7218 (79)						
Northwest	3.0700	11.2829	0.7600	0.7000	0.7700	12.7704 (81)						
Southwest	7.2800	36.7938	0.7600	0.7000	0.7700	98.7532 (79)						
Solar gains	237.1567	412.2697	586.1423	763.2296	888.6261	897.0434	858.6684	762.8478	647.1123	461.5930	285.5714	201.9782 (83)
Total gains	852.6396	1040.4595	1188.6629	1342.6855	1438.5415	1426.2725	1367.5666	1273.5150	1173.3545	1006.9316	865.1899	804.9184 (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, n <sub>l,m</sub> (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	51.4986	51.6575	51.8174	52.6322	52.7982	53.6444	53.6444	53.8169	53.3027	52.7982	52.4672	52.1403
alpha	4.4332	4.4438	4.4545	4.5088	4.5199	4.5763	4.5763	4.5878	4.5535	4.5199	4.4978	4.4760
util living area	0.9573	0.9108	0.8334	0.6912	0.5263	0.3681	0.2653	0.2965	0.4790	0.7558	0.9180	0.9649 (86)
Living	19.9938	20.2971	20.5955	20.8525	20.9620	20.9942	20.9990	20.9983	20.9812	20.8180	20.3819	19.9415
Non living	18.9938	19.3669	19.7231	20.0209	20.1339	20.1740	20.1773	20.1794	20.1598	19.9943	19.4865	18.9361
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	20.4853	20.2971	20.5955	20.8525	20.9620	20.9942	20.9990	20.9983	20.9812	20.8180	20.3819	20.0896 (87)
Th 2	20.1463	20.1487	20.1511	20.1632	20.1656	20.1777	20.1777	20.1801	20.1728	20.1656	20.1608	20.1559 (88)
util rest of house	0.9493	0.8961	0.8091	0.6554	0.4833	0.3217	0.2159	0.2441	0.4249	0.7158	0.9018	0.9582 (89)
MIT 2	19.6868	19.3669	19.7231	20.0209	20.1339	20.1740	20.1773	20.1794	20.1598	19.9943	19.4865	19.1559 (90)
Living area fraction	f <sub>LA</sub> = Living area / (4) =											
MIT	19.9066	19.6229	19.9633	20.2498	20.3619	20.3997	20.4035	20.4048	20.3859	20.2210	19.7330	19.4129 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.9066	19.6229	19.9633	20.2498	20.3619	20.3997	20.4035	20.4048	20.3859	20.2210	19.7330	19.4129 (93)

## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9467	0.8857	0.8033	0.6593	0.4936	0.3343	0.2295	0.2585	0.4390	0.7187	0.8923	0.9511 (94)
Useful gains	807.2089	921.5268	954.8614	885.1906	709.9928	476.8146	313.8227	329.1826	515.0918	723.6359	771.9745	765.5301 (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	1342.5894	1262.6722	1151.0764	955.3589	726.8123	478.9771	314.1113	329.6787	522.4539	807.2934	1066.7121	1292.6154 (97)
Space heating kWh	398.3231	229.2497	145.9840	50.5212	12.5137	0.0000	0.0000	0.0000	0.0000	62.2412	212.2111	392.1515 (98a)
Space heating requirement - total per year (kWh/year)	1503.1953											
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	398.3231	229.2497	145.9840	50.5212	12.5137	0.0000	0.0000	0.0000	0.0000	62.2412	212.2111	392.1515 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	1503.1953											
Space heating per m2	(98c) / (4) = 16.1634 (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 %)	396.5739 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	398.3231	229.2497	145.9840	50.5212	12.5137	0.0000	0.0000	0.0000	0.0000	62.2412	212.2111	392.1515	(98)
Space heating efficiency (main heating system 1)	396.5739	396.5739	396.5739	396.5739	396.5739	0.0000	0.0000	0.0000	0.0000	396.5739	396.5739	396.5739	(210)
Space heating fuel (main heating system)	100.4411	57.8076	36.8113	12.7394	3.1555	0.0000	0.0000	0.0000	0.0000	15.6947	53.5111	98.8849	(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	333.7536	295.3056	313.3779	273.8957	264.5674	237.3036	233.0571	242.6925	245.8447	275.5128	294.7506	329.8264	(64)
Efficiency of water heater	190.3379	190.3379	190.3379	190.3379	190.3379	190.3379	190.3379	190.3379	190.3379	190.3379	190.3379	190.3379	(216)
Fuel for water heating, kWh/month	175.3480	155.1481	164.6430	143.8997	138.9988	124.6749	122.4439	127.5062	129.1623	144.7494	154.8566	173.2847	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	17.0659	15.4144	17.0659	16.5154	17.0659	16.5154	17.0659	17.0659	16.5154	17.0659	16.5154	17.0659	(231)
Lighting	28.3738	22.7625	20.4951	15.0156	11.5985	9.4761	10.5805	13.7530	17.8637	23.4382	26.4734	29.1624	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-107.3583	-171.5323	-272.6028	-323.1189	-353.6937	-329.6075	-324.9584	-306.9943	-266.1019	-206.7700	-124.4773	-90.0257	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	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)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1													379.0455 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													190.3379
Water heating fuel used													1754.7155 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7700)													
mechanical ventilation fans (SFP = 0.7700)													200.9377 (230a)
Total electricity for the above, kWh/year													200.9377 (231)
Electricity for lighting (calculated in Appendix L)													228.9927 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-2877.2409 (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													-313.5495 (238)

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

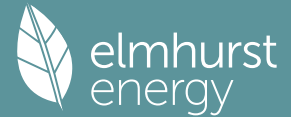
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	379.0455	0.1578	59.8244 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1754.7155	0.1410	247.4267 (264)
Space and water heating			307.2511 (265)
Pumps, fans and electric keep-hot	200.9377	0.1387	27.8725 (267)
Energy for lighting	228.9927	0.1443	33.0507 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2877.2409	0.1333	-383.6084
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-383.6084 (269)
Total CO2, kg/year			-15.4341 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			-0.1700 (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	379.0455	1.5842	600.4841 (275)



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Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1754.7155	1.5214	2669.6194 (278)
Space and water heating			3270.1035 (279)
Pumps, fans and electric keep-hot	200.9377	1.5128	303.9785 (281)
Energy for lighting	228.9927	1.5338	351.2366 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2877.2409	1.4927	-4294.8335
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-4294.8335 (283)
Total Primary energy kWh/year			-369.5149 (286)
Dwelling Primary energy Rate (DPER)			-3.9700 (287)

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

## 1. Overall dwelling characteristics

	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	93.0000 (1b)	x 2.3000 (2b)	= 213.9000 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 213.9000 (5)

## 2. Ventilation rate

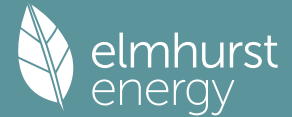
		m <sup>3</sup> per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1403 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3903 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3903 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4976	0.4878	0.4781	0.4293	0.4195	0.3707	0.3707	0.3610	0.3903	0.4195	0.4390	0.4585 (22b)
Effective ac	0.6238	0.6190	0.6143	0.5921	0.5880	0.5687	0.5687	0.5652	0.5761	0.5880	0.5964	0.6051 (25)

## 3. Heat losses and heat loss parameter

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K
TER Opening Type (Uw = 1.20)			21.6500	1.1450	24.7901		(27)
Ground Floor			93.0000	0.1300	12.0900		(28a)
External Wall	80.0400	21.6500	58.3900	0.1800	10.5102		(29a)
External Flat Roof	19.2000		19.2000	0.1100	2.1120		(30)
Total net area of external elements Aum(A, m <sup>2</sup> )			192.2400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.5023		(33)
Party Wall 11.20			11.2000	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							179.4296 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value		Total
E2 Other lintels (including other steel lintels)				15.5500	0.0500		0.7775
E3 Sill				8.3500	0.0500		0.4175
E4 Jamb				26.9600	0.0500		1.3480

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E5 Ground floor (normal)	34.8000	0.1600	5.5680	
E7 Party floor between dwellings (in blocks of flats)	40.9200	0.0700	2.8644	
E14 Flat roof	16.8000	0.0800	1.3440	
E16 Corner (normal)	11.5000	0.0900	1.0350	
P2 Party wall - Intermediate floor within a dwelling	4.8600	0.0000	0.0000	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	4.8600	0.0000	0.0000	
P1 Party wall - Ground floor	4.8600	0.0800	0.3888	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				13.7432 (36)
Point Thermal bridges				(36a) = 0.0000
Total fabric heat loss				(33) + (36) + (36a) = 63.2455 (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
	44.0314	43.6921	43.3595	41.7974	41.5051	40.1445	40.1445	39.8926	40.6686	41.5051	42.0964	42.7145 (38)
Heat transfer coeff	107.2769	106.9376	106.6050	105.0428	104.7506	103.3900	103.3900	103.1380	103.9141	104.7506	105.3418	105.9600 (39)
Average = Sum(39)m / 12 =												105.0414

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1535	1.1499	1.1463	1.1295	1.1264	1.1117	1.1117	1.1090	1.1174	1.1264	1.1327	1.1394 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

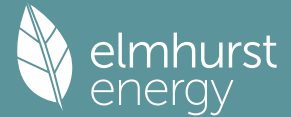
#### 4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.6646 (42)
Hot water usage for mixer showers	68.8963	67.8609	66.3522	63.4655	61.3351	58.9594	57.6091	59.1064	60.7477	63.2985	66.2473	68.6323 (42a)	
Hot water usage for baths	29.7509	29.3090	28.6868	27.5396	26.6806	25.7280	25.2135	25.8314	26.5041	27.5233	28.6942	29.6503 (42b)	
Hot water usage for other uses	41.9181	40.3938	38.8695	37.3453	35.8210	34.2967	34.2967	35.8210	37.3453	38.8695	40.3938	41.9181 (42c)	
Average daily hot water use (litres/day)													129.2112 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	140.5653	137.5638	133.9086	128.3503	123.8366	118.9841	117.1192	120.7587	124.5971	129.6914	135.3353	140.2008 (44)	
Energy conte	222.6211	195.8890	205.8125	175.7052	166.7079	146.3048	141.6456	149.5245	153.6407	175.9900	192.8100	219.5205 (45)	
Energy content (annual)													Total = Sum(45)m = 2146.1718
Distribution loss (46)m = 0.15 x (45)m	33.3932	29.3834	30.8719	26.3558	25.0062	21.9457	21.2468	22.4287	23.0461	26.3985	28.9215	32.9281 (46)	
Water storage loss:													250.0000 (47)
Store volume													1.8903 (48)
a) If manufacturer declared loss factor is known (kWh/day):													0.5400 (49)
Temperature factor from Table 2b													1.0208 (55)
Enter (49) or (54) in (55)													
Total storage loss	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444 (56)	
If cylinder contains dedicated solar storage	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444 (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	277.5279	245.4823	260.7193	228.8408	221.6147	199.4404	196.5523	204.4313	206.7763	230.8968	245.9456	274.4273 (62)	
WWHRS	-31.4965	-27.8558	-29.1690	-24.1531	-22.5098	-19.2618	-18.0548	-19.1995	-19.9290	-23.4941	-26.6159	-30.9132 (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	246.0314	217.6265	231.5503	204.6877	199.1049	180.1787	178.4975	185.2318	186.8473	207.4028	219.3296	243.5141 (64)	
Total per year (kWh/year)													Total per year (kWh/year) = Sum(64)m = 2500.0026 (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	117.9470	104.8077	112.3581	100.9304	99.3558	91.1548	91.0226	93.6423	93.5940	102.4421	106.6178	116.9160 (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	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	123.3171	136.5297	123.3171	127.4277	123.3171	127.4277	123.3171	123.3171	127.4277	123.3171	127.4277	123.3171 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.4900	247.0270	240.6338	227.0233	209.8424	193.6949	182.9074	180.3703	186.7636	200.3741	217.5549	233.7024 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230 (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)	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839 (71)
Water heating gains (Table 5)	158.5309	155.9638	151.0189	140.1812	133.5428	126.6039	122.3422	125.8633	129.9917	137.6910	148.0803	157.1452 (72)
Total internal gains	592.3069	605.4895	580.9387	560.6011	532.6713	510.6955	491.5356	492.5197	507.1519	527.3512	559.0318	580.1337 (73)

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## 6. Solar gains

[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			
Northeast				2.9400	11.2829	0.6300	0.7000	0.7700	10.1377 (75)			
Southeast				0.6400	36.7938	0.6300	0.7000	0.7700	7.1966 (77)			
Southwest				15.0000	36.7938	0.6300	0.7000	0.7700	168.6701 (79)			
Northwest				3.0700	11.2829	0.6300	0.7000	0.7700	10.5860 (81)			
Solar gains	196.5905	341.7499	485.8812	632.6772	736.6242	743.6018	711.7909	632.3606	536.4220	382.6363	236.7236	167.4293 (83)
Total gains	788.8974	947.2393	1066.8199	1193.2783	1269.2955	1254.2973	1203.3265	1124.8804	1043.5739	909.9874	795.7554	747.5630 (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	43.2084	43.3455	43.4807	44.1274	44.2505	44.8328	44.8328	44.9423	44.6067	44.2505	44.0021	43.7454
alpha	3.8806	3.8897	3.8987	3.9418	3.9500	3.9889	3.9889	3.9962	3.9738	3.9500	3.9335	3.9164
util living area	0.9764	0.9535	0.9128	0.8220	0.6816	0.5073	0.3732	0.4139	0.6298	0.8628	0.9564	0.9803 (86)
MIT	19.4859	19.7855	20.1506	20.5674	20.8373	20.9619	20.9912	20.9868	20.9107	20.5460	19.9524	19.4422 (87)
Th 2	19.9574	19.9603	19.9632	19.9768	19.9794	19.9913	19.9913	19.9935	19.9867	19.9794	19.9742	19.9688 (88)
util rest of house	0.9710	0.9435	0.8946	0.7875	0.6266	0.4345	0.2899	0.3269	0.5549	0.8274	0.9453	0.9759 (89)
MIT 2	18.2193	18.5956	19.0469	19.5485	19.8416	19.9674	19.9878	19.9878	19.9241	19.5398	18.8196	18.1721 (90)
Living area fraction	flA = Living area / (4) =											
MIT	18.5680	18.9231	19.3507	19.8290	20.1157	20.2412	20.2640	20.2628	20.1957	19.8168	19.1314	18.5217 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.5680	18.9231	19.3507	19.8290	20.1157	20.2412	20.2640	20.2628	20.1957	19.8168	19.1314	18.5217 (93)

## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9615	0.9310	0.8818	0.7819	0.6343	0.4530	0.3127	0.3505	0.5712	0.8209	0.9337	0.9673 (94)
Useful gains	758.5005	881.8947	940.7579	933.0684	805.1724	568.1996	376.2287	394.3130	596.0747	746.9894	742.9782	723.1104 (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	1530.6218	1499.5987	1369.9503	1148.0108	881.5497	583.2426	378.8193	398.4006	633.4303	965.4612	1267.4127	1517.5254 (97)
Space heating kWh	574.4582	415.0971	319.3192	154.7585	56.8247	0.0000	0.0000	0.0000	0.0000	162.5430	377.5928	591.0448 (98a)
Space heating requirement - total per year (kWh/year)												2651.6383
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	574.4582	415.0971	319.3192	154.7585	56.8247	0.0000	0.0000	0.0000	0.0000	162.5430	377.5928	591.0448 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2651.6383
Space heating per m2												(98c) / (4) = 28.5122 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

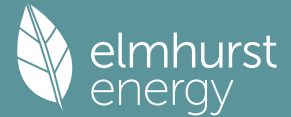
Efficiency of main space heating system 1 (in %) 92.3000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	574.4582	415.0971	319.3192	154.7585	56.8247	0.0000	0.0000	0.0000	0.0000	162.5430	377.5928	591.0448 (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)	622.3816	449.7260	345.9580	167.6690	61.5652	0.0000	0.0000	0.0000	0.0000	176.1030	409.0930	640.3518 (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	246.0314	217.6265	231.5503	204.6877	199.1049	180.1787	178.4975	185.2318	186.8473	207.4028	219.3296	243.5141 (64)
Efficiency of water heater												
(217)m	85.8951	85.4839	84.7809	83.4411	81.6371	79.8000	79.8000	79.8000	79.8000	83.5192	85.2666	79.8000 (216)
Fuel for water heating, kWh/month												
												85.9708 (217)

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Space cooling fuel requirement (221)m	286.4323	254.5817	273.1163	245.3081	243.8903	225.7878	223.6811	232.1200	234.1445	248.3295	257.2282	283.2520	(219)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	(231)
Lighting	25.6229	20.5556	18.5080	13.5598	10.4740	8.5573	9.5547	12.4196	16.1318	21.1658	23.9067	26.3350	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-70.2966	-91.6880	-122.0542	-126.7848	-128.5243	-117.1334	-115.5932	-112.8943	-107.3073	-99.4511	-74.5512	-61.6787	(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	-65.8737	-134.3992	-259.8401	-380.2540	-493.5848	-492.6985	-486.9434	-416.4413	-310.8751	-188.7259	-86.7440	-52.4211	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												2872.8476	(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												3007.8717	(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)												206.7912	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-4596.7580	(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												1576.7524	(238)

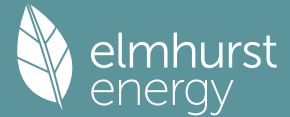
## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2872.8476	0.2100	603.2980 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3007.8717	0.2100	631.6531 (264)
Space and water heating			1234.9510 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	206.7912	0.1443	29.8464 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1227.9570	0.1363	-167.3569
PV Unit electricity exported	-3368.8010	0.1267	-426.7514
Total			-594.1083 (269)
Total CO2, kg/year			682.6184 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			7.3400 (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	2872.8476	1.1300	3246.3177 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3007.8717	1.1300	3398.8950 (278)
Space and water heating			6645.2127 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	206.7912	1.5338	317.1832 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1227.9570	1.5038	-1846.5928
PV Unit electricity exported	-3368.8010	0.4650	-1566.5863
Total			-3413.1790 (283)
Total Primary energy kWh/year			3679.3177 (286)
Target Primary Energy Rate (TPER)			39.5600 (287)

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## 1. Overall dwelling characteristics

	Area (m <sup>2</sup> )	x	Storey height (m)	=	Volume (m <sup>3</sup> )
Ground floor	93.0000 (1b)		2.3000 (2b)		213.9000 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0000				(4)
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 213.9000 (5)

## 2. Ventilation rate

		m <sup>3</sup> per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
		Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1403 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.2903 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2903 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3701	0.3628	0.3556	0.3193	0.3120	0.2757	0.2757	0.2685	0.2903	0.3120	0.3265	0.3410 (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	0.5685	0.5658	0.5632	0.5510	0.5487	0.5380	0.5380	0.5360	0.5421	0.5487	0.5533	0.5582 (25)

## 3. Heat losses and heat loss parameter

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K
Window (Uw = 1.20)			14.3700	1.1450	16.4542		(27)
Glazed Door (Uw = 1.20)			7.2800	1.1450	8.3359		(27)
Ground Floor			93.0000	0.1500	13.9500	75.0000	6975.0000 (28a)
External Wall	80.0400	21.6500	58.3900	0.1400	8.1746	70.0000	4087.3000 (29a)
External Flat Roof	19.2000		19.2000	0.1100	2.1120	9.0000	172.8000 (30)
Total net area of external elements Aum(A, m <sup>2</sup> )			192.2400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.0267		(33)
Party Wall 11.20			11.2000	0.0000	0.0000	70.0000	784.0000 (32)
Party Ceiling			73.8000			40.0000	2952.0000 (32b)
Internal Wall			190.6500			9.0000	1715.8500 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	16686.9500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K		179.4296 (35)

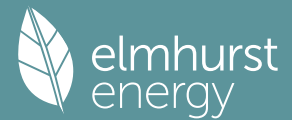
### List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	15.5500	0.0040	0.0622
E3 Sill	8.3500	0.0150	0.1253
E4 Jamb	26.9600	0.0260	0.7010
E5 Ground floor (normal)	34.8000	0.0720	2.5056
E7 Party floor between dwellings (in blocks of flats)	40.9200	0.2800	11.4576
E14 Flat roof	16.8000	0.0390	0.6552
E16 Corner (normal)	11.5000	0.0320	0.3680
P2 Party wall - Intermediate floor within a dwelling	4.8600	0.0000	0.0000
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	4.8600	0.0000	0.0000
P1 Party wall - Ground floor	4.8600	0.3200	1.5552
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			17.4300 (36)
Point Thermal bridges			0.0000 (36a)
Total fabric heat loss			(33) + (36) + (36a) = 66.4567 (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	40.1271	39.9394	39.7554	38.8913	38.7296	37.9770	37.9770	37.8376	38.2669	38.7296	39.0567	39.3986 (38)
Heat transfer coeff	106.5837	106.3961	106.2121	105.3479	105.1863	104.4336	104.4336	104.2943	104.7235	105.1863	105.5133	105.8553 (39)
Average = Sum(39)m / 12 =												105.3472

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1461	1.1440	1.1421	1.1328	1.1310	1.1229	1.1229	1.1214	1.1261	1.1310	1.1346	1.1382 (40)
HLP (average)												1.1328
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												2.6646 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	29.7509	29.3090	28.6868	27.5396	26.6806	25.7280	25.2135	25.8314	26.5041	27.5233	28.6942	29.6503 (42b)
Hot water usage for other uses	41.9181	40.3938	38.8695	37.3453	35.8210	34.2967	34.2967	35.8210	37.3453	38.8695	40.3938	41.9181 (42c)
Average daily hot water use (litres/day)												65.6912 (43)
Daily hot water use	71.6690	69.7029	67.5564	64.8849	62.5015	60.0247	59.5102	61.6523	63.8493	66.3929	69.0881	71.5684 (44)
Energy content (annual)	113.5062	99.2560	103.8316	88.8241	84.1391	73.8074	71.9724	76.3385	78.7326	90.0945	98.4286	112.0589 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	96.4803	84.3676	88.2569	75.5005	71.5182	62.7362	61.1765	64.8877	66.9227	76.5803	83.6643	95.2501 (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	96.4803	84.3676	88.2569	75.5005	71.5182	62.7362	61.1765	64.8877	66.9227	76.5803	83.6643	95.2501 (64)
Total per year (kWh/year)												927.3414 (64)
Electric shower(s)	55.1745	49.1609	53.6818	51.2279	52.1892	49.7834	51.4428	52.1892	51.2279	53.6818	52.6724	55.1745 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												627.6062 (64a)
Heat gains from water heating, kWh/month	37.9137	33.3821	35.4847	31.6821	30.9268	28.1299	28.1548	29.2692	29.5377	32.5655	34.0842	37.6061 (65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Metabolic gains (Table 5), Watts	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	123.3171	136.5297	123.3171	127.4277	123.3171	127.4277	123.3171	123.3171	127.4277	123.3171	127.4277	123.3171 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.4900	247.0270	240.6338	227.0233	209.8424	193.6949	182.9074	180.3703	186.7636	200.3741	217.5549	233.7024 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230 (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)	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839 (71)
Water heating gains (Table 5)	50.9593	49.6758	47.6945	44.0029	41.5683	39.0693	37.8425	39.3403	41.0245	43.7709	47.3391	50.5459 (72)
Total internal gains	481.7353	496.2014	474.6143	461.4228	437.6969	423.1609	407.0360	405.9967	418.1848	430.4310	455.2907	470.5344 (73)

## 6. Solar gains

[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						
Northeast	2.9400	11.2829	0.7600	0.7000	0.7700	12.2297 (75)						
Southeast	0.6400	36.7938	0.7600	0.7000	0.7700	8.6816 (77)						
Southwest	7.7200	36.7938	0.7600	0.7000	0.7700	104.7218 (79)						
Northwest	3.0700	11.2829	0.7600	0.7000	0.7700	12.7704 (81)						
Southwest	7.2800	36.7938	0.7600	0.7000	0.7700	98.7532 (79)						
Solar gains	237.1567	412.2697	586.1423	763.2296	888.6261	897.0434	858.6684	762.8478	647.1123	461.5930	285.5714	201.9782 (83)
Total gains	718.8920	908.4711	1060.7566	1224.6524	1326.3229	1320.2043	1265.7044	1168.8445	1065.2971	892.0240	740.8620	672.5126 (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	43.4894	43.5661	43.6416	43.9996	44.0672	44.3848	44.3848	44.4441	44.2619	44.0672	43.9306	43.7887	
alpha	3.8993	3.9044	3.9094	3.9333	3.9378	3.9590	3.9590	3.9629	3.9508	3.9378	3.9287	3.9192	
util living area	0.9824	0.9587	0.9137	0.8129	0.6625	0.4888	0.3588	0.4033	0.6231	0.8698	0.9650	0.9861 (86)	
MIT	19.4054	19.7489	20.1514	20.5842	20.8516	20.9655	20.9920	20.9875	20.9123	20.5260	19.8806	19.3407 (87)	
Th 2	19.9634	19.9650	19.9666	19.9742	19.9756	19.9821	19.9821	19.9834	19.9796	19.9756	19.9727	19.9697 (88)	
util rest of house	0.9783	0.9497	0.8956	0.7775	0.6072	0.4173	0.2778	0.3174	0.5480	0.8354	0.9558	0.9829 (89)	
MIT 2	18.5285	18.8654	19.2527	19.6547	19.8785	19.9655	19.9797	19.9792	19.9320	19.6164	19.0045	18.4695 (90)	
Living area fraction									fLA = Living area / (4) =			0.2753 (91)	
MIT	18.7699	19.1086	19.5001	19.9105	20.1464	20.2408	20.2584	20.2567	20.2019	19.8668	19.2457	18.7093 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.7699	19.1086	19.5001	19.9105	20.1464	20.2408	20.2584	20.2567	20.2019	19.8668	19.2457	18.7093 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9721	0.9405	0.8861	0.7751	0.6169	0.4359	0.3000	0.3408	0.5652	0.8312	0.9475	0.9775 (94)
Useful gains	698.8494	854.3810	939.9446	949.2277	818.1829	575.4704	379.7247	398.3677	602.1231	741.4697	701.9462	657.3977 (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	1542.2577	1511.7354	1380.7666	1159.9350	888.4424	589.0869	382.0567	402.2363	639.0075	974.7400	1281.5299	1535.8883 (97)
Space heating kWh	627.4957	441.7422	327.9716	151.7093	52.2731	0.0000	0.0000	0.0000	0.0000	173.5531	417.3003	653.5970 (98a)
Space heating requirement - total per year (kWh/year)												2845.6423
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	627.4957	441.7422	327.9716	151.7093	52.2731	0.0000	0.0000	0.0000	0.0000	173.5531	417.3003	653.5970 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2845.6423
Space heating per m2										(98c) / (4) =		30.5983 (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	981.6762	772.8089	792.6364	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9258	0.9581	0.9428	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	908.7975	740.4096	747.2787	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1494.3924	1433.0799	1322.2886	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	421.6283	515.3466	427.8073	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	105.4071	128.8367	106.9518	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												341.1956 (107)
Energy for space heating												30.5983 (99)
Energy for space cooling												3.6688 (108)
Total												34.2671 (109)
Fabric Energy Efficiency (DFEE)												34.3 (109)

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

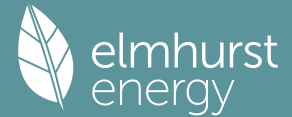
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	93.0000 (1b)	x 2.3000 (2b)	= 213.9000 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0000		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	213.9000 (5)





# Full SAP Calculation Printout



Average daily hot water use (litres/day)												65.6912 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	71.6690	69.7029	67.5564	64.8849	62.5015	60.0247	59.5102	61.6523	63.8493	66.3929	69.0881	71.5684 (44)
Energy content	113.5062	99.2560	103.8316	88.8241	84.1391	73.8074	71.9724	76.3385	78.7326	90.0945	98.4286	112.0589 (45)
Energy content (annual)												Total = Sum(45)m = 1090.9899
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	96.4803	84.3676	88.2569	75.5005	71.5182	62.7362	61.1765	64.8877	66.9227	76.5803	83.6643	95.2501 (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	96.4803	84.3676	88.2569	75.5005	71.5182	62.7362	61.1765	64.8877	66.9227	76.5803	83.6643	95.2501 (64)
											Total per year (kWh/year) = Sum(64)m = 927 (64)	
12Total per year (kWh/year)												
Electric shower(s)	55.1745	49.1609	53.6818	51.2279	52.1892	49.7834	51.4428	52.1892	51.2279	53.6818	52.6724	55.1745 (64a)
											Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 627.6062 (64a)	
Heat gains from water heating, kWh/month	37.9137	33.3821	35.4847	31.6821	30.9268	28.1299	28.1548	29.2692	29.5377	32.5655	34.0842	37.6061 (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	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	123.3171	136.5297	123.3171	127.4277	123.3171	127.4277	123.3171	123.3171	127.4277	123.3171	127.4277	123.3171 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.4900	247.0270	240.6338	227.0233	209.8424	193.6949	182.9074	180.3703	186.7636	200.3741	217.5549	233.7024 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230 (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)	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839 (71)
Water heating gains (Table 5)	50.9593	49.6758	47.6945	44.0029	41.5683	39.0693	37.8425	39.3403	41.0245	43.7709	47.3391	50.5459 (72)
Total internal gains	481.7353	496.2014	474.6143	461.4228	437.6969	423.1609	407.0360	405.9967	418.1848	430.4310	455.2907	470.5344 (73)

## 6. Solar gains

[Jan]	Area m <sup>2</sup>	Solar flux Table 6a W/m <sup>2</sup>	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W				
Northeast	2.9400	11.2829	0.6300	0.7000	0.7700	10.1377 (75)						
Southeast	0.6400	36.7938	0.6300	0.7000	0.7700	7.1966 (77)						
Southwest	15.0000	36.7938	0.6300	0.7000	0.7700	168.6701 (79)						
Northwest	3.0700	11.2829	0.6300	0.7000	0.7700	10.5860 (81)						
Solar gains	196.5905	341.7499	485.8812	632.6772	736.6242	743.6018	711.7909	632.3606	536.4220	382.6363	236.7236	167.4293 (83)
Total gains	678.3258	837.9513	960.4954	1094.1000	1174.3211	1166.7626	1118.8269	1038.3574	954.6068	813.0673	692.0143	637.9637 (84)

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, n <sub>1,m</sub> (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	43.2084	43.3455	43.4807	44.1274	44.2505	44.8328	44.8328	44.9423	44.6067	44.2505	44.0021	43.7454
alpha	3.8806	3.8897	3.8987	3.9418	3.9500	3.9889	3.9889	3.9962	3.9738	3.9500	3.9335	3.9164
util living area	0.9855	0.9679	0.9344	0.8527	0.7176	0.5400	0.3999	0.4458	0.6721	0.8956	0.9716	0.9884 (86)
MIT	19.3351	19.6487	20.0372	20.4959	20.8038	20.9526	20.9887	20.9828	20.8873	20.4610	19.8203	19.2900 (87)
Th 2	19.9574	19.9603	19.9632	19.9768	19.9794	19.9913	19.9913	19.9935	19.9867	19.9794	19.9742	19.9688 (88)
util rest of house	0.9821	0.9606	0.9197	0.8214	0.6635	0.4643	0.3113	0.3532	0.5967	0.8657	0.9640	0.9856 (89)
MIT 2	18.4548	18.7650	19.1436	19.5820	19.8478	19.9678	19.9877	19.9876	19.9238	19.5637	18.9476	18.4188 (90)
Living area fraction	18.6971	19.0083	19.3896	19.8335	20.1110	20.2389	20.2633	20.2616	20.1890	19.8107	19.1878	18.6586 (92)
Temperature adjustment	18.6971	19.0083	19.3896	19.8335	20.1110	20.2389	20.2633	20.2616	20.1890	19.8107	19.1878	18.6586 (93)
adjusted MIT	18.6971	19.0083	19.3896	19.8335	20.1110	20.2389	20.2633	20.2616	20.1890	19.8107	19.1878	18.6586 (93)

## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9766	0.9522	0.9099	0.8165	0.6709	0.4835	0.3355	0.3784	0.6127	0.8600	0.9564	0.9809	(94)
Useful gains	662.4236	797.8632	873.9508	893.3551	787.8515	564.0841	375.4012	392.8957	584.9253	699.2132	661.8239	625.7535	(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	1544.4805	1508.7031	1374.0943	1148.4907	881.0546	583.0025	378.7463	398.2740	632.7317	964.8286	1273.3513	1532.0334	(97)
Space heating kWh	656.2504	477.6844	372.1068	183.6976	69.3431	0.0000	0.0000	0.0000	0.0000	197.6178	440.2997	674.2722	(98a)
Space heating requirement - total per year (kWh/year)												3071.2721	
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	656.2504	477.6844	372.1068	183.6976	69.3431	0.0000	0.0000	0.0000	0.0000	197.6178	440.2997	674.2722	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3071.2721	
Space heating per m2												(98c) / (4) =	33.0244 (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	971.8660	765.0860	783.8491	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8997	0.9416	0.9230	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	874.3918	720.4304	723.4591	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1315.0450	1261.4049	1169.7712	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	317.2703	402.4850	332.0562	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fc = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	79.3176	100.6213	83.0140	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												262.9529	(107)
Energy for space heating												33.0244	(99)
Energy for space cooling												2.8275	(108)
Total												35.8519	(109)
Fabric Energy Efficiency (TFEE)												35.9	(109)

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

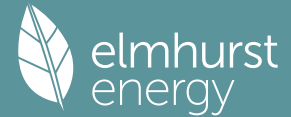
## 1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	93.0000 (1b)	x 2.3000 (2b)	= 213.9000 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0000		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 213.9000 (5)
Dwelling volume			

## 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	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door

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Measured/design AP50 3.0000 (17)  
 Infiltration rate 0.1500 (18)  
 Number of sides sheltered 0 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 1.0000 (20)  
 Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1500 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												82.8000 (23c)
Effective ac	0.2772	0.2735	0.2698	0.2510	0.2472	0.2285	0.2285	0.2248	0.2360	0.2472	0.2548	0.2622 (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
Window (Uw = 1.20)			14.3700	1.1450	16.4542		(27)
Glazed Door (Uw = 1.20)			7.2800	1.1450	8.3359		(27)
Ground Floor			93.0000	0.1500	13.9500	75.0000	6975.0000 (28a)
External Wall	80.0400	21.6500	58.3900	0.1400	8.1746	70.0000	4087.3000 (29a)
External Flat Roof	19.2000		19.2000	0.1100	2.1120	9.0000	172.8000 (30)
Total net area of external elements Aum(A, m2)			192.2400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 49.0267		(33)
Party Wall 11.20			11.2000	0.0000	0.0000	70.0000	784.0000 (32)
Party Ceiling			73.8000			40.0000	2952.0000 (32b)
Internal Wall			190.6500			9.0000	1715.8500 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16686.9500 (34)
Thermal mass parameter (TMP = Cm / TFA) in KJ/m2K							179.4296 (35)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 16686.9500 (34)  
 Thermal mass parameter (TMP = Cm / TFA) in KJ/m2K 179.4296 (35)

#### List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	15.5500	0.0040	0.0622
E3 Sill	8.3500	0.0150	0.1253
E4 Jamb	26.9600	0.0260	0.7010
E5 Ground floor (normal)	34.8000	0.0720	2.5056
E7 Party floor between dwellings (in blocks of flats)	40.9200	0.2800	11.4576
E14 Flat roof	16.8000	0.0390	0.6552
E16 Corner (normal)	11.5000	0.0320	0.3680
P2 Party wall - Intermediate floor within a dwelling	4.8600	0.0000	0.0000
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	4.8600	0.0000	0.0000
P1 Party wall - Ground floor	4.8600	0.3200	1.5552

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 17.4300 (36)

Point Thermal bridges (36a) = 0.0000  
 Total fabric heat loss (33) + (36) + (36a) = 66.4567 (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	19.5702	19.3055	19.0408	17.7173	17.4526	16.1291	16.1291	15.8644	16.6585	17.4526	17.9820	18.5114 (38)
Average = Sum(39)m / 12 =	86.0269	85.7622	85.4975	84.1740	83.9093	82.5858	82.5858	82.3211	83.1152	83.9093	84.4387	84.9681 (39)
												84.1078

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9250	0.9222	0.9193	0.9051	0.9023	0.8880	0.8880	0.8852	0.8937	0.9023	0.9079	0.9136 (40)
HLP (average)												0.9044
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

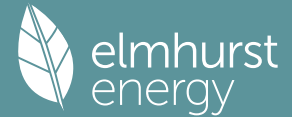
### 4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6646 (42)											
Hot water usage for mixer showers	103.3445	101.7914	99.5283	95.1982	92.0027	88.4391	86.4136	88.6596	91.1216	94.9478	99.3709	102.9485 (42a)
Hot water usage for baths	29.7509	29.3090	28.6868	27.5396	26.6806	25.7280	25.2135	25.8314	26.5041	27.5233	28.6942	29.6503 (42b)
Hot water usage for other uses	41.9181	40.3938	38.8695	37.3453	35.8210	34.2967	34.2967	35.8210	37.3453	38.8695	40.3938	41.9181 (42c)
Average daily hot water use (litres/day)												160.9713 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	175.0135	171.4943	167.0846	160.0830	154.5042	148.4638	145.9238	150.3119	154.9710	161.3407	168.4589	174.5169 (44)
Energy content (annual)	277.1786	244.2056	256.8029	219.1457	207.9924	182.5536	176.4821	186.1175	191.0947	218.9378	240.0006	273.2514 (45)
Distribution loss (46)m = 0.15 x (45)m	41.5768	36.6308	38.5204	32.8719	31.1989	27.3830	26.4723	27.9176	28.6642	32.8407	36.0001	40.9877 (46)

Water storage loss:  
 Store volume 250.0000 (47)  
 a) If manufacturer declared loss factor is known (kWh/day): 1.9900 (48)  
 Temperature factor from Table 2b 0.5400 (49)

# Full SAP Calculation Printout



Enter (49) or (54) in (55)													1.0746 (55)
Total storage loss	33.3126	30.0888	33.3126	32.2380	33.3126	32.2380	33.3126	33.3126	32.2380	33.3126	32.2380	33.3126	(56)
If cylinder contains dedicated solar storage	33.3126	30.0888	33.3126	32.2380	33.3126	32.2380	33.3126	33.3126	32.2380	33.3126	32.2380	33.3126	(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	333.7536	295.3056	313.3779	273.8957	264.5674	237.3036	233.0571	242.6925	245.8447	275.5128	294.7506	329.8264	(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	333.7536	295.3056	313.3779	273.8957	264.5674	237.3036	233.0571	242.6925	245.8447	275.5128	294.7506	329.8264	(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	137.4219	122.0783	130.6470	116.6659	114.4175	104.4991	103.9403	107.1441	107.3390	118.0568	123.6002	136.1161	(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	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.4163	28.7919	23.4151	17.7267	13.2509	11.1870	12.0880	15.7124	21.0891	26.7775	31.2533	33.3172	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	364.9104	368.6970	359.1549	338.8407	313.1977	289.0969	272.9961	269.2094	278.7516	299.0658	324.7088	348.8096	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	(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)	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	(71)
Water heating gains (Table 5)	184.7068	181.6642	175.6007	162.0360	153.7869	145.1376	139.7047	144.0109	149.0819	158.6785	171.6670	182.9517	(72)
Total internal gains	688.9776	686.0972	665.1148	625.5476	587.1797	552.3656	531.7329	535.8768	555.8668	591.4659	634.5732	672.0227	(73)

## 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
Northeast	2.9400	11.2829	0.7600	0.7000	0.7700	12.2297	(75)
Southeast	0.6400	36.7938	0.7600	0.7000	0.7700	8.6816	(77)
Southwest	7.7200	36.7938	0.7600	0.7000	0.7700	104.7218	(79)
Northwest	3.0700	11.2829	0.7600	0.7000	0.7700	12.7704	(81)
Southwest	7.2800	36.7938	0.7600	0.7000	0.7700	98.7532	(79)

Solar gains	237.1567	412.2697	586.1423	763.2296	888.6261	897.0434	858.6684	762.8478	647.1123	461.5930	285.5714	201.9782	(83)
Total gains	926.1344	1098.3669	1251.2572	1388.7772	1475.8057	1449.4090	1390.4013	1298.7246	1202.9791	1053.0589	920.1445	874.0009	(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, n11,m (see Table 9a)	53.8815	54.0478	54.2152	55.0676	55.2413	56.1266	56.1266	56.3071	55.7691	55.2413	54.8950	54.5530	21.0000 (85)
tau	4.5921	4.6032	4.6143	4.6712	4.6828	4.7418	4.7418	4.7538	4.7179	4.6828	4.6597	4.6369	
util living area	0.9482	0.9013	0.8181	0.6779	0.5158	0.3627	0.2610	0.2910	0.4690	0.7390	0.9071	0.9575	(86)
Living	20.1252	20.3874	20.6610	20.8787	20.9699	20.9955	20.9993	20.9988	20.9854	20.8511	20.4666	20.0722	
Non living	19.1535	19.4736	19.7969	20.0478	20.1409	20.1749	20.1774	20.1796	20.1629	20.0280	19.5857	19.0956	
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	20.5525	20.3874	20.6610	20.8787	20.9699	20.9955	20.9993	20.9988	20.9854	20.8511	20.4666	20.2020	(87)
Th 2	20.1463	20.1487	20.1511	20.1632	20.1656	20.1777	20.1777	20.1801	20.1728	20.1656	20.1608	20.1559	(88)
util rest of house	0.9386	0.8850	0.7921	0.6415	0.4731	0.3169	0.2124	0.2394	0.4155	0.6976	0.8889	0.9493	(89)
MIT 2	19.7505	19.4736	19.7969	20.0478	20.1409	20.1749	20.1774	20.1796	20.1629	20.0280	19.5857	19.2867	(90)
Living area fraction										fLA = Living area / (4) =		0.2753	(91)
MIT	19.9713	19.7251	20.0348	20.2765	20.3691	20.4008	20.4036	20.4051	20.3893	20.2546	19.8282	19.5386	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9713	19.7251	20.0348	20.2765	20.3691	20.4008	20.4036	20.4051	20.3893	20.2546	19.8282	19.5386	(93)

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## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9364	0.8759	0.7883	0.6466	0.4836	0.3294	0.2258	0.2536	0.4297	0.7022	0.8807	0.9423	(94)
Useful gains	867.2218	962.1138	986.4137	897.9985	713.7428	477.3776	313.9155	329.3393	516.8958	739.4713	810.3808	823.5538	(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	1348.1505	1271.4329	1157.1902	957.6055	727.4201	479.0644	314.1257	329.7029	522.7387	810.1103	1074.7493	1303.2961	(97)
Space heating kWh	357.8110	207.8624	127.0577	42.9171	10.1759	0.0000	0.0000	0.0000	0.0000	52.5554	190.3453	356.9283	(98a)
Space heating requirement - total per year (kWh/year)												1345.6531	
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	357.8110	207.8624	127.0577	42.9171	10.1759	0.0000	0.0000	0.0000	0.0000	52.5554	190.3453	356.9283	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1345.6531	
Space heating per m2										(98c) / (4) =		14.4694	(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 %)													396.5739	(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	357.8110	207.8624	127.0577	42.9171	10.1759	0.0000	0.0000	0.0000	0.0000	52.5554	190.3453	356.9283	(98)	
Space heating efficiency (main heating system 1)	396.5739	396.5739	396.5739	396.5739	396.5739	0.0000	0.0000	0.0000	0.0000	396.5739	396.5739	396.5739	(210)	
Space heating fuel (main heating system)	90.2256	52.4146	32.0389	10.8220	2.5659	0.0000	0.0000	0.0000	0.0000	13.2524	47.9974	90.0030	(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	333.7536	295.3056	313.3779	273.8957	264.5674	237.3036	233.0571	242.6925	245.8447	275.5128	294.7506	329.8264	(64)	
Efficiency of water heater (217)m	190.3379	190.3379	190.3379	190.3379	190.3379	190.3379	190.3379	190.3379	190.3379	190.3379	190.3379	190.3379	(216)	
Fuel for water heating, kWh/month	175.3480	155.1481	164.6430	143.8997	138.9988	124.6749	122.4439	127.5062	129.1623	144.7494	154.8566	173.2847	(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	17.0659	15.4144	17.0659	16.5154	17.0659	16.5154	17.0659	17.0659	16.5154	17.0659	16.5154	17.0659	(231)	
Lighting	28.3738	22.7625	20.4951	15.0156	11.5985	9.4761	10.5805	13.7530	17.8637	23.4382	26.4734	29.1624	(232)	
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-107.2353	-171.2785	-271.9863	-322.5632	-353.4257	-329.6075	-324.9584	-306.9943	-266.1019	-206.5237	-124.3406	-89.9480	(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)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)	
Annual totals kWh/year														
Space heating fuel - main system 1													339.3197	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													190.3379	
Water heating fuel used													1754.7155	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7700) mechanical ventilation fans (SFP = 0.7700)													200.9377	(230a)
Total electricity for the above, kWh/year													200.9377	(231)
Electricity for lighting (calculated in Appendix L)													228.9927	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-2874.9632	(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													-350.9977	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	339.3197	16.4900	55.9538 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1754.7155	16.4900	289.3526 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	200.9377	16.4900	33.1346 (249)
Energy for lighting	228.9927	16.4900	37.7609 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2874.9632	16.4900	-474.0814
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-474.0814 (252)
Total energy cost			-57.8795 (255)

-----  
 11a. SAP rating - Individual heating systems  
 -----

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	-0.1510 (257)
SAP value		102.4475
SAP rating (Section 12)		102 (258)
SAP band		A

-----  
 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	339.3197	0.1580	53.6017 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1754.7155	0.1410	247.4267 (264)
Space and water heating			301.0284 (265)
Pumps, fans and electric keep-hot	200.9377	0.1387	27.8725 (267)
Energy for lighting	228.9927	0.1443	33.0507 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2874.9632	0.1333	-383.2718
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-383.2718 (269)
Total CO2, kg/year			-21.3201 (272)
CO2 emissions per m2			-0.2300 (273)
EI value			100.2070
EI rating			100 (274)
EI band			A

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 SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
 CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY  
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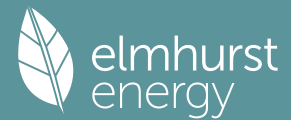
-----  
 1. Overall dwelling characteristics  
 -----

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	93.0000 (1b)	x 2.3000 (2b)	= 213.9000 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	213.9000 (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)

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Number of intermittent extract fans 0 \* 10 = 0.0000 (7a)  
 Number of passive vents 0 \* 10 = 0.0000 (7b)  
 Number of flueless gas fires 0 \* 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)  
 Pressure test Yes  
 Pressure Test Method Blower Door  
 Measured/design AP50 3.0000 (17)  
 Infiltration rate 0.1500 (18)  
 Number of sides sheltered 0 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 1.0000 (20)  
 Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1500 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	6.6000	6.2000	5.9000	5.2000	5.2000	4.7000	4.7000	4.7000	5.1000	6.0000	6.2000	6.6000 (22)
Wind factor	1.6500	1.5500	1.4750	1.3000	1.3000	1.1750	1.1750	1.1750	1.2750	1.5000	1.5500	1.6500 (22a)
Adj infilt rate	0.2475	0.2325	0.2213	0.1950	0.1950	0.1762	0.1762	0.1762	0.1912	0.2250	0.2325	0.2475 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												82.8000 (23c)
Effective ac	0.3335	0.3185	0.3073	0.2810	0.2810	0.2622	0.2622	0.2622	0.2772	0.3110	0.3185	0.3335 (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
Window (Uw = 1.20)			14.3700	1.1450	16.4542		(27)
Glazed Door (Uw = 1.20)			7.2800	1.1450	8.3359		(27)
Ground Floor			93.0000	0.1500	13.9500	75.0000	6975.0000 (28a)
External Wall	80.0400	21.6500	58.3900	0.1400	8.1746	70.0000	4087.3000 (29a)
External Flat Roof	19.2000		19.2000	0.1100	2.1120	9.0000	172.8000 (30)
Total net area of external elements Aum(A, m2)			192.2400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 49.0267		(33)
Party Wall 11.20			11.2000	0.0000	0.0000	70.0000	784.0000 (32)
Party Ceiling			73.8000			40.0000	2952.0000 (32b)
Internal Wall			190.6500			9.0000	1715.8500 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16686.9500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							179.4296 (35)

#### List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	15.5500	0.0040	0.0622
E3 Sill	8.3500	0.0150	0.1253
E4 Jamb	26.9600	0.0260	0.7010
E5 Ground floor (normal)	34.8000	0.0720	2.5056
E7 Party floor between dwellings (in blocks of flats)	40.9200	0.2800	11.4576
E14 Flat roof	16.8000	0.0390	0.6552
E16 Corner (normal)	11.5000	0.0320	0.3680
P2 Party wall - Intermediate floor within a dwelling	4.8600	0.0000	0.0000
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	4.8600	0.0000	0.0000
P1 Party wall - Ground floor	4.8600	0.3200	1.5552

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 17.4300 (36)  
 Point Thermal bridges (36a) = 0.0000  
 Total fabric heat loss (33) + (36) + (36a) = 66.4567 (37)

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

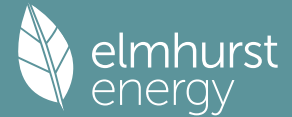
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	23.5408	22.4820	21.6879	19.8349	19.8349	18.5114	18.5114	18.5114	19.5702	21.9526	22.4820	23.5408 (38)
Average = Sum(39)m / 12 =	89.9975	88.9386	88.1445	86.2916	86.2916	84.9681	84.9681	84.9681	86.0269	88.4092	88.9386	89.9975 (39)
												87.3284

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9677	0.9563	0.9478	0.9279	0.9279	0.9136	0.9136	0.9136	0.9250	0.9506	0.9563	0.9677 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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

Assumed occupancy	2.6646 (42)											
Hot water usage for mixer showers	103.3445	101.7914	99.5283	95.1982	92.0027	88.4391	86.4136	88.6596	91.1216	94.9478	99.3709	102.9485 (42a)
Hot water usage for baths	29.7509	29.3090	28.6868	27.5396	26.6806	25.7280	25.2135	25.8314	26.5041	27.5233	28.6942	29.6503 (42b)
Hot water usage for other uses	41.9181	40.3938	38.8695	37.3453	35.8210	34.2967	34.2967	35.8210	37.3453	38.8695	40.3938	41.9181 (42c)
Average daily hot water use (litres/day)												160.9713 (43)
Daily hot water use	175.0135	171.4943	167.0846	160.0830	154.5042	148.4638	145.9238	150.3119	154.9710	161.3407	168.4589	174.5169 (44)

# Full SAP Calculation Printout



Energy content (annual)	277.1786	244.2056	256.8029	219.1457	207.9924	182.5536	176.4821	186.1175	191.0947	218.9378	240.0006	273.2514 (45)
Distribution loss (46)m = 0.15 x (45)m												2673.7628
Water storage loss:												40.9877 (46)
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9900 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0746 (55)
Total storage loss												
33.3126	30.0888	33.3126	32.2380	33.3126	32.2380	33.3126	33.3126	32.2380	33.3126	32.2380	33.3126	(56)
If cylinder contains dedicated solar storage												
33.3126	30.0888	33.3126	32.2380	33.3126	32.2380	33.3126	33.3126	32.2380	33.3126	32.2380	33.3126	(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	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month												
333.7536	295.3056	313.3779	273.8957	264.5674	237.3036	233.0571	242.6925	245.8447	275.5128	294.7506	329.8264	(62)
WVHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h												
333.7536	295.3056	313.3779	273.8957	264.5674	237.3036	233.0571	242.6925	245.8447	275.5128	294.7506	329.8264	(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												
137.4219	122.0783	130.6470	116.6659	114.4175	104.4991	103.9403	107.1441	107.3390	118.0568	123.6002	136.1161	(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	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.4163	28.7919	23.4151	17.7267	13.2509	11.1870	12.0880	15.7124	21.0891	26.7775	31.2533	33.3172 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	364.9104	368.6970	359.1549	338.8407	313.1977	289.0969	272.9961	269.2094	278.7516	299.0658	324.7088	348.8096 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522 (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)	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839 (71)
Water heating gains (Table 5)	184.7068	181.6642	175.6007	162.0360	153.7869	145.1376	139.7047	144.0109	149.0819	158.6785	171.6670	182.9517 (72)
Total internal gains	688.9776	686.0972	665.1148	625.5476	587.1797	552.3656	531.7329	535.8768	555.8668	591.4659	634.5732	672.0227 (73)

## 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W
Northeast	2.9400	15.4493	0.7600	0.7000	0.7700	16.7456 (75)
Southeast	0.6400	47.1180	0.7600	0.7000	0.7700	11.1176 (77)
Southwest	7.7200	47.1180	0.7600	0.7000	0.7700	134.1064 (79)
Northwest	3.0700	15.4493	0.7600	0.7000	0.7700	17.4860 (81)
Southwest	7.2800	47.1180	0.7600	0.7000	0.7700	126.4630 (79)

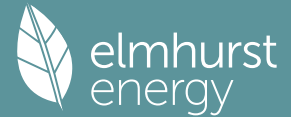
Solar gains	305.9186	457.0949	647.2675	862.7411	958.4385	1044.2999	903.8535	861.9544	745.3670	531.8606	355.0240	259.7081 (83)
Total gains	994.8962	1143.1921	1312.3823	1488.2887	1545.6181	1596.6655	1435.5864	1397.8312	1301.2338	1123.3265	989.5972	931.7307 (84)

## 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, n11,m (see Table 9a)												
tau	51.5044	52.1175	52.5871	53.7163	53.7163	54.5530	54.5530	54.5530	53.8815	52.4296	52.1175	51.5044
alpha	4.4336	4.4745	4.5058	4.5811	4.5811	4.6369	4.6369	4.6369	4.5921	4.4953	4.4745	4.4336
util living area	0.8999	0.8478	0.7480	0.6103	0.4764	0.3286	0.2718	0.2670	0.3869	0.6281	0.8200	0.9078 (86)
Living	20.4208	20.5849	20.7854	20.9224	20.9775	20.9968	20.9989	20.9990	20.9935	20.9286	20.7130	20.4139
Non living	19.4881	19.6858	19.9157	20.0738	20.1263	20.1540	20.1555	20.1555	20.1425	20.0670	19.8392	19.4824
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	20.7037	20.5849	20.7854	20.9224	20.9775	20.9968	20.9989	20.9990	20.9935	20.9286	20.7130	20.4959 (87)
Th 2	20.1103	20.1199	20.1271	20.1439	20.1439	20.1559	20.1559	20.1559	20.1463	20.1247	20.1199	20.1103 (88)
util rest of house												
0.8806	0.8225	0.7138	0.5705	0.4323	0.2844	0.2221	0.2160	0.3322	0.5744	0.7853	0.8889	0.8889 (89)
MIT 2	19.8623	19.6858	19.9157	20.0738	20.1263	20.1540	20.1555	20.1555	20.1425	20.0670	19.8392	19.5955 (90)



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Living area fraction									FLA = Living area / (4) =	0.2753 (91)		
MIT	20.0939	19.9333	20.1551	20.3074	20.3606	20.3860	20.3876	20.3877	20.3768	20.3042	20.0798	19.8434 (92)
Temperature adjustment												0.0000
adjusted MIT	20.0939	19.9333	20.1551	20.3074	20.3606	20.3860	20.3876	20.3877	20.3768	20.3042	20.0798	19.8434 (93)

## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8802	0.8167	0.7149	0.5783	0.4436	0.2965	0.2358	0.2300	0.3470	0.5858	0.7836	0.8824	(94)
Useful gains	875.6745	933.6273	938.2647	860.6266	685.5821	473.4251	338.5017	321.5627	451.5915	658.0079	775.4264	822.1300	(95)
Ext temp.	6.9000	7.1000	8.3000	9.9000	12.3000	14.8000	16.4000	16.6000	15.1000	12.5000	9.8000	7.4000	(96)
Heat loss rate W	1187.4165	1141.3755	1044.9626	898.0688	695.5634	474.6291	338.8221	321.8360	453.9448	689.9593	914.2684	1119.8715	(97)
Space heating kWh	231.9361	139.6068	79.3832	26.9584	7.4261	0.0000	0.0000	0.0000	0.0000	23.7718	99.9662	221.5197	(98a)
Space heating requirement - total per year (kWh/year)												830.5683	
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	231.9361	139.6068	79.3832	26.9584	7.4261	0.0000	0.0000	0.0000	0.0000	23.7718	99.9662	221.5197	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												830.5683	
Space heating per m2												8.9308	(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 %)													399.1554 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	231.9361	139.6068	79.3832	26.9584	7.4261	0.0000	0.0000	0.0000	0.0000	23.7718	99.9662	221.5197	(98)
Space heating efficiency (main heating system 1)	399.1554	399.1554	399.1554	399.1554	399.1554	0.0000	0.0000	0.0000	0.0000	399.1554	399.1554	399.1554	(210)
Space heating fuel (main heating system)	58.1067	34.9755	19.8878	6.7539	1.8605	0.0000	0.0000	0.0000	0.0000	5.9555	25.0444	55.4971	(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	333.7536	295.3056	313.3779	273.8957	264.5674	237.3036	233.0571	242.6925	245.8447	275.5128	294.7506	329.8264	(64)
Efficiency of water heater	189.9766	189.9766	189.9766	189.9766	189.9766	189.9766	189.9766	189.9766	189.9766	189.9766	189.9766	189.9766	(216)
Fuel for water heating, kWh/month	175.6814	155.4431	164.9560	144.1734	139.2631	124.9120	122.6767	127.7486	129.4079	145.0246	155.1510	173.6142	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	17.0659	15.4144	17.0659	16.5154	17.0659	16.5154	17.0659	17.0659	16.5154	17.0659	16.5154	17.0659	(231)
Lighting	28.3738	22.7625	20.4951	15.0156	11.5985	9.4761	10.5805	13.7530	17.8637	23.4382	26.4734	29.1624	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-139.2072	-191.2555	-296.5607	-347.6889	-366.3384	-348.2293	-332.3480	-326.5449	-293.1069	-234.8395	-154.5036	-116.8654	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	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)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1													208.0814 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													189.9766
Water heating fuel used													1758.0520 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7700)													
mechanical ventilation fans (SFP = 0.7700)													200.9377 (230a)
Total electricity for the above, kWh/year													200.9377 (231)
Electricity for lighting (calculated in Appendix L)													228.9927 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													

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PV generation	-3147.4882	(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	-751.4245	(238)

## 10a. Fuel costs - using BEDF prices (528)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	208.0814	21.5100	44.7583 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1758.0520	21.5100	378.1570 (247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000 (247a)
Pumps, fans and electric keep-hot	200.9377	21.5100	43.2217 (249)
Energy for lighting	228.9927	21.5100	49.2563 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3147.4882	21.5100	-677.0247
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-677.0247 (252)
Total energy cost			-161.6314 (255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	208.0814	0.1584	32.9594 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1758.0520	0.1410	247.8972 (264)
Space and water heating			280.8566 (265)
Pumps, fans and electric keep-hot	200.9377	0.1387	27.8725 (267)
Energy for lighting	228.9927	0.1443	33.0507 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3147.4882	0.1341	-422.0691
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-422.0691 (269)
Total CO2, kg/year			-80.2893 (272)

## 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	208.0814	1.5863	330.0806 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1758.0520	1.5214	2674.6955 (278)
Space and water heating			3004.7761 (279)
Pumps, fans and electric keep-hot	200.9377	1.5128	303.9785 (281)
Energy for lighting	228.9927	1.5338	351.2366 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3147.4882	1.4956	-4707.2924
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-4707.2924 (283)
Total Primary energy kWh/year			-1047.3012 (286)

## SAP 10 EPC IMPROVEMENTS

709914\_Flat 1

Current energy efficiency rating: A 102  
 Current environmental impact rating: A 100

N Solar water heating Not applicable  
 U Solar photovoltaic panels Not applicable  
 V2 Wind turbine Not applicable

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

Typical annual savings Energy Environmental  
 efficiency impact

# Full SAP Calculation Printout



Recommended measures  
(none)

Total Savings £0 0.00 kg/m<sup>2</sup>

Potential energy efficiency rating: A 102  
Potential environmental impact rating: A 100

Fuel prices for cost data on this page from database revision number 528 TEST (04 Oct 2023)  
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South West England):

	Current £515	Potential £515	£0 Saving
Electricity			
Space heating	£88	£88	£0
Water heating	£378	£378	£0
Lighting	£49	£49	£0
Generated (PV)	-£677	-£677	£0
Total cost of fuels	-£162	-£162	£0
Total cost of uses	-£162	-£162	£0
Delivered energy	-8 kWh/m <sup>2</sup>	-8 kWh/m <sup>2</sup>	0 kWh/m <sup>2</sup>
Carbon dioxide emissions	-0.1 tonnes	-0.1 tonnes	0.0 tonnes
CO2 emissions per m <sup>2</sup>	-1 kg/m <sup>2</sup>	-1 kg/m <sup>2</sup>	0 kg/m <sup>2</sup>
Primary energy	-11 kWh/m <sup>2</sup>	-11 kWh/m <sup>2</sup>	0 kWh/m <sup>2</sup>

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

## 1. Overall dwelling characteristics

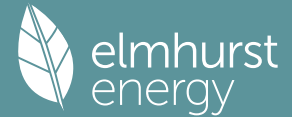
	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	93.0000 (1b)	2.3000 (2b)	213.9000 (1b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0000		213.9000 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 213.9000 (5)

## 2. Ventilation rate

	m <sup>3</sup> per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.0000 (17)
Infiltration rate	0.1500 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1500 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												82.8000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2772	0.2735	0.2698	0.2510	0.2472	0.2285	0.2285	0.2248	0.2360	0.2472	0.2548	0.2622 (25)

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### 3. Heat losses and heat loss parameter

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K
Window (Uw = 1.20)			14.3700	1.1450	16.4542		(27)
Glazed Door (Uw = 1.20)			7.2800	1.1450	8.3359		(27)
Ground Floor			93.0000	0.1500	13.9500	75.0000	6975.0000 (28a)
External Wall	80.0400	21.6500	58.3900	0.1400	8.1746	70.0000	4087.3000 (29a)
External Flat Roof	19.2000		19.2000	0.1100	2.1120	9.0000	172.8000 (30)
Total net area of external elements Aum(A, m <sup>2</sup> )			192.2400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	49.0267	(33)
Party Wall 11.20			11.2000	0.0000	0.0000	70.0000	784.0000 (32)
Party Ceiling			73.8000			40.0000	2952.0000 (32b)
Internal Wall			190.6500			9.0000	1715.8500 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 16686.9500 (34)  
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m<sup>2</sup>K 179.4296 (35)

#### List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	15.5500	0.0040	0.0622
E3 Sill	8.3500	0.0150	0.1253
E4 Jamb	26.9600	0.0260	0.7010
E5 Ground floor (normal)	34.8000	0.0720	2.5056
E7 Party floor between dwellings (in blocks of flats)	40.9200	0.2800	11.4576
E14 Flat roof	16.8000	0.0390	0.6552
E16 Corner (normal)	11.5000	0.0320	0.3680
P2 Party wall - Intermediate floor within a dwelling	4.8600	0.0000	0.0000
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	4.8600	0.0000	0.0000
P1 Party wall - Ground floor	4.8600	0.3200	1.5552

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 17.4300 (36)  
 Point Thermal bridges (36a) = 0.0000  
 Total fabric heat loss (33) + (36) + (36a) = 66.4567 (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	19.5702	19.3055	19.0408	17.7173	17.4526	16.1291	16.1291	15.8644	16.6585	17.4526	17.9820	18.5114 (38)
Average = Sum(39)m / 12 =	86.0269	85.7622	85.4975	84.1740	83.9093	82.5858	82.5858	82.3211	83.1152	83.9093	84.4387	84.9681 (39)
HLP	0.9250	0.9222	0.9193	0.9051	0.9023	0.8880	0.8880	0.8852	0.8937	0.9023	0.9079	0.9136 (40)
HLP (average)												0.9044
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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

Assumed occupancy													2.6646 (42)	
Hot water usage for mixer showers														102.9485 (42a)
Hot water usage for baths														29.6503 (42b)
Hot water usage for other uses														41.9181 (42c)
Average daily hot water use (litres/day)														160.9713 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Energy conte	175.0135	171.4943	167.0846	160.0830	154.5042	148.4638	145.9238	150.3119	154.9710	161.3407	168.4589	174.5169 (44)		
Energy content (annual)	277.1786	244.2056	256.8029	219.1457	207.9924	182.5536	176.4821	186.1175	191.0947	218.9378	240.0006	273.2514 (45)		
Distribution loss (46)m = 0.15 x (45)m													Total = Sum(45)m = 2673.7628	
Water storage loss:	41.5768	36.6308	38.5204	32.8719	31.1989	27.3830	26.4723	27.9176	28.6642	32.8407	36.0001	40.9877 (46)		
Store volume													250.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):													1.9900 (48)	
Temperature factor from Table 2b													0.5400 (49)	
Enter (49) or (54) in (55)													1.0746 (55)	
Total storage loss	33.3126	30.0888	33.3126	32.2380	33.3126	32.2380	33.3126	33.3126	32.2380	33.3126	32.2380	33.3126 (56)		
If cylinder contains dedicated solar storage	33.3126	30.0888	33.3126	32.2380	33.3126	32.2380	33.3126	33.3126	32.2380	33.3126	32.2380	33.3126 (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	333.7536	295.3056	313.3779	273.8957	264.5674	237.3036	233.0571	242.6925	245.8447	275.5128	294.7506	329.8264 (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	333.7536	295.3056	313.3779	273.8957	264.5674	237.3036	233.0571	242.6925	245.8447	275.5128	294.7506	329.8264 (64)		
Total per year (kWh/year) = Sum(64)m =													3339.8878 (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	137.4219	122.0783	130.6470	116.6659	114.4175	104.4991	103.9403	107.1441	107.3390	118.0568	123.6002	136.1161 (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	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.4163	28.7919	23.4151	17.7267	13.2509	11.1870	12.0880	15.7124	21.0891	26.7775	31.2533	33.3172 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	364.9104	368.6970	359.1549	338.8407	313.1977	289.0969	272.9961	269.2094	278.7516	299.0658	324.7088	348.8096 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522 (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)	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839 (71)
Water heating gains (Table 5)	184.7068	181.6642	175.6007	162.0360	153.7869	145.1376	139.7047	144.0109	149.0819	158.6785	171.6670	182.9517 (72)
Total internal gains	688.9776	686.0972	665.1148	625.5476	587.1797	552.3656	531.7329	535.8768	555.8668	591.4659	634.5732	672.0227 (73)

## 6. Solar gains

[Jan]	Area m <sup>2</sup>	Solar flux Table 6a W/m <sup>2</sup>	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W						
Northeast	2.9400	11.2829	0.7600	0.7000	0.7700	12.2297 (75)						
Southeast	0.6400	36.7938	0.7600	0.7000	0.7700	8.6816 (77)						
Southwest	7.7200	36.7938	0.7600	0.7000	0.7700	104.7218 (79)						
Northwest	3.0700	11.2829	0.7600	0.7000	0.7700	12.7704 (81)						
Southwest	7.2800	36.7938	0.7600	0.7000	0.7700	98.7532 (79)						
Solar gains	237.1567	412.2697	586.1423	763.2296	888.6261	897.0434	858.6684	762.8478	647.1123	461.5930	285.5714	201.9782 (83)
Total gains	926.1344	1098.3669	1251.2572	1388.7772	1475.8057	1449.4090	1390.4013	1298.7246	1202.9791	1053.0589	920.1445	874.0009 (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, n1,m (see Table 9a)												21.0000 (85)
tau	53.8815	54.0478	54.2152	55.0676	55.2413	56.1266	56.1266	56.3071	55.7691	55.2413	54.8950	54.5530
alpha	4.5921	4.6032	4.6143	4.6712	4.6828	4.7418	4.7418	4.7538	4.7179	4.6828	4.6597	4.6369
util living area	0.9482	0.9013	0.8181	0.6779	0.5158	0.3627	0.2610	0.2910	0.4690	0.7390	0.9071	0.9575 (86)
Living	20.1252	20.3874	20.6610	20.8787	20.9699	20.9955	20.9993	20.9988	20.9854	20.8511	20.4666	20.0722
Non living	19.1535	19.4736	19.7969	20.0478	20.1409	20.1749	20.1774	20.1796	20.1629	20.0280	19.5857	19.0956
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	20.5525	20.3874	20.6610	20.8787	20.9699	20.9955	20.9993	20.9988	20.9854	20.8511	20.4666	20.2020 (87)
Th 2	20.1463	20.1487	20.1511	20.1632	20.1656	20.1777	20.1777	20.1801	20.1728	20.1656	20.1608	20.1559 (88)
util rest of house	0.9386	0.8850	0.7921	0.6415	0.4731	0.3169	0.2124	0.2394	0.4155	0.6976	0.8889	0.9493 (89)
MIT 2	19.7505	19.4736	19.7969	20.0478	20.1409	20.1749	20.1774	20.1796	20.1629	20.0280	19.5857	19.2867 (90)
Living area fraction									fLA = Living area / (4) =			0.2753 (91)
MIT	19.9713	19.7251	20.0348	20.2765	20.3691	20.4008	20.4036	20.4051	20.3893	20.2546	19.8282	19.5386 (92)
Temperature adjustment												0.0000
adjusted MIT	19.9713	19.7251	20.0348	20.2765	20.3691	20.4008	20.4036	20.4051	20.3893	20.2546	19.8282	19.5386 (93)

## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9364	0.8759	0.7883	0.6466	0.4836	0.3294	0.2258	0.2536	0.4297	0.7022	0.8807	0.9423 (94)
Useful gains	867.2218	962.1138	986.4137	897.9985	713.7428	477.3776	313.9155	329.3393	516.8958	739.4713	810.3808	823.5538 (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	1348.1505	1271.4329	1157.1902	957.6055	727.4201	479.0644	314.1257	329.7029	522.7387	810.1103	1074.7493	1303.2961 (97)
Space heating kWh	357.8110	207.8624	127.0577	42.9171	10.1759	0.0000	0.0000	0.0000	0.0000	52.5554	190.3453	356.9283 (98a)
Space heating requirement - total per year (kWh/year)												1345.6531
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	357.8110	207.8624	127.0577	42.9171	10.1759	0.0000	0.0000	0.0000	0.0000	52.5554	190.3453	356.9283 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1345.6531
Space heating per m <sup>2</sup>										(98c) / (4) =		14.4694 (99)

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## 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 %)													396.5739 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	357.8110	207.8624	127.0577	42.9171	10.1759	0.0000	0.0000	0.0000	0.0000	52.5554	190.3453	356.9283	(98)
Space heating efficiency (main heating system 1)	396.5739	396.5739	396.5739	396.5739	396.5739	0.0000	0.0000	0.0000	0.0000	396.5739	396.5739	396.5739	(210)
Space heating fuel (main heating system)	90.2256	52.4146	32.0389	10.8220	2.5659	0.0000	0.0000	0.0000	0.0000	13.2524	47.9974	90.0030	(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 requirement	333.7536	295.3056	313.3779	273.8957	264.5674	237.3036	233.0571	242.6925	245.8447	275.5128	294.7506	329.8264	(64)
Efficiency of water heater (217)m	190.3379	190.3379	190.3379	190.3379	190.3379	190.3379	190.3379	190.3379	190.3379	190.3379	190.3379	190.3379	(216)
Fuel for water heating, kWh/month	175.3480	155.1481	164.6430	143.8997	138.9988	124.6749	122.4439	127.5062	129.1623	144.7494	154.8566	173.2847	(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	17.0659	15.4144	17.0659	16.5154	17.0659	16.5154	17.0659	17.0659	16.5154	17.0659	16.5154	17.0659	(231)
Lighting	28.3738	22.7625	20.4951	15.0156	11.5985	9.4761	10.5805	13.7530	17.8637	23.4382	26.4734	29.1624	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-107.2353	-171.2785	-271.9863	-322.5632	-353.4257	-329.6075	-324.9584	-306.9943	-266.1019	-206.5237	-124.3406	-89.9480	(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)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1													339.3197 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													190.3379
Water heating fuel used													1754.7155 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7700) mechanical ventilation fans (SFP = 0.7700)													200.9377 (230a)
Total electricity for the above, kWh/year													200.9377 (231)
Electricity for lighting (calculated in Appendix L)													228.9927 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-2874.9632 (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													-350.9977 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	339.3197	16.4900	55.9538	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1754.7155	16.4900	289.3526	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	200.9377	16.4900	33.1346	(249)
Energy for lighting	228.9927	16.4900	37.7609	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2874.9632	16.4900	-474.0814	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-474.0814	(252)
Total energy cost			-57.8795	(255)

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**11a. SAP rating - Individual heating systems**  
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Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	-0.1510 (257)
SAP value		102.4475
SAP rating (Section 12)		102 (258)
SAP band		A

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**12a. Carbon dioxide emissions - Individual heating systems including micro-CHP**  
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	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	339.3197	0.1580	53.6017 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1754.7155	0.1410	247.4267 (264)
Space and water heating			301.0284 (265)
Pumps, fans and electric keep-hot	200.9377	0.1387	27.8725 (267)
Energy for lighting	228.9927	0.1443	33.0507 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2874.9632	0.1333	-383.2718
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-383.2718 (269)
Total CO2, kg/year			-21.3201 (272)
CO2 emissions per m2			-0.2300 (273)
EI value			100.2070
EI rating			100 (274)
EI band			A

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**SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)**  
**CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING**  
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**1. Overall dwelling characteristics**  
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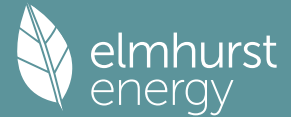
	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	93.0000 (1b)	x 2.3000 (2b)	= 213.9000 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	213.9000 (5)

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**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	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.0000 (17)
Infiltration rate	0.1500 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1500 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	6.6000	6.2000	5.9000	5.2000	5.2000	4.7000	4.7000	4.7000	5.1000	6.0000	6.2000	6.6000 (22)
Wind factor	1.6500	1.5500	1.4750	1.3000	1.3000	1.1750	1.1750	1.1750	1.2750	1.5000	1.5500	1.6500 (22a)
Adj infilt rate	0.2475	0.2325	0.2213	0.1950	0.1950	0.1762	0.1762	0.1762	0.1912	0.2250	0.2325	0.2475 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)

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If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)  
 If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 82.8000 (23c)

Effective ac 0.3335 0.3185 0.3073 0.2810 0.2810 0.2622 0.2622 0.2622 0.2772 0.3110 0.3185 0.3335 (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
Window (Uw = 1.20)			14.3700	1.1450	16.4542		(27)
Glazed Door (Uw = 1.20)			7.2800	1.1450	8.3359		(27)
Ground Floor			93.0000	0.1500	13.9500	75.0000	6975.0000 (28a)
External Wall	80.0400	21.6500	58.3900	0.1400	8.1746	70.0000	4087.3000 (29a)
External Flat Roof	19.2000		19.2000	0.1100	2.1120	9.0000	172.8000 (30)
Total net area of external elements Aum(A, m2)			192.2400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 49.0267		(33)
Party Wall 11.20			11.2000	0.0000	0.0000	70.0000	784.0000 (32)
Party Ceiling			73.8000			40.0000	2952.0000 (32b)
Internal Wall			190.6500			9.0000	1715.8500 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 16686.9500 (34)  
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 179.4296 (35)

#### List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	15.5500	0.0040	0.0622
E3 Sill	8.3500	0.0150	0.1253
E4 Jamb	26.9600	0.0260	0.7010
E5 Ground floor (normal)	34.8000	0.0720	2.5056
E7 Party floor between dwellings (in blocks of flats)	40.9200	0.2800	11.4576
E14 Flat roof	16.8000	0.0390	0.6552
E16 Corner (normal)	11.5000	0.0320	0.3680
P2 Party wall - Intermediate floor within a dwelling	4.8600	0.0000	0.0000
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	4.8600	0.0000	0.0000
P1 Party wall - Ground floor	4.8600	0.3200	1.5552

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 17.4300 (36)  
 Point Thermal bridges (36a) = 0.0000  
 Total fabric heat loss (33) + (36) + (36a) = 66.4567 (37)

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

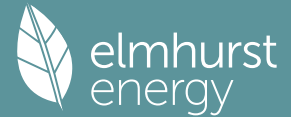
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	23.5408	22.4820	21.6879	19.8349	19.8349	18.5114	18.5114	18.5114	19.5702	21.9526	22.4820	23.5408 (38)
Average = Sum(39)m / 12 =	89.9975	88.9386	88.1445	86.2916	86.2916	84.9681	84.9681	84.9681	86.0269	88.4092	88.9386	89.9975 (39)
HLP	0.9677	0.9563	0.9478	0.9279	0.9279	0.9136	0.9136	0.9136	0.9250	0.9506	0.9563	0.9677 (40)
HLP (average)												0.9390
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	103.3445	101.7914	99.5283	95.1982	92.0027	88.4391	86.4136	88.6596	91.1216	94.9478	99.3709	102.9485 (42a)
Hot water usage for baths	29.7509	29.3090	28.6868	27.5396	26.6806	25.7280	25.2135	25.8314	26.5041	27.5233	28.6942	29.6503 (42b)
Hot water usage for other uses	41.9181	40.3938	38.8695	37.3453	35.8210	34.2967	34.2967	35.8210	37.3453	38.8695	40.3938	41.9181 (42c)
Average daily hot water use (litres/day)												160.9713 (43)
Daily hot water use	175.0135	171.4943	167.0846	160.0830	154.5042	148.4638	145.9238	150.3119	154.9710	161.3407	168.4589	174.5169 (44)
Energy content (annual)	277.1786	244.2056	256.8029	219.1457	207.9924	182.5536	176.4821	186.1175	191.0947	218.9378	240.0006	273.2514 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 2673.7628
Water storage loss:	41.5768	36.6308	38.5204	32.8719	31.1989	27.3830	26.4723	27.9176	28.6642	32.8407	36.0001	40.9877 (46)
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9900 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0746 (55)
Total storage loss	33.3126	30.0888	33.3126	32.2380	33.3126	32.2380	33.3126	33.3126	32.2380	33.3126	32.2380	33.3126 (56)
If cylinder contains dedicated solar storage	33.3126	30.0888	33.3126	32.2380	33.3126	32.2380	33.3126	33.3126	32.2380	33.3126	32.2380	33.3126 (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	333.7536	295.3056	313.3779	273.8957	264.5674	237.3036	233.0571	242.6925	245.8447	275.5128	294.7506	329.8264 (62)
WVHRS	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	333.7536	295.3056	313.3779	273.8957	264.5674	237.3036	233.0571	242.6925	245.8447	275.5128	294.7506	329.8264 (64)



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Electric shower(s)	Total per year (kWh/year) = Sum(64)m = 3339.8878 (64)											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	137.4219	122.0783	130.6470	116.6659	114.4175	104.4991	103.9403	107.1441	107.3390	118.0568	123.6002	136.1161 (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	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.4163	28.7919	23.4151	17.7267	13.2509	11.1870	12.0880	15.7124	21.0891	26.7775	31.2533	33.3172 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	364.9104	368.6970	359.1549	338.8407	313.1977	289.0969	272.9961	269.2094	278.7516	299.0658	324.7088	348.8096 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522 (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)	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839 (71)
Water heating gains (Table 5)	184.7068	181.6642	175.6007	162.0360	153.7869	145.1376	139.7047	144.0109	149.0819	158.6785	171.6670	182.9517 (72)
Total internal gains	688.9776	686.0972	665.1148	625.5476	587.1797	552.3656	531.7329	535.8768	555.8668	591.4659	634.5732	672.0227 (73)

## 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	FF Specific data or Table 6c	Access factor Table 6d	Gains W					
Northeast	2.9400	15.4493	0.7600	0.7000	0.7700	16.7456 (75)						
Southeast	0.6400	47.1180	0.7600	0.7000	0.7700	11.1176 (77)						
Southwest	7.7200	47.1180	0.7600	0.7000	0.7700	134.1064 (79)						
Northwest	3.0700	15.4493	0.7600	0.7000	0.7700	17.4860 (81)						
Southwest	7.2800	47.1180	0.7600	0.7000	0.7700	126.4630 (79)						
Solar gains	305.9186	457.0949	647.2675	862.7411	958.4385	1044.2999	903.8535	861.9544	745.3670	531.8606	355.0240	259.7081 (83)
Total gains	994.8962	1143.1921	1312.3823	1488.2887	1545.6181	1596.6655	1435.5864	1397.8312	1301.2338	1123.3265	989.5972	931.7307 (84)

## 7. Mean internal temperature (heating season)

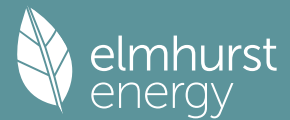
### Temperature during heating periods in the living area from Table 9, Th1 (C)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, n1,m (see Table 9a)	51.5044	52.1175	52.5871	53.7163	53.7163	54.5530	54.5530	54.5530	53.8815	52.4296	52.1175	51.5044
tau	4.4336	4.4745	4.5058	4.5811	4.5811	4.6369	4.6369	4.6369	4.5921	4.4953	4.4745	4.4336
util living area	0.8999	0.8478	0.7480	0.6103	0.4764	0.3286	0.2718	0.2670	0.3869	0.6281	0.8200	0.9078 (86)
Living	20.4208	20.5849	20.7854	20.9224	20.9775	20.9968	20.9989	20.9990	20.9935	20.9286	20.7130	20.4139
Non living	19.4881	19.6858	19.9157	20.0738	20.1263	20.1540	20.1555	20.1555	20.1425	20.0670	19.8392	19.4824
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	20.7037	20.5849	20.7854	20.9224	20.9775	20.9968	20.9989	20.9990	20.9935	20.9286	20.7130	20.4959 (87)
Th 2	20.1103	20.1199	20.1271	20.1439	20.1439	20.1559	20.1559	20.1559	20.1463	20.1247	20.1199	20.1103 (88)
util rest of house	0.8806	0.8225	0.7138	0.5705	0.4323	0.2844	0.2221	0.2160	0.3322	0.5744	0.7853	0.8889 (89)
MIT 2	19.8623	19.6858	19.9157	20.0738	20.1263	20.1540	20.1555	20.1555	20.1425	20.0670	19.8392	19.5955 (90)
Living area fraction	20.0939	19.9333	20.1551	20.3074	20.3606	20.3860	20.3876	20.3877	20.3768	20.3042	20.0798	19.8434 (92)
Temperature adjustment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
adjusted MIT	20.0939	19.9333	20.1551	20.3074	20.3606	20.3860	20.3876	20.3877	20.3768	20.3042	20.0798	19.8434 (93)

## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8802	0.8167	0.7149	0.5783	0.4436	0.2965	0.2358	0.2300	0.3470	0.5858	0.7836	0.8824 (94)
Useful gains	875.6745	933.6273	938.2647	860.6266	685.5821	473.4251	338.5017	321.5627	451.5915	658.0079	775.4264	822.1300 (95)
Ext temp.	6.9000	7.1000	8.3000	9.9000	12.3000	14.8000	16.4000	16.6000	15.1000	12.5000	9.8000	7.4000 (96)
Heat loss rate W	1187.4165	1141.3755	1044.9626	898.0688	695.5634	474.6291	338.8221	321.8360	453.9448	689.9593	914.2684	1119.8715 (97)
Space heating kWh	231.9361	139.6068	79.3832	26.9584	7.4261	0.0000	0.0000	0.0000	0.0000	23.7718	99.9662	221.5197 (98a)
Space heating requirement - total per year (kWh/year)												830.5683
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

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Space heating kWh	231.9361	139.6068	79.3832	26.9584	7.4261	0.0000	0.0000	0.0000	0.0000	23.7718	99.9662	221.5197 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												830.5683
Space heating per m2												(98c) / (4) = 8.9308 (99)

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**9a. Energy requirements - Individual heating systems, including micro-CHP**  
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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 %)												399.1554 (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	231.9361	139.6068	79.3832	26.9584	7.4261	0.0000	0.0000	0.0000	0.0000	23.7718	99.9662	221.5197	(98)
Space heating efficiency (main heating system 1)	399.1554	399.1554	399.1554	399.1554	399.1554	0.0000	0.0000	0.0000	0.0000	399.1554	399.1554	399.1554	(210)
Space heating fuel (main heating system)	58.1067	34.9755	19.8878	6.7539	1.8605	0.0000	0.0000	0.0000	0.0000	5.9555	25.0444	55.4971	(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 requirement	333.7536	295.3056	313.3779	273.8957	264.5674	237.3036	233.0571	242.6925	245.8447	275.5128	294.7506	329.8264	(64)
Efficiency of water heater (217)m	189.9766	189.9766	189.9766	189.9766	189.9766	189.9766	189.9766	189.9766	189.9766	189.9766	189.9766	189.9766	(216)
Fuel for water heating, kWh/month	175.6814	155.4431	164.9560	144.1734	139.2631	124.9120	122.6767	127.7486	129.4079	145.0246	155.1510	173.6142	(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	17.0659	15.4144	17.0659	16.5154	17.0659	16.5154	17.0659	17.0659	16.5154	17.0659	16.5154	17.0659	(231)
Lighting	28.3738	22.7625	20.4951	15.0156	11.5985	9.4761	10.5805	13.7530	17.8637	23.4382	26.4734	29.1624	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-139.2072	-191.2555	-296.5607	-347.6889	-366.3384	-348.2293	-332.3480	-326.5449	-293.1069	-234.8395	-154.5036	-116.8654	(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)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1													208.0814 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													189.9766
Water heating fuel used													1758.0520 (219)
Space cooling fuel													0.0000 (221)

Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7700) mechanical ventilation fans (SFP = 0.7700)													200.9377 (230a)
Total electricity for the above, kWh/year													200.9377 (231)
Electricity for lighting (calculated in Appendix L)													228.9927 (232)

Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-3147.4882 (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													-751.4245 (238)

-----  
**10a. Fuel costs - using BEDF prices (528)**  
 -----

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	208.0814	21.5100	44.7583	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1758.0520	21.5100	378.1570	(247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(247a)
Pumps, fans and electric keep-hot	200.9377	21.5100	43.2217	(249)
Energy for lighting	228.9927	21.5100	49.2563	(250)
Additional standing charges			0.0000	(251)

# Full SAP Calculation Printout



Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3147.4882	21.5100	-677.0247
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-677.0247 (252)
Total energy cost			-161.6314 (255)

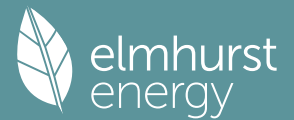
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 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP  
 -----

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	208.0814	0.1584	32.9594 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1758.0520	0.1410	247.8972 (264)
Space and water heating			280.8566 (265)
Pumps, fans and electric keep-hot	200.9377	0.1387	27.8725 (267)
Energy for lighting	228.9927	0.1443	33.0507 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3147.4882	0.1341	-422.0691
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-422.0691 (269)
Total CO2, kg/year			-80.2893 (272)

-----  
 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	208.0814	1.5863	330.0806 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1758.0520	1.5214	2674.6955 (278)
Space and water heating			3004.7761 (279)
Pumps, fans and electric keep-hot	200.9377	1.5128	303.9785 (281)
Energy for lighting	228.9927	1.5338	351.2366 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3147.4882	1.4956	-4707.2924
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-4707.2924 (283)
Total Primary energy kWh/year			-1047.3012 (286)

# Predicted Energy Assessment



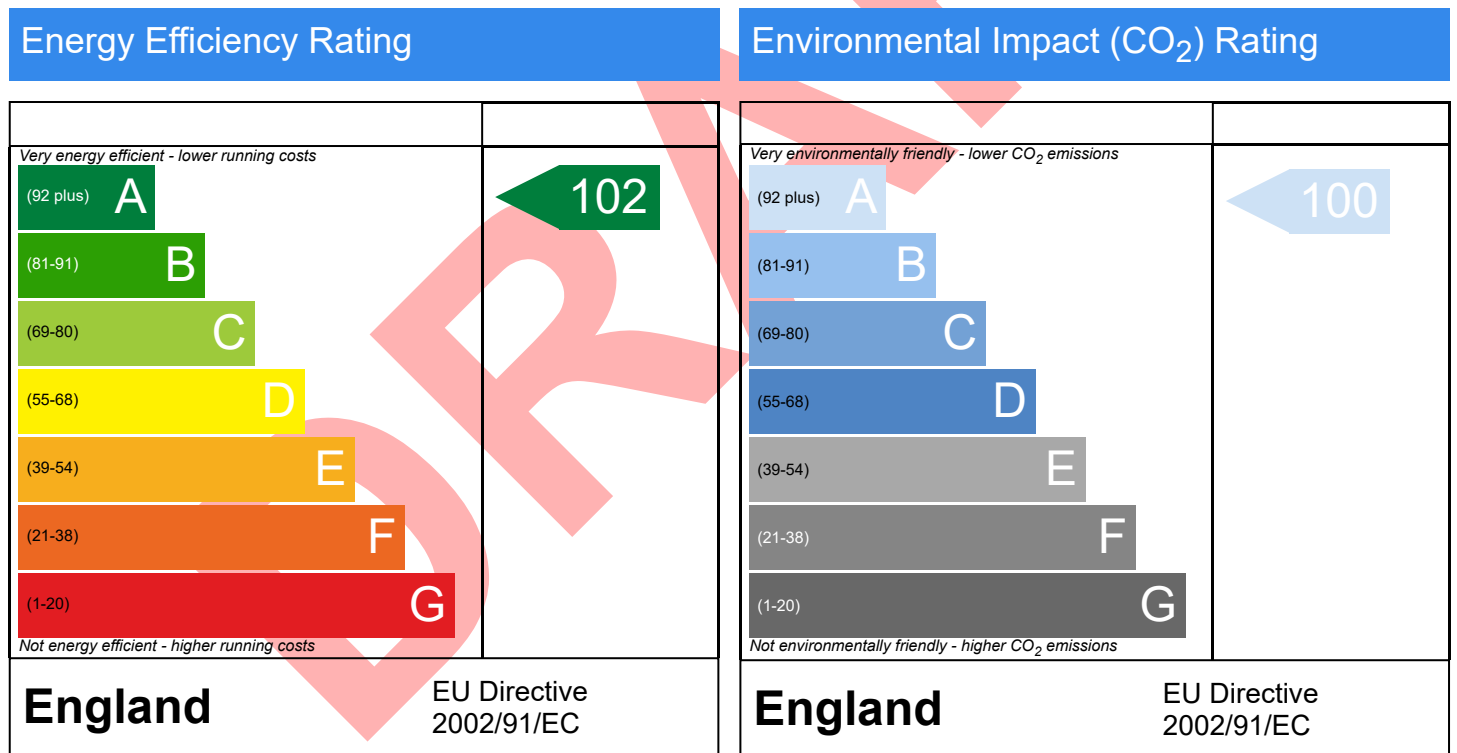
Block 3, 236 Henvver Road, Newquay, Cornwall, TR7 3EM

Dwelling type:  
Date of assessment:  
Produced by:  
Total floor area:  
DRRN:

Flat, Semi-Detached  
11/10/2023  
Kyle Jones  
93 m<sup>2</sup>

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

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



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

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

# Building Regulations England Part L (BREL) Compliance Report

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

Date: Wed 11 Oct 2023 14:17:14

Project Information			
Assessed By	Kyle Jones	Building Type	Flat, Semi-detached
OCDEA Registration	EES/027281	Assessment Date	2023-10-11

Dwelling Details			
Assessment Type	As designed	Total Floor Area	75 m <sup>2</sup>
Site Reference	709914_Flat 2	Plot Reference	709914_Flat 2
Address	Block 3 236 Henvver Road, Newquay, TR7 3EM		

Client Details	
Name	Keith Parker
Company	Keith Parker Architects
Address	Block 3, 236 Henvver Road, Cornwall, Newquay, TR7 3EM

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

1a Target emission rate and dwelling emission rate			
Fuel for main heating system	Electricity		
Target carbon dioxide emission rate	10.07 kgCO <sub>2</sub> /m <sup>2</sup>		
Dwelling carbon dioxide emission rate	-0.43 kgCO <sub>2</sub> /m <sup>2</sup>		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	53.95 kWh <sub>PE</sub> /m <sup>2</sup>		
Dwelling primary energy	-7.17 kWh <sub>PE</sub> /m <sup>2</sup>		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	43.6 kWh/m <sup>2</sup>		
Dwelling fabric energy efficiency	41.9 kWh/m <sup>2</sup>		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m <sup>2</sup> K]	Dwelling average U-Value [W/m <sup>2</sup> K]	Element with highest individual U-Value	
External walls	0.26	0.14	Walls (1) (0.14)	OK
Party walls	0.2	0	Party Wall (1) (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	N/A	N/A	N/A
Roofs	0.16	0.11	Roof (2) (0.15)	OK
Windows, doors, and roof windows	1.6	1.2	NE (1.2)	OK
Rooflights	2.2	1.2	NW, North West (1.2)	OK

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	Net area [m <sup>2</sup> ]	U-Value [W/m <sup>2</sup> K]
Exposed wall: Walls (1)	80.34	0.14 (!)
Party wall: Party Wall (1)	14.1	0 (!)
Exposed roof: Roof (1)	70.11	0.11
Exposed roof: Roof (2)	4.46	0.15

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m <sup>2</sup> ]	Orientation	Frame factor	U-Value [W/m <sup>2</sup> K]
NE, Window	2.94	North East	0.7	1.2
SW, Window	3.86	South West	0.7	1.2
SW, Glazed Door	7.28	South West	0.7	1.2
SE, Window	0.64	South East	0.7	1.2
NW, Glazed Door	3.64	North West	0.7	1.2
NW, Roof light	0.77	North West	0.7	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Not government-approved scheme	0.004 (!)	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E3: Sill	Not government-approved scheme	0.015 (!)	
External wall	E4: Jamb	Not government-approved scheme	0.026 (!)	
External wall	E7: Party floor between dwellings (in blocks of flats)	SAP table default	0.28	
External wall	E14: Flat roof	Not government-approved scheme	0.039 (!)	
External wall	E16: Corner (normal)	Not government-approved scheme	0.032 (!)	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	SAP table default	0 (!)	
Party wall	P4: Roof (insulation at ceiling level)	SAP table default	0.48	
External wall	E11: Eaves (insulation at rafter level)	Not government-approved scheme	0.02 (!)	
External wall	E13: Gable (insulation at rafter level)	Not government-approved scheme	0.041	

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

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

### 4 Space heating

<b>Main heating system 1:</b> Heat pump with radiators or underfloor heating - Electricity	
Efficiency	388.7%
Emitter type	Radiators
Flow temperature	35°C
System type	Heat Pump
Manufacturer	Atlantic
Model	Logic Air 8kW
Commissioning	
<b>Secondary heating system:</b> N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

### 5 Hot water

<b>Cylinder/store</b> - type: Cylinder	
Capacity	250 litres
Declared heat loss	1.99 kWh/day
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	
<b>Waste water heat recovery system 1</b> - type: N/A	
Efficiency	
Manufacturer	
Model	

### 6 Controls

<b>Main heating 1</b> - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	
<b>Water heating</b> - type: Cylinder thermostat and HW separately timed	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	75 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
<b>System type:</b> Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	1.5 W/(l/s)	
Specific fan power	0.52 W/(l/s)	OK
Minimum permitted heat recovery efficiency	73%	
Heat recovery efficiency	92%	OK
Manufacturer/Model	Sentinel Kinetic Plus B	
Commissioning		

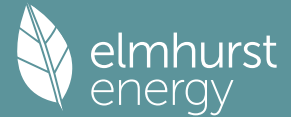
9 Local generation		
Technology type: <b>Photovoltaic system (1)</b>		
Peak power	5.5 kWp	
Orientation	South West	
Pitch	30°	
Overshading	1 (overshading factor calculated according to MCS)	
Manufacturer		
MCS certificate		

10 Heat networks		
N/A		

11 Supporting documentary evidence		
N/A		

12 Declarations		
<b>a. Assessor Declaration</b>		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed:	Assessor ID:	
Name:	Date:	
<b>b. Client Declaration</b>		
N/A		

# Full SAP Calculation Printout



Property Reference	709914_Flat 2		Issued on Date	11/10/2023	
Assessment Reference	709914_Flat 2	Prop Type Ref	709914_Flat 1		
Property	Block 3, 236 Henver Road, Newquay, Cornwall, TR7 3EM				
SAP Rating	104 A	DER	-0.43	TER	10.07
Environmental	100 A	% DER < TER			104.27
CO <sub>2</sub> Emissions (t/year)	-0.09	DFEE	41.90	TFEE	43.63
Compliance Check	See BREL	% DFEE < TFEE			3.97
% DPER < TPER	113.29	DPER	-7.17	TPER	53.95
Assessor Details	Mr. Kyle Jones			Assessor ID	AV53-0001
Client	709914, Keith Parker				

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 <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	75.4000 (1b)	2.9000 (2b)	218.6600 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	75.4000		
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 218.6600 (5)

## 2. Ventilation rate

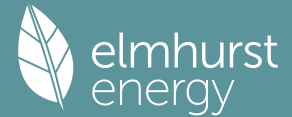
	m <sup>3</sup> per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500 (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	Jan 1.2750, Feb 1.2500, Mar 1.2250, Apr 1.1000, May 1.0750, Jun 0.9500, Jul 0.9500, Aug 0.9250, Sep 1.0000, Oct 1.0750, Nov 1.1250, Dec 1.1750	(22a)
Adj infilt rate	Jan 0.1912, Feb 0.1875, Mar 0.1837, Apr 0.1650, May 0.1612, Jun 0.1425, Jul 0.1425, Aug 0.1388, Sep 0.1500, Oct 0.1612, Nov 0.1687, Dec 0.1762	(22b)
Balanced mechanical ventilation with heat recovery		
If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		82.8000 (23c)
Effective ac	Jan 0.2772, Feb 0.2735, Mar 0.2698, Apr 0.2510, May 0.2472, Jun 0.2285, Jul 0.2285, Aug 0.2248, Sep 0.2360, Oct 0.2472, Nov 0.2548, Dec 0.2622	(25)

## 3. Heat losses and heat loss parameter

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K
Window (U <sub>w</sub> = 1.20)			7.4400	1.1450	8.5191		(27)
Glazed Door (U <sub>w</sub> = 1.20)			10.9200	1.1450	12.5038		(27)
NW			0.7700	1.1450	0.8817		(27a)



# Full SAP Calculation Printout



External Wall	98.7000	18.3600	80.3400	0.1400	11.2476	70.0000	5623.8000 (29a)
External Flat Roof	70.1100		70.1100	0.1100	7.7121	9.0000	630.9900 (30)
External Slope Roof	5.2300	0.7700	4.4600	0.1500	0.6690	9.0000	40.1400 (30)
Total net area of external elements Aum(A, m2)			174.0400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.5333		(33)
Party Wall 11.20			14.1000	0.0000	0.0000	70.0000	987.0000 (32)
Party Floor			75.4000			40.0000	3016.0000 (32d)
Internal Wall			147.4500			9.0000	1327.0500 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 11624.9800 (34)  
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 154.1775 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	11.2600	0.0040	0.0450
E3 Sill	11.2600	0.0150	0.1689
E4 Jamb	24.4200	0.0260	0.6349
E7 Party floor between dwellings (in blocks of flats)	40.9200	0.2800	11.4576
E14 Flat roof	34.8800	0.0390	1.3603
E16 Corner (normal)	14.5000	0.0320	0.4640
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	4.8600	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	4.8600	0.4800	2.3328
E11 Eaves (insulation at rafter level)	5.0000	0.0200	0.1000
E13 Gable (insulation at rafter level)	1.0400	0.0410	0.0426

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 16.6062 (36)  
 Point Thermal bridges (36a) = 0.0000  
 Total fabric heat loss (33) + (36) + (36a) = 58.1395 (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	20.0058	19.7352	19.4646	18.1116	17.8410	16.4881	16.4881	16.2175	17.0292	17.8410	18.3822	18.9234 (38)
Average = Sum(39)m / 12 =	78.1453	77.8747	77.6041	76.2511	75.9805	74.6276	74.6276	74.3570	75.1687	75.9805	76.5217	77.0629 (39)
												76.1835

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0364	1.0328	1.0292	1.0113	1.0077	0.9898	0.9898	0.9862	0.9969	1.0077	1.0149	1.0221 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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

Assumed occupancy 2.3698 (42)

Hot water usage for mixer showers	95.9300	94.4884	92.3876	88.3682	85.4020	82.0941	80.2139	82.2987	84.5841	88.1358	92.2415	95.5625 (42a)
Hot water usage for baths	27.6253	27.2150	26.6372	25.5720	24.7743	23.8898	23.4121	23.9858	24.6104	25.5569	26.6441	27.5319 (42b)
Hot water usage for other uses	38.8991	37.4846	36.0700	34.6555	33.2410	31.8265	31.8265	33.2410	34.6555	36.0700	37.4846	38.8991 (42c)
Average daily hot water use (litres/day)												149.4200 (43)

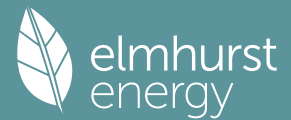
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	162.4543	159.1879	155.0949	148.5957	143.4173	137.8104	135.4524	139.5255	143.8501	149.7627	156.3702	161.9934 (44)
Energy content (annual)	257.2879	226.6815	238.3751	203.4201	193.0672	169.4540	163.8180	172.7617	177.3815	203.2266	222.7780	253.6425 (45)
Distribution loss (46)m = 0.15 x (45)m	38.5932	34.0022	35.7563	30.5130	28.9601	25.4181	24.5727	25.9143	26.6072	30.4840	33.4167	38.0464 (46)
Water storage loss:												250.0000 (47)
Store volume												1.9900 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												1.0746 (55)
Enter (49) or (54) in (55)												
Total storage loss	33.3126	30.0888	33.3126	32.2380	33.3126	32.2380	33.3126	33.3126	32.2380	33.3126	32.2380	33.3126 (56)
If cylinder contains dedicated solar storage	33.3126	30.0888	33.3126	32.2380	33.3126	32.2380	33.3126	33.3126	32.2380	33.3126	32.2380	33.3126 (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	313.8629	277.7815	294.9501	258.1701	249.6422	224.2040	220.3930	229.3367	232.1315	259.8016	277.5280	310.2175 (62)
WVHRS	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	313.8629	277.7815	294.9501	258.1701	249.6422	224.2040	220.3930	229.3367	232.1315	259.8016	277.5280	310.2175 (64)
Total per year (kWh/year)												3148.0189 (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	130.8082	116.2516	124.5197	111.4372	109.4549	100.1434	99.7295	102.7033	102.7794	112.8328	117.8737	129.5961 (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
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

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(66)m	118.4897	118.4897	118.4897	118.4897	118.4897	118.4897	118.4897	118.4897	118.4897	118.4897	118.4897	118.4897	118.4897	118.4897	118.4897	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	105.6986	117.0234	105.6986	109.2219	105.6986	109.2219	105.6986	105.6986	109.2219	105.6986	109.2219	105.6986	109.2219	105.6986	109.2219	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	209.5593	211.7339	206.2540	194.5881	179.8619	166.0214	156.7751	154.6005	160.0804	171.7463	186.4725	200.3130	(68)			
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.8490	34.8490	34.8490	34.8490	34.8490	34.8490	34.8490	34.8490	34.8490	34.8490	34.8490	34.8490	(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)	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	(71)			
Water heating gains (Table 5)	175.8175	172.9934	167.3652	154.7739	147.1167	139.0881	134.0450	138.0420	142.7491	151.6570	163.7134	174.1883	(72)			
Total internal gains	549.6223	560.2977	537.8647	517.1307	491.2242	472.8783	455.0656	456.8881	470.5983	487.6489	517.9547	538.7468	(73)			

## 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W						
Northeast	2.9400	11.2829	0.7600	0.7000	0.7700	12.2297	(75)						
Southeast	0.6400	36.7938	0.7600	0.7000	0.7700	8.6816	(77)						
Southwest	3.8600	36.7938	0.7600	0.7000	0.7700	52.3609	(79)						
Southwest	7.2800	36.7938	0.7600	0.7000	0.7700	98.7532	(79)						
Northwest	3.6400	11.2829	0.7600	0.7000	0.7700	15.1415	(81)						
Northwest	0.7700	16.3666	0.7600	0.7000	1.0000	6.0340	(82)						
Solar gains	193.2009	340.3248	495.7096	664.9691	791.4220	806.2690	768.7637	671.2318	553.7973	384.2150	233.4501	164.0226	(83)
Total gains	742.8232	900.6224	1033.5743	1182.0998	1282.6462	1279.1473	1223.8293	1128.1199	1024.3955	871.8638	751.4048	702.7695	(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)	41.3226	41.4661	41.6107	42.3490	42.4999	43.2704	43.2704	43.4278	42.9588	42.4999	42.1993	41.9029		
tau	3.7548	3.7644	3.7740	3.8233	3.8333	3.8847	3.8847	3.8952	3.8639	3.8333	3.8133	3.7935		
util living area	0.9443	0.8978	0.8227	0.6853	0.5242	0.3682	0.2671	0.3012	0.4876	0.7524	0.9040	0.9524	(86)	
Living	19.7311	20.0632	20.4210	20.7617	20.9275	20.9860	20.9969	20.9951	20.9593	20.7157	20.1872	19.6804		
Non living	18.6051	19.0135	19.4431	19.8412	20.0154	20.0827	20.0905	20.0926	20.0567	19.8056	19.1845	18.5508		
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	20.3509	20.0632	20.4210	20.7617	20.9275	20.9860	20.9969	20.9951	20.9593	20.7157	20.1872	19.8650	(87)	
Th 2	20.0531	20.0561	20.0590	20.0739	20.0769	20.0919	20.0919	20.0949	20.0859	20.0769	20.0710	20.0650	(88)	
util rest of house	0.9346	0.8818	0.7975	0.6483	0.4786	0.3178	0.2125	0.2428	0.4288	0.7114	0.8861	0.9440	(89)	
MIT 2	19.4758	19.0135	19.4431	19.8412	20.0154	20.0827	20.0905	20.0926	20.0567	19.8056	19.1845	18.8236	(90)	
Living area fraction	19.8075	19.4114	19.8137	20.1901	20.3612	20.4251	20.4341	20.4347	fLA = Living area / (4) =	20.3988	20.1506	19.5645	0.3790	(91)
MIT	19.8075	19.4114	19.8137	20.1901	20.3612	20.4251	20.4341	20.4347	20.3988	20.1506	19.5645	19.2183	(92)	
Temperature adjustment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(93)	
adjusted MIT	19.8075	19.4114	19.8137	20.1901	20.3612	20.4251	20.4341	20.4347	20.3988	20.1506	19.5645	19.2183	(93)	

## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9317	0.8692	0.7904	0.6531	0.4929	0.3364	0.2332	0.2648	0.4493	0.7149	0.8748	0.9348	(94)
Useful gains	692.1137	782.8630	816.9281	772.0369	632.2365	430.3550	285.3522	298.7384	460.2581	623.2913	657.3536	656.9809	(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	1211.8380	1130.0707	1033.2008	860.8828	658.0801	434.7127	286.1274	300.0058	473.4754	725.6565	953.8077	1157.3572	(97)
Space heating kWh	386.6749	233.3236	160.9069	63.9691	19.2277	0.0000	0.0000	0.0000	0.0000	76.1597	213.4469	372.2799	(98a)
Space heating requirement - total per year (kWh/year)												1525.9886	
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	386.6749	233.3236	160.9069	63.9691	19.2277	0.0000	0.0000	0.0000	0.0000	76.1597	213.4469	372.2799	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1525.9886	
Space heating per m2										(98c) / (4) =		20.2386	(99)

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

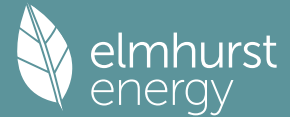
Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	388.6691	(206)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	386.6749	233.3236	160.9069	63.9691	19.2277	0.0000	0.0000	0.0000	0.0000	76.1597	213.4469	372.2799	(98)
Space heating efficiency (main heating system 1)	388.6691	388.6691	388.6691	388.6691	388.6691	0.0000	0.0000	0.0000	0.0000	388.6691	388.6691	388.6691	(210)
Space heating fuel (main heating system)	99.4869	60.0314	41.3994	16.4585	4.9471	0.0000	0.0000	0.0000	0.0000	19.5950	54.9174	95.7833	(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	313.8629	277.7815	294.9501	258.1701	249.6422	224.2040	220.3930	229.3367	232.1315	259.8016	277.5280	310.2175	(64)
Efficiency of water heater	191.2533	191.2533	191.2533	191.2533	191.2533	191.2533	191.2533	191.2533	191.2533	191.2533	191.2533	191.2533	(216)
Fuel for water heating, kWh/month	164.1085	145.2427	154.2196	134.9886	130.5296	117.2288	115.2362	119.9126	121.3739	135.8416	145.1102	162.2024	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	16.4941	14.8979	16.4941	15.9621	16.4941	15.9621	16.4941	16.4941	15.9621	16.4941	15.9621	16.4941	(231)
Lighting	22.5215	18.0676	16.2679	11.9185	9.2062	7.5216	8.3982	10.9163	14.1792	18.6039	21.0131	23.1475	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-112.2640	-177.1859	-276.6083	-318.6847	-339.3130	-311.8283	-307.5945	-295.5028	-262.0869	-210.7877	-129.4493	-94.2825	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	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)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1													392.6189 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													191.2533
Water heating fuel used													1645.9946 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7280)													
mechanical ventilation fans (SFP = 0.7280)													194.2051 (230a)
Total electricity for the above, kWh/year													194.2051 (231)
Electricity for lighting (calculated in Appendix L)													181.7615 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-2835.5879 (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													-421.0078 (238)
-----													
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP													
-----													
						Energy		Emission factor		Emissions			
						kWh/year		kg CO2/kWh		kg CO2/year			
Space heating - main system 1						392.6189		0.1572		61.7322			(261)
Total CO2 associated with community systems										0.0000			(373)
Water heating (other fuel)						1645.9946		0.1410		232.0390			(264)
Space and water heating										293.7712			(265)
Pumps, fans and electric keep-hot						194.2051		0.1387		26.9386			(267)
Energy for lighting						181.7615		0.1443		26.2338			(268)
Energy saving/generation technologies													
PV Unit electricity used in dwelling						-2835.5879		0.1339		-379.5464			
PV Unit electricity exported						0.0000		0.0000		0.0000			
Total										-379.5464			(269)
Total CO2, kg/year										-32.6028			(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)										-0.4300			(273)
-----													
13a. Primary energy - Individual heating systems including micro-CHP													
-----													
							Energy	Primary energy factor		Primary energy			

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	kWh/year	kg CO2/kWh	kWh/year
Space heating - main system 1	392.6189	1.5820	621.1286 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1645.9946	1.5213	2503.9968 (278)
Space and water heating			3125.1255 (279)
Pumps, fans and electric keep-hot	194.2051	1.5128	293.7934 (281)
Energy for lighting	181.7615	1.5338	278.7919 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2835.5879	1.4947	-4238.2699
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-4238.2699 (283)
Total Primary energy kWh/year			-540.5591 (286)
Dwelling Primary energy Rate (DPER)			-7.1700 (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	75.4000 (1b)	2.9000 (2b)	218.6600 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	75.4000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 218.6600 (5)

### 2. Ventilation rate

		m3 per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		30.0000 / (5) = 0.1372 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3872 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3872 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4937	0.4840	0.4743	0.4259	0.4162	0.3678	0.3678	0.3582	0.3872	0.4162	0.4356	0.4550 (22b)
Effective ac	0.6219	0.6171	0.6125	0.5907	0.5866	0.5677	0.5677	0.5641	0.5750	0.5866	0.5949	0.6035 (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 Opening Type (Uw = 1.20)			18.0900	1.1450	20.7137		(27)
NW			0.7600	1.8519	1.4074		(27a)
External Wall	98.7000	18.0900	80.6100	0.1800	14.5098		(29a)
External Flat Roof	70.1100		70.1100	0.1100	7.7121		(30)
External Slope Roof	5.2300	0.7600	4.4700	0.1100	0.4917		(30)
Total net area of external elements Aum(A, m2)			174.0400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.8347		(33)
Party Wall 11.20			14.1000	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	Length	Psi-value	Total
List of Thermal Bridges			154.1775 (35)
K1 Element			

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E2 Other lintels (including other steel lintels)	11.2600	0.0500	0.5630
E3 Sill	11.2600	0.0500	0.5630
E4 Jamb	24.4200	0.0500	1.2210
E7 Party floor between dwellings (in blocks of flats)	40.9200	0.0700	2.8644
E14 Flat roof	34.8800	0.0800	2.7904
E16 Corner (normal)	14.5000	0.0900	1.3050
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	4.8600	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	4.8600	0.1200	0.5832
E11 Eaves (insulation at rafter level)	5.0000	0.0400	0.2000
E13 Gable (insulation at rafter level)	1.0400	0.0800	0.0832
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			10.1732 (36)
Point Thermal bridges			0.0000 (36a) =
Total fabric heat loss		(33) + (36) + (36a) =	55.0079 (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	44.8720	44.5306	44.1959	42.6239	42.3298	40.9606	40.9606	40.7070	41.4880	42.3298	42.9248	43.5468 (38)
Heat transfer coeff	99.8800	99.5385	99.2038	97.6318	97.3377	95.9685	95.9685	95.7150	96.4959	97.3377	97.9327	98.5547 (39)
Average = Sum(39)m / 12 =												97.6304

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3247	1.3201	1.3157	1.2949	1.2910	1.2728	1.2728	1.2694	1.2798	1.2910	1.2988	1.3071 (40)
HLP (average)												1.2948
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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

Assumed occupancy													2.3698 (42)
Hot water usage for mixer showers													63.7083 (42a)
Hot water usage for baths													27.5319 (42b)
Hot water usage for other uses													38.8991 (42c)
Average daily hot water use (litres/day)													119.9386 (43)

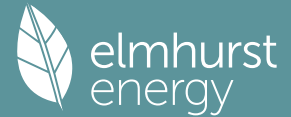
  

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	130.4777	127.6918	124.2990	119.1396	114.9500	110.4457	108.7145	112.0926	115.6554	120.3841	125.6230	130.1392 (44)	
Energy content (annual)	206.6447	181.8314	191.0430	163.0962	154.7447	135.8059	131.4807	138.7940	142.6146	163.3601	178.9730	203.7666 (45)	
Distribution loss (46)m = 0.15 x (45)m	30.9967	27.2747	28.6564	24.4644	23.2117	20.3709	19.7221	20.8191	21.3922	24.5040	26.8459	30.5650 (46)	
Water storage loss:													250.0000 (47)
Store volume													1.8903 (48)
a) If manufacturer declared loss factor is known (kWh/day):													0.5400 (49)
Temperature factor from Table 2b													1.0208 (55)
Enter (49) or (54) in (55)													
Total storage loss	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444 (56)	
If cylinder contains dedicated solar storage													
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 (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 (61)	
Total heat required for water heating calculated for each month	261.5515	231.4246	245.9497	216.2318	209.6515	188.9415	186.3875	193.7008	195.7502	218.2669	232.1086	258.6734 (62)	
MWHRs	-29.2368	-25.8573	-27.0762	-22.4202	-20.8948	-17.8798	-16.7595	-17.8220	-18.4992	-21.8085	-24.7064	-28.6954 (63a)	
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)	
FGHRs	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)	
Output from w/h	232.3147	205.5674	218.8735	193.8116	188.7567	171.0616	169.6280	175.8788	177.2511	196.4584	207.4022	229.9780 (64)	
Total per year (kWh/year) = Sum(64)m =													2366.9820 (64)
12Total per year (kWh/year)													2367 (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	112.6348	100.1335	107.4472	96.7380	95.3781	87.6639	87.6428	90.0745	89.9278	98.2427	102.0170	111.6778 (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	118.4897	118.4897	118.4897	118.4897	118.4897	118.4897	118.4897	118.4897	118.4897	118.4897	118.4897	118.4897 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	105.6986	117.0234	105.6986	109.2219	105.6986	109.2219	105.6986	105.6986	109.2219	105.6986	109.2219	105.6986 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	209.5593	211.7339	206.2540	194.5881	179.8619	166.0214	156.7751	154.6005	160.0804	171.7463	186.4725	200.3130 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.8490	34.8490	34.8490	34.8490	34.8490	34.8490	34.8490	34.8490	34.8490	34.8490	34.8490	34.8490 (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)	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918 (71)
Water heating gains (Table 5)	151.3909	149.0082	144.4183	134.3583	128.1963	121.7555	117.7994	121.0678	124.8998	132.0466	141.6903	150.1046 (72)
Total internal gains												

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528.1957 539.3124 517.9178 499.7152 475.3038 455.5457 438.8200 439.9139 452.7490 471.0384 498.9315 517.6631 (73)

## 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
Northeast	2.9000	11.2829	0.6300		0.7000	0.7700	9.9998 (75)	
Southeast	0.6300	36.7938	0.6300		0.7000	0.7700	7.0841 (77)	
Southwest	10.9700	36.7938	0.6300		0.7000	0.7700	123.3541 (79)	
Northwest	3.5900	11.2829	0.6300		0.7000	0.7700	12.3791 (81)	
Northwest	0.7600	16.3666	0.6300		0.7000	1.0000	4.9369 (82)	

Solar gains	157.7540	277.8982	404.8152	543.0941	646.4177	658.5640	627.9216	548.2270	452.2703	313.7469	190.6211	133.9276 (83)
Total gains	685.9497	817.2107	922.7330	1042.8092	1121.7215	1114.1097	1066.7416	988.1409	905.0192	784.7853	689.5526	651.5907 (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	32.3304	32.4413	32.5508	33.0749	33.1748	33.6481	33.6481	33.7373	33.4642	33.1748	32.9733	32.7652
alpha	3.1554	3.1628	3.1701	3.2050	3.2117	3.2432	3.2432	3.2492	3.2309	3.2117	3.1982	3.1843
util living area	0.9634	0.9380	0.8959	0.8074	0.6755	0.5123	0.3838	0.4271	0.6365	0.8491	0.9405	0.9682 (86)
MIT	19.0353	19.3673	19.8039	20.3329	20.7097	20.9142	20.9745	20.9639	20.8229	20.3195	19.6006	18.9920 (87)
Th 2	19.8216	19.8251	19.8286	19.8449	19.8479	19.8622	19.8622	19.8649	19.8567	19.8479	19.8417	19.8353 (88)
util rest of house	0.9560	0.9259	0.8757	0.7714	0.6184	0.4336	0.2896	0.3291	0.5577	0.8120	0.9268	0.9617 (89)
MIT 2	17.5824	17.9983	18.5385	19.1787	19.5970	19.8065	19.8516	19.8486	19.7282	19.1842	18.3080	17.5366 (90)
Living area fraction									fLA = Living area / (4) =			0.3790 (91)
MIT	18.1331	18.5172	19.0181	19.6162	20.0188	20.2263	20.2773	20.2714	20.1431	19.6145	18.7980	18.0883 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1331	18.5172	19.0181	19.6162	20.0188	20.2263	20.2773	20.2714	20.1431	19.6145	18.7980	18.0883 (93)

## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9415	0.9087	0.8589	0.7634	0.6274	0.4597	0.3246	0.3652	0.5787	0.8032	0.9109	0.9484 (94)
Useful gains	645.8550	742.6395	792.5176	796.1209	703.8207	512.1035	346.3076	360.8313	523.7656	630.3681	628.1329	617.9633 (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	1381.6503	1355.4372	1241.8452	1046.2428	809.7306	539.9521	352.9013	370.5463	583.1377	877.4499	1145.6166	1368.7542 (97)
Space heating kWh	547.4318	411.8001	334.2997	180.0878	78.7970	0.0000	0.0000	0.0000	0.0000	183.8289	372.5882	558.5884 (98a)
Space heating requirement - total per year (kWh/year)												2667.4219
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	547.4318	411.8001	334.2997	180.0878	78.7970	0.0000	0.0000	0.0000	0.0000	183.8289	372.5882	558.5884 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2667.4219
Space heating per m2										(98c) / (4) =		35.3769 (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	547.4318	411.8001	334.2997	180.0878	78.7970	0.0000	0.0000	0.0000	0.0000	183.8289	372.5882	558.5884 (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)	593.1005	446.1539	362.1882	195.1114	85.3705	0.0000	0.0000	0.0000	0.0000	199.1645	403.6709	605.1879 (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

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Efficiency of water heater (217)m	232.3147	205.5674	218.8735	193.8116	188.7567	171.0616	169.6280	175.8788	177.2511	196.4584	207.4022	229.9780 (64)	79.8000 (216)
Fuel for water heating, kWh/month	85.9132	85.5860	85.0066	83.8954	82.2552	79.8000	79.8000	79.8000	79.8000	83.9110	85.3575	85.9722 (217)	
Space cooling fuel requirement (221)m	270.4064	240.1882	257.4781	231.0157	229.4769	214.3630	212.5664	220.3995	222.1191	234.1270	242.9806	267.5027 (219)	
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 (221)	
Lighting	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685 (231)	
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	21.9621	17.6188	15.8638	11.6225	8.9775	7.3347	8.1896	10.6452	13.8270	18.1418	20.4911	22.5725 (232)	
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	-58.2594	-76.5998	-102.8013	-107.7189	-109.9866	-100.5696	-99.3030	-96.6248	-91.2099	-83.6233	-62.0390	-51.0449 (233a)	
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	-52.1411	-106.7010	-206.8206	-303.3641	-394.3900	-393.8533	-389.2052	-332.5355	-247.8325	-150.0169	-68.7315	-41.4619 (233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)	
Annual totals kWh/year													
Space heating fuel - main system 1												2889.9479 (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												2842.6238 (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)												177.2466 (232)	
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-3726.8339 (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												2268.9843 (238)	

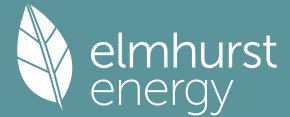
## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2889.9479	0.2100	606.8891 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2842.6238	0.2100	596.9510 (264)
Space and water heating			1203.8400 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	177.2466	0.1443	25.5822 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1039.7803	0.1361	-141.5044
PV Unit electricity exported	-2687.0536	0.1266	-340.2061
Total			-481.7105 (269)
Total CO2, kg/year			759.6409 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.0700 (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	2889.9479	1.1300	3265.6411 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2842.6238	1.1300	3212.1648 (278)
Space and water heating			6477.8060 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	177.2466	1.5338	271.8667 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1039.7803	1.5030	-1562.8414
PV Unit electricity exported	-2687.0536	0.4648	-1248.8754
Total			-2811.7168 (283)
Total Primary energy kWh/year			4068.0567 (286)
Target Primary Energy Rate (TPER)			53.9500 (287)

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

## 1. Overall dwelling characteristics

	Area (m <sup>2</sup> )	x	Storey height (m)	=	Volume (m <sup>3</sup> )
Ground floor	75.4000 (1b)		2.9000 (2b)		218.6600 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	75.4000				(4)
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 218.6600 (5)

## 2. Ventilation rate

		m <sup>3</sup> per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1372 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.2872 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2872 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3662	0.3590	0.3518	0.3159	0.3087	0.2728	0.2728	0.2657	0.2872	0.3087	0.3231	0.3375 (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	0.5670	0.5644	0.5619	0.5499	0.5477	0.5372	0.5372	0.5353	0.5412	0.5477	0.5522	0.5569 (25)

## 3. Heat losses and heat loss parameter

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K
Window (Uw = 1.20)			7.4400	1.1450	8.5191		(27)
Glazed Door (Uw = 1.20)			10.9200	1.1450	12.5038		(27)
NW			0.7700	1.1450	0.8817		(27a)
External Wall	98.7000	18.3600	80.3400	0.1400	11.2476	70.0000	5623.8000 (29a)
External Flat Roof	70.1100		70.1100	0.1100	7.7121	9.0000	630.9900 (30)
External Slope Roof	5.2300	0.7700	4.4600	0.1500	0.6690	9.0000	40.1400 (30)
Total net area of external elements Aum(A, m <sup>2</sup> )			174.0400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	41.5333	(33)
Party Wall 11.20			14.1000	0.0000	0.0000	70.0000	987.0000 (32)
Party Floor			75.4000			40.0000	3016.0000 (32d)
Internal Wall			147.4500			9.0000	1327.0500 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 11624.9800 (34)  
Thermal mass parameter (TMP = Cm / TFA) in kJ/m<sup>2</sup>K 154.1775 (35)

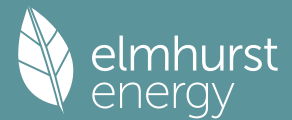
### List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	11.2600	0.0040	0.0450
E3 Sill	11.2600	0.0150	0.1689
E4 Jamb	24.4200	0.0260	0.6349
E7 Party floor between dwellings (in blocks of flats)	40.9200	0.2800	11.4576
E14 Flat roof	34.8800	0.0390	1.3603
E16 Corner (normal)	14.5000	0.0320	0.4640
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	4.8600	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	4.8600	0.4800	2.3328
E11 Eaves (insulation at rafter level)	5.0000	0.0200	0.1000
E13 Gable (insulation at rafter level)	1.0400	0.0410	0.0426
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			16.6062 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 58.1395 (37)

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



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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.9166	40.7288	40.5446	39.6798	39.5179	38.7647	38.7647	38.6252	39.0548	39.5179	39.8453	40.1875	(38)
Heat transfer coeff	99.0561	98.8683	98.6841	97.8193	97.6574	96.9042	96.9042	96.7647	97.1943	97.6574	97.9848	98.3270	(39)
Average = Sum(39)m / 12 =												97.8185	
HLP	1.3137	1.3113	1.3088	1.2973	1.2952	1.2852	1.2852	1.2834	1.2890	1.2952	1.2995	1.3041	(40)
HLP (average)												1.2973	
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													2.3698	(42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	27.6253	27.2150	26.6372	25.5720	24.7743	23.8898	23.4121	23.9858	24.6104	25.5569	26.6441	27.5319	27.5319	(42b)
Hot water usage for other uses	38.8991	37.4846	36.0700	34.6555	33.2410	31.8265	31.8265	33.2410	34.6555	36.0700	37.4846	38.8991	38.8991	(42c)
Average daily hot water use (litres/day)													60.9757	(43)
Daily hot water use	66.5243	64.6995	62.7073	60.2275	58.0153	55.7163	55.2386	57.2268	59.2660	61.6269	64.1286	66.4309	66.4309	(44)
Energy content	105.3583	92.1313	96.3787	82.4484	78.0998	68.5097	66.8063	70.8587	73.0809	83.6271	91.3630	104.0148	104.0148	(45)
Energy content (annual)													1012.6769	
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	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	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	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	0.0000	(59)
Total heat required for water heating calculated for each month	89.5545	78.3116	81.9219	70.0812	66.3848	58.2333	56.7853	60.2299	62.1187	71.0831	77.6585	88.4126	88.4126	(62)
WWHS	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	(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	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	0.0000	(63c)
FGHS	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	(63d)
Output from w/h	89.5545	78.3116	81.9219	70.0812	66.3848	58.2333	56.7853	60.2299	62.1187	71.0831	77.6585	88.4126	88.4126	(64)
Total per year (kWh/year)													860.7754	(64)
Electric shower(s)	51.2160	45.6339	49.8304	47.5526	48.4449	46.2117	47.7521	48.4449	47.5526	49.8304	48.8934	51.2160	51.2160	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													861	(64)
Heat gains from water heating, kWh/month	35.1926	30.9864	32.9381	29.4084	28.7074	26.1112	26.1344	27.1687	27.4178	30.2284	31.6380	34.9071	34.9071	(65)

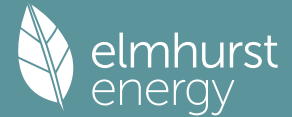
## 5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	118.4897	118.4897	118.4897	118.4897	118.4897	118.4897	118.4897	118.4897	118.4897	118.4897	118.4897	118.4897	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	105.6986	117.0234	105.6986	109.2219	105.6986	109.2219	105.6986	105.6986	109.2219	105.6986	109.2219	105.6986	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	209.5593	211.7339	206.2540	194.5881	179.8619	166.0214	156.7751	154.6005	160.0804	171.7463	186.4725	200.3130	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.8490	34.8490	34.8490	34.8490	34.8490	34.8490	34.8490	34.8490	34.8490	34.8490	34.8490	34.8490	(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)	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	(71)
Water heating gains (Table 5)	47.3019	46.1107	44.2716	40.8450	38.5852	36.2656	35.1268	36.5171	38.0803	40.6295	43.9416	46.9182	(72)
Total internal gains	421.1067	433.4149	414.7712	403.2019	382.6927	370.0558	356.1474	355.3631	365.9295	376.6214	398.1829	411.4767	(73)

## 6. Solar gains

[Jan]	Area m <sup>2</sup>	Solar flux Table 6a W/m <sup>2</sup>	Specific data or Table 6b g	Specific data or Table 6c FF	Access factor Table 6d	Gains W
Northeast	2.9400	11.2829	0.7600	0.7000	0.7700	12.2297 (75)
Southeast	0.6400	36.7938	0.7600	0.7000	0.7700	8.6816 (77)
Southwest	3.8600	36.7938	0.7600	0.7000	0.7700	52.3609 (79)
Southwest	7.2800	36.7938	0.7600	0.7000	0.7700	98.7532 (79)
Northwest	3.6400	11.2829	0.7600	0.7000	0.7700	15.1415 (81)
Northwest	0.7700	16.3666	0.7600	0.7000	1.0000	6.0340 (82)

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Solar gains	193.2009	340.3248	495.7096	664.9691	791.4220	806.2690	768.7637	671.2318	553.7973	384.2150	233.4501	164.0226 (83)
Total gains	614.3076	773.7396	910.4807	1068.1710	1174.1147	1176.3248	1124.9112	1026.5949	919.7268	760.8363	631.6330	575.4993 (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, n <sub>l,m</sub> (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	32.5993	32.6613	32.7222	33.0115	33.0662	33.3232	33.3232	33.3713	33.2238	33.0662	32.9557	32.8410
alpha	3.1733	3.1774	3.1815	3.2008	3.2044	3.2215	3.2215	3.2248	3.2149	3.2044	3.1970	3.1894
util living area	0.9724	0.9454	0.8983	0.7995	0.6570	0.4932	0.3685	0.4165	0.6320	0.8586	0.9521	0.9772 (86)
MIT	18.9327	19.3161	19.7994	20.3525	20.7311	20.9213	20.9767	20.9654	20.8240	20.2878	19.5069	18.8636 (87)
Th 2	19.8301	19.8320	19.8339	19.8429	19.8446	19.8524	19.8524	19.8539	19.8494	19.8446	19.8412	19.8376 (88)
util rest of house	0.9667	0.9345	0.8785	0.7628	0.5995	0.4157	0.2768	0.3196	0.5528	0.8228	0.9407	0.9723 (89)
MIT 2	17.9825	18.3577	18.8234	19.3407	19.6649	19.8130	19.8450	19.8419	19.7503	19.3007	18.5568	17.9199 (90)
Living area fraction	f <sub>LA</sub> = Living area / (4) =											
MIT	18.3427	18.7210	19.1933	19.7242	20.0691	20.2331	20.2740	20.2678	20.1573	19.6748	18.9169	0.3790 (91)
Temperature adjustment												0.0000
adjusted MIT	18.3427	18.7210	19.1933	19.7242	20.0691	20.2331	20.2740	20.2678	20.1573	19.6748	18.9169	18.2776 (92)
												0.0000
												18.2776 (93)

## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9568	0.9215	0.8656	0.7586	0.6114	0.4422	0.3111	0.3555	0.5753	0.8167	0.9289	0.9635 (94)
Useful gains	587.7892	713.0127	788.1199	810.3013	717.8106	520.2039	349.9967	364.9454	529.1534	621.3807	586.7504	554.5049 (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	1391.0134	1366.4580	1252.6303	1058.8199	817.3006	545.8699	356.0222	374.2616	588.7342	886.2264	1157.8781	1384.2078 (97)
Space heating kWh	597.5988	439.1152	345.5957	178.9334	74.0205	0.0000	0.0000	0.0000	0.0000	197.0452	411.2119	617.2990 (98a)
Space heating requirement - total per year (kWh/year)												2860.8198
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	597.5988	439.1152	345.5957	178.9334	74.0205	0.0000	0.0000	0.0000	0.0000	197.0452	411.2119	617.2990 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2860.8198
Space heating per m <sup>2</sup>												(98c) / (4) = 37.9419 (99)

## 8c. Space cooling requirement

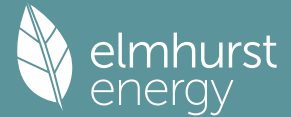
Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	910.8991	717.0908	735.4115	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8824	0.9238	0.9008	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	803.7574	662.4733	662.4807	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1325.0775	1267.6948	1156.7579	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	375.3505	450.2848	367.7422	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction	f <sub>C</sub> = 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 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	93.8376	112.5712	91.9356	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling requirement												298.3444 (107)
Energy for space heating												37.9419 (99)
Energy for space cooling												3.9568 (108)
Total												41.8987 (109)
Fabric Energy Efficiency (DFEE)												41.9 (109)

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

## 1. Overall dwelling characteristics

Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
------------------------	-------------------	--------------------------

# Full SAP Calculation Printout



Ground floor  
 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 75.4000 75.4000 (1b) x 2.9000 (2b) = 218.6600 (1b) -  
 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 218.6600 (4)  
 (5)

## 2. Ventilation rate

m3 per hour

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 30.0000 / (5) = 0.1372 (8)  
 Pressure test Yes  
 Pressure Test Method Blower Door  
 Measured/design AP50 5.0000 (17)  
 Infiltration rate 0.3872 (18)  
 Number of sides sheltered 0 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 1.0000 (20)  
 Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3872 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4937	0.4840	0.4743	0.4259	0.4162	0.3678	0.3678	0.3582	0.3872	0.4162	0.4356	0.4550 (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	0.6219	0.6171	0.6125	0.5907	0.5866	0.5677	0.5677	0.5641	0.5750	0.5866	0.5949	0.6035 (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 Opening Type (Uw = 1.20)			18.0900	1.1450	20.7137		(27)
NW			0.7600	1.8519	1.4074		(27a)
External Wall	98.7000	18.0900	80.6100	0.1800	14.5098		(29a)
External Flat Roof	70.1100		70.1100	0.1100	7.7121		(30)
External Slope Roof	5.2300	0.7600	4.4700	0.1100	0.4917		(30)
Total net area of external elements Aum(A, m2)			174.0400				(31)
Fabric heat loss, W/K = Sum (A x U)					44.8347		(33)
Party Wall 11.20			14.1000	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 154.1775 (35)

### List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	11.2600	0.0500	0.5630
E3 Sill	11.2600	0.0500	0.5630
E4 Jamb	24.4200	0.0500	1.2210
E7 Party floor between dwellings (in blocks of flats)	40.9200	0.0700	2.8644
E14 Flat roof	34.8800	0.0800	2.7904
E16 Corner (normal)	14.5000	0.0900	1.3050
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	4.8600	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	4.8600	0.1200	0.5832
E11 Eaves (insulation at rafter level)	5.0000	0.0400	0.2000
E13 Gable (insulation at rafter level)	1.0400	0.0800	0.0832

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.1732 (36)  
 Point Thermal bridges (36a) = 0.0000  
 Total fabric heat loss (33) + (36) + (36a) = 55.0079 (37)

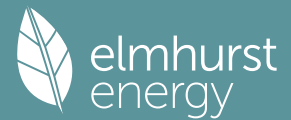
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	44.8720	44.5306	44.1959	42.6239	42.3298	40.9606	40.9606	40.7070	41.4880	42.3298	42.9248	43.5468 (38)
Average = Sum(39)m / 12 =	99.8800	99.5385	99.2038	97.6318	97.3377	95.9685	95.9685	95.7150	96.4959	97.3377	97.9327	98.5547 (39)
												97.6304

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.3247	1.3201	1.3157	1.2949	1.2910	1.2728	1.2728	1.2694	1.2798	1.2910	1.2988	1.3071 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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

# Full SAP Calculation Printout



Assumed occupancy												2.3698 (42)	
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	27.6253	27.2150	26.6372	25.5720	24.7743	23.8898	23.4121	23.9858	24.6104	25.5569	26.6441	27.5319	(42b)
Hot water usage for other uses	38.8991	37.4846	36.0700	34.6555	33.2410	31.8265	31.8265	33.2410	34.6555	36.0700	37.4846	38.8991	(42c)
Average daily hot water use (litres/day)												60.9757 (43)	
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy content (annual)	66.5243	64.6995	62.7073	60.2275	58.0153	55.7163	55.2386	57.2268	59.2660	61.6269	64.1286	66.4309	(44)
Distribution loss (46)m = 0.15 x (45)m	105.3583	92.1313	96.3787	82.4484	78.0998	68.5097	66.8063	70.8587	73.0809	83.6271	91.3630	104.0148	(45)
Total = Sum(45)m =												1012.6769	
Water 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)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	89.5545	78.3116	81.9219	70.0812	66.3848	58.2333	56.7853	60.2299	62.1187	71.0831	77.6585	88.4126	(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	89.5545	78.3116	81.9219	70.0812	66.3848	58.2333	56.7853	60.2299	62.1187	71.0831	77.6585	88.4126	(64)
12Total per year (kWh/year)												861 (64)	
Electric shower(s)	51.2160	45.6339	49.8304	47.5526	48.4449	46.2117	47.7521	48.4449	47.5526	49.8304	48.8934	51.2160	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												582.5786 (64a)	
Heat gains from water heating, kWh/month	35.1926	30.9864	32.9381	29.4084	28.7074	26.1112	26.1344	27.1687	27.4178	30.2284	31.6380	34.9071	(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	118.4897	118.4897	118.4897	118.4897	118.4897	118.4897	118.4897	118.4897	118.4897	118.4897	118.4897	118.4897	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	105.6986	117.0234	105.6986	109.2219	105.6986	109.2219	105.6986	105.6986	109.2219	105.6986	109.2219	105.6986	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	209.5593	211.7339	206.2540	194.5881	179.8619	166.0214	156.7751	154.6005	160.0804	171.7463	186.4725	200.3130	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.8490	34.8490	34.8490	34.8490	34.8490	34.8490	34.8490	34.8490	34.8490	34.8490	34.8490	34.8490	(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)	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	(71)
Water heating gains (Table 5)	47.3019	46.1107	44.2716	40.8450	38.5852	36.2656	35.1268	36.5171	38.0803	40.6295	43.9416	46.9182	(72)
Total internal gains	421.1067	433.4149	414.7712	403.2019	382.6927	370.0558	356.1474	355.3631	365.9295	376.6214	398.1829	411.4767	(73)

## 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF Access factor Table 6d	Gains W							
Northeast	2.9000	11.2829	0.6300	0.7000	0.7700	9.9998 (75)							
Southeast	0.6300	36.7938	0.6300	0.7000	0.7700	7.0841 (77)							
Southwest	10.9700	36.7938	0.6300	0.7000	0.7700	123.3541 (79)							
Northwest	3.5900	11.2829	0.6300	0.7000	0.7700	12.3791 (81)							
Northwest	0.7600	16.3666	0.6300	0.7000	1.0000	4.9369 (82)							
Solar gains	157.7540	277.8982	404.8152	543.0941	646.4177	658.5640	627.9216	548.2270	452.2703	313.7469	190.6211	133.9276	(83)
Total gains	578.8607	711.3131	819.5863	946.2960	1029.1104	1028.6198	984.0690	903.5901	818.1998	690.3682	588.8040	545.4043	(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	32.3304	32.4413	32.5508	33.0749	33.1748	33.6481	33.6481	33.7373	33.4642	33.1748	32.9733	32.7652	
alpha	3.1554	3.1628	3.1701	3.2050	3.2117	3.2432	3.2432	3.2492	3.2309	3.2117	3.1982	3.1843	
util living area	0.9766	0.9559	0.9200	0.8389	0.7116	0.5462	0.4129	0.4619	0.6799	0.8838	0.9599	0.9803	(86)
MIT	18.8489	19.1981	19.6619	20.2384	20.6598	20.8966	20.9685	20.9547	20.7840	20.2088	19.4370	18.8034	(87)

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Th 2	19.8216	19.8251	19.8286	19.8449	19.8479	19.8622	19.8622	19.8649	19.8567	19.8479	19.8417	19.8353 (88)
util rest of house	0.9715	0.9468	0.9034	0.8063	0.6557	0.4648	0.3128	0.3579	0.6015	0.8523	0.9501	0.9760 (89)
MIT 2	17.8944	18.2390	18.6910	19.2442	19.6153	19.8090	19.8518	19.8486	19.7317	19.2346	18.4901	17.8591 (90)
Living area fraction									fLA = Living area / (4) =			0.3790 (91)
MIT	18.2562	18.6025	19.0590	19.6211	20.0112	20.2213	20.2751	20.2679	20.1306	19.6039	18.8490	18.2170 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2562	18.6025	19.0590	19.6211	20.0112	20.2213	20.2751	20.2679	20.1306	19.6039	18.8490	18.2170 (93)

## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9625	0.9346	0.8901	0.7991	0.6643	0.4916	0.3500	0.3961	0.6218	0.8444	0.9390	0.9680 (94)
Useful gains	557.1520	664.7953	729.5396	756.1874	683.6000	505.6463	344.4715	357.9019	508.7327	582.9387	552.9137	527.9322 (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	1393.9459	1363.9306	1245.9015	1046.7185	808.9908	539.4637	352.6943	370.2136	581.9253	876.4147	1150.6108	1381.4461 (97)
Space heating kWh	622.5747	469.8189	384.1732	209.1824	93.2908	0.0000	0.0000	0.0000	0.0000	218.3461	430.3419	635.0144 (98a)
Space heating requirement - total per year (kWh/year)												3062.7424
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	622.5747	469.8189	384.1732	209.1824	93.2908	0.0000	0.0000	0.0000	0.0000	218.3461	430.3419	635.0144 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3062.7424
Space heating per m2												(98c) / (4) = 40.6199 (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	902.1042	710.1671	727.4339	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8486	0.8993	0.8730	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	765.4842	638.6855	635.0808	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1154.1818	1104.7027	1014.2654	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	279.8623	346.7168	282.1134	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	69.9656	86.6792	70.5283	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												227.1731 (107)
Energy for space heating												40.6199 (99)
Energy for space cooling												3.0129 (108)
Total												43.6328 (109)
Fabric Energy Efficiency (TFEE)												43.6 (109)

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

## 1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	75.4000 (1b)	x 2.9000 (2b)	= 218.6600 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	75.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	218.6600 (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)

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Number of intermittent extract fans		0 * 10 =	0.0000 (7a)
Number of passive vents		0 * 10 =	0.0000 (7b)
Number of flueless gas fires		0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour	0.0000 / (5) = 0.0000 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50			3.0000 (17)
Infiltration rate			0.1500 (18)
Number of sides sheltered			0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.1500 (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	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation													0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													82.8000 (23c)
Effective ac	0.2772	0.2735	0.2698	0.2510	0.2472	0.2285	0.2285	0.2248	0.2360	0.2472	0.2548	0.2622	(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
Window (Uw = 1.20)			7.4400	1.1450	8.5191		(27)
Glazed Door (Uw = 1.20)			10.9200	1.1450	12.5038		(27)
NW			0.7700	1.1450	0.8817		(27a)
External Wall	98.7000	18.3600	80.3400	0.1400	11.2476	70.0000	5623.8000 (29a)
External Flat Roof	70.1100		70.1100	0.1100	7.7121	9.0000	630.9900 (30)
External Slope Roof	5.2300	0.7700	4.4600	0.1500	0.6690	9.0000	40.1400 (30)
Total net area of external elements Aum(A, m2)			174.0400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	41.5333	(33)
Party Wall 11.20			14.1000	0.0000	0.0000	70.0000	987.0000 (32)
Party Floor			75.4000			40.0000	3016.0000 (32d)
Internal Wall			147.4500			9.0000	1327.0500 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11624.9800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							154.1775 (35)

#### List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	11.2600	0.0040	0.0450
E3 Sill	11.2600	0.0150	0.1689
E4 Jamb	24.4200	0.0260	0.6349
E7 Party floor between dwellings (in blocks of flats)	40.9200	0.2800	11.4576
E14 Flat roof	34.8800	0.0390	1.3603
E16 Corner (normal)	14.5000	0.0320	0.4640
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	4.8600	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	4.8600	0.4800	2.3328
E11 Eaves (insulation at rafter level)	5.0000	0.0200	0.1000
E13 Gable (insulation at rafter level)	1.0400	0.0410	0.0426
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			16.6062 (36)
Point Thermal bridges			0.0000 (36a)
Total fabric heat loss			(33) + (36) + (36a) = 58.1395 (37)

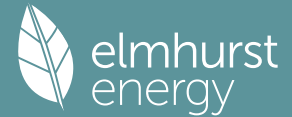
#### Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	20.0058	19.7352	19.4646	18.1116	17.8410	16.4881	16.4881	16.2175	17.0292	17.8410	18.3822	18.9234 (38)
Heat transfer coeff	78.1453	77.8747	77.6041	76.2511	75.9805	74.6276	74.6276	74.3570	75.1687	75.9805	76.5217	77.0629 (39)
Average = Sum(39)m / 12 =												76.1835
HLP	1.0364	1.0328	1.0292	1.0113	1.0077	0.9898	0.9898	0.9862	0.9969	1.0077	1.0149	1.0221 (40)
HLP (average)												1.0104
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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

Assumed occupancy													2.3698 (42)
Hot water usage for mixer showers	95.9300	94.4884	92.3876	88.3682	85.4020	82.0941	80.2139	82.2987	84.5841	88.1358	92.2415	95.5625	95.5625 (42a)
Hot water usage for baths	27.6253	27.2150	26.6372	25.5720	24.7743	23.8898	23.4121	23.9858	24.6104	25.5569	26.6441	27.5319	27.5319 (42b)
Hot water usage for other uses	38.8991	37.4846	36.0700	34.6555	33.2410	31.8265	31.8265	33.2410	34.6555	36.0700	37.4846	38.8991	38.8991 (42c)
Average daily hot water use (litres/day)													149.4200 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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Energy conte	162.4543	159.1879	155.0949	148.5957	143.4173	137.8104	135.4524	139.5255	143.8501	149.7627	156.3702	161.9934 (44)
Energy content (annual)	257.2879	226.6815	238.3751	203.4201	193.0672	169.4540	163.8180	172.7617	177.3815	203.2266	222.7780	253.6425 (45)
Distribution loss (46) <sub>m</sub> = 0.15 x (45) <sub>m</sub>												2481.8939
	38.5932	34.0022	35.7563	30.5130	28.9601	25.4181	24.5727	25.9143	26.6072	30.4840	33.4167	38.0464 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9900 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0746 (55)
Total storage loss												
	33.3126	30.0888	33.3126	32.2380	33.3126	32.2380	33.3126	33.3126	32.2380	33.3126	32.2380	33.3126 (56)
If cylinder contains dedicated solar storage												
	33.3126	30.0888	33.3126	32.2380	33.3126	32.2380	33.3126	33.3126	32.2380	33.3126	32.2380	33.3126 (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												
	313.8629	277.7815	294.9501	258.1701	249.6422	224.2040	220.3930	229.3367	232.1315	259.8016	277.5280	310.2175 (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												
	313.8629	277.7815	294.9501	258.1701	249.6422	224.2040	220.3930	229.3367	232.1315	259.8016	277.5280	310.2175 (64)
												Total per year (kWh/year) = Sum(64) <sub>m</sub> = 3148.0189 (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) <sub>m</sub> = 0.0000 (64a)
Heat gains from water heating, kWh/month												
	130.8082	116.2516	124.5197	111.4372	109.4549	100.1434	99.7295	102.7033	102.7794	112.8328	117.8737	129.5961 (65)

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

Metabolic gains (Table 5), Watts												
(66) <sub>m</sub>	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	142.1877	142.1877	142.1877	142.1877	142.1877	142.1877	142.1877	142.1877	142.1877	142.1877	142.1877	142.1877 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	25.7302	22.8534	18.5856	14.0705	10.5179	8.8796	9.5947	12.4716	16.7394	21.2545	24.8071	26.4453 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	312.7751	316.0207	307.8418	290.4300	268.4506	247.7931	233.9927	230.7471	238.9259	256.3378	278.3171	298.9746 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	51.5886	51.5886	51.5886	51.5886	51.5886	51.5886	51.5886	51.5886	51.5886	51.5886	51.5886	51.5886 (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)												
	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918 (71)
Water heating gains (Table 5)												
	175.8175	172.9934	167.3652	154.7739	147.1167	139.0881	134.0450	138.0420	142.7491	151.6570	163.7134	174.1883 (72)
Total internal gains												
	613.3073	610.8519	592.7771	558.2588	525.0697	494.7453	476.6169	480.2451	497.3988	528.2337	565.8221	598.5927 (73)

## 6. Solar gains

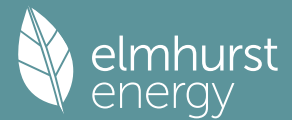
[Jan]		Area	Solar flux	g	FF	Access	Gains
		m <sup>2</sup>	Table 6a	Specific data	Specific data	factor	W
			W/m <sup>2</sup>	or Table 6b	or Table 6c	Table 6d	
Northeast		2.9400	11.2829	0.7600	0.7000	0.7700	12.2297 (75)
Southeast		0.6400	36.7938	0.7600	0.7000	0.7700	8.6816 (77)
Southwest		3.8600	36.7938	0.7600	0.7000	0.7700	52.3609 (79)
Southwest		7.2800	36.7938	0.7600	0.7000	0.7700	98.7532 (79)
Northwest		3.6400	11.2829	0.7600	0.7000	0.7700	15.1415 (81)
Northwest		0.7700	16.3666	0.7600	0.7000	1.0000	6.0340 (82)

Solar gains	193.2009	340.3248	495.7096	664.9691	791.4220	806.2690	768.7637	671.2318	553.7973	384.2150	233.4501	164.0226 (83)
Total gains	806.5081	951.1767	1088.4867	1223.2278	1316.4917	1301.0143	1245.3806	1151.4770	1051.1961	912.4487	799.2722	762.6154 (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, n <sub>1,m</sub> (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	41.3226	41.4661	41.6107	42.3490	42.4999	43.2704	43.2704	43.4278	42.9588	42.4999	42.1993	41.9029
alpha	3.7548	3.7644	3.7740	3.8233	3.8333	3.8847	3.8847	3.8952	3.8639	3.8333	3.8133	3.7935
util living area												
	0.9302	0.8834	0.8035	0.6694	0.5127	0.3623	0.2626	0.2952	0.4766	0.7326	0.8881	0.9401 (86)
Living	19.8337	20.1299	20.4720	20.7804	20.9328	20.9868	20.9971	20.9955	20.9624	20.7421	20.2519	19.7808
Non living	18.7309	19.0931	19.5008	19.8604	20.0201	20.0832	20.0906	20.0927	20.0590	19.8326	19.2609	18.6746
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	20.4034	20.1299	20.4720	20.7804	20.9328	20.9868	20.9971	20.9955	20.9624	20.7421	20.2519	19.9513 (87)
Th 2	20.0531	20.0561	20.0590	20.0739	20.0769	20.0919	20.0919	20.0949	20.0859	20.0769	20.0710	20.0650 (88)
util rest of house												

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MIT 2	0.9186	0.8659	0.7769	0.6323	0.4676	0.3126	0.2089	0.2379	0.4187	0.6907	0.8683	0.9299 (89)
Living area fraction	19.5260	19.0931	19.5008	19.8604	20.0201	20.0832	20.0906	20.0927	20.0590	19.8326	19.2609	18.9252 (90)
MIT	19.8586	19.4861	19.8689	20.2091	20.3661	20.4257	20.4342	20.4349	20.4014	20.1774	19.6366	19.3141 (92)
Temperature adjustment												0.0000
adjusted MIT	19.8586	19.4861	19.8689	20.2091	20.3661	20.4257	20.4342	20.4349	20.4014	20.1774	19.6366	19.3141 (93)

## 8. Space heating requirement

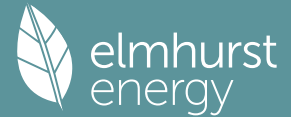
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9160	0.8539	0.7712	0.6379	0.4820	0.3310	0.2292	0.2595	0.4390	0.6955	0.8577	0.9203 (94)
Useful gains	738.7474	812.2153	839.3954	780.2970	634.4938	430.6430	285.4083	298.8439	461.4599	634.6103	685.5510	701.8210 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1215.8283	1135.8847	1037.4825	862.3340	658.4527	434.7585	286.1365	300.0228	473.6703	727.6927	959.3191	1164.7388 (97)
Space heating kWh	354.9482	217.5058	147.3768	59.0667	17.8254	0.0000	0.0000	0.0000	0.0000	69.2534	197.1130	344.4109 (98a)
Space heating requirement - total per year (kWh/year)												1407.5003
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	354.9482	217.5058	147.3768	59.0667	17.8254	0.0000	0.0000	0.0000	0.0000	69.2534	197.1130	344.4109 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1407.5003
Space heating per m2										(98c) / (4) =		18.6671 (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 %)												388.6691 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	354.9482	217.5058	147.3768	59.0667	17.8254	0.0000	0.0000	0.0000	0.0000	69.2534	197.1130	344.4109 (98)
Space heating efficiency (main heating system 1)	388.6691	388.6691	388.6691	388.6691	388.6691	0.0000	0.0000	0.0000	0.0000	388.6691	388.6691	388.6691 (210)
Space heating fuel (main heating system)	91.3240	55.9617	37.9183	15.1972	4.5863	0.0000	0.0000	0.0000	0.0000	17.8181	50.7149	88.6129 (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	313.8629	277.7815	294.9501	258.1701	249.6422	224.2040	220.3930	229.3367	232.1315	259.8016	277.5280	310.2175 (64)
Efficiency of water heater (217)m	191.2533	191.2533	191.2533	191.2533	191.2533	191.2533	191.2533	191.2533	191.2533	191.2533	191.2533	191.2533 (216)
Fuel for water heating, kWh/month	164.1085	145.2427	154.2196	134.9886	130.5296	117.2288	115.2362	119.9126	121.3739	135.8416	145.1102	162.2024 (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	16.4941	14.8979	16.4941	15.9621	16.4941	15.9621	16.4941	16.4941	15.9621	16.4941	15.9621	16.4941 (231)
Lighting	22.5215	18.0676	16.2679	11.9185	9.2062	7.5216	8.3982	10.9163	14.1792	18.6039	21.0131	23.1475 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-112.1309	-176.9296	-276.0180	-318.2134	-339.1050	-311.8283	-307.5945	-295.5028	-262.0869	-210.5498	-129.3086	-94.1968 (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)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												362.1333 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												191.2533
Water heating fuel used												1645.9946 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7280)												
mechanical ventilation fans (SFP = 0.7280)												194.2051 (230a)
Total electricity for the above, kWh/year												194.2051 (231)
Electricity for lighting (calculated in Appendix L)												181.7615 (232)



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## Energy saving/generation technologies (Appendices M ,N and Q)

PV generation	-2833.4645 (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	-449.3701 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	362.1333	16.4900	59.7158 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1645.9946	16.4900	271.4245 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	194.2051	16.4900	32.0244 (249)
Energy for lighting	181.7615	16.4900	29.9725 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2833.4645	16.4900	-467.2383
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-467.2383 (252)
Total energy cost			-74.1011 (255)

## 11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] = -0.2216 (257)
SAP value	103.5916
SAP rating (Section 12)	104 (258)
SAP band	A

## 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	362.1333	0.1572	56.9449 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1645.9946	0.1410	232.0390 (264)
Space and water heating			288.9838 (265)
Pumps, fans and electric keep-hot	194.2051	0.1387	26.9386 (267)
Energy for lighting	181.7615	0.1443	26.2338 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2833.4645	0.1338	-379.2309
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-379.2309 (269)
Total CO2, kg/year			-37.0747 (272)
CO2 emissions per m2			-0.4900 (273)
EI value			100.4126
EI rating			100 (274)
EI band			A

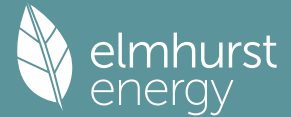
## SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

### 1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	75.4000 (1b)	x 2.9000 (2b)	= 218.6600 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	75.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	218.6600 (5)



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Hot water usage for mixer showers	95.9300	94.4884	92.3876	88.3682	85.4020	82.0941	80.2139	82.2987	84.5841	88.1358	92.2415	95.5625 (42a)
Hot water usage for baths	27.6253	27.2150	26.6372	25.5720	24.7743	23.8898	23.4121	23.9858	24.6104	25.5569	26.6441	27.5319 (42b)
Hot water usage for other uses	38.8991	37.4846	36.0700	34.6555	33.2410	31.8265	31.8265	33.2410	34.6555	36.0700	37.4846	38.8991 (42c)
Average daily hot water use (litres/day)												149.4200 (43)
Daily hot water use	162.4543	159.1879	155.0949	148.5957	143.4173	137.8104	135.4524	139.5255	143.8501	149.7627	156.3702	161.9934 (44)
Energy content (annual)	257.2879	226.6815	238.3751	203.4201	193.0672	169.4540	163.8180	172.7617	177.3815	203.2266	222.7780	253.6425 (45)
Distribution loss (46) <sub>m</sub> = 0.15 x (45) <sub>m</sub>	38.5932	34.0022	35.7563	30.5130	28.9601	25.4181	24.5727	25.9143	26.6072	30.4840	33.4167	38.0464 (46)
Water storage loss:												250.0000 (47)
Store volume												1.9900 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												1.0746 (55)
Enter (49) or (54) in (55)												
Total storage loss	33.3126	30.0888	33.3126	32.2380	33.3126	32.2380	33.3126	33.3126	32.2380	33.3126	32.2380	33.3126 (56)
If cylinder contains dedicated solar storage	33.3126	30.0888	33.3126	32.2380	33.3126	32.2380	33.3126	33.3126	32.2380	33.3126	32.2380	33.3126 (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	313.8629	277.7815	294.9501	258.1701	249.6422	224.2040	220.3930	229.3367	232.1315	259.8016	277.5280	310.2175 (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	313.8629	277.7815	294.9501	258.1701	249.6422	224.2040	220.3930	229.3367	232.1315	259.8016	277.5280	310.2175 (64)
Total per year (kWh/year) = Sum(64) <sub>m</sub>												3148.0189 (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) <sub>m</sub>												0.0000 (64a)
Heat gains from water heating, kWh/month	130.8082	116.2516	124.5197	111.4372	109.4549	100.1434	99.7295	102.7033	102.7794	112.8328	117.8737	129.5961 (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) <sub>m</sub>	142.1877	142.1877	142.1877	142.1877	142.1877	142.1877	142.1877	142.1877	142.1877	142.1877	142.1877	142.1877 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.7302	22.8534	18.5856	14.0705	10.5179	8.8796	9.5947	12.4716	16.7394	21.2545	24.8071	26.4453 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	312.7751	316.0207	307.8418	290.4300	268.4506	247.7931	233.9927	230.7471	238.9259	256.3378	278.3171	298.9746 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.5886	51.5886	51.5886	51.5886	51.5886	51.5886	51.5886	51.5886	51.5886	51.5886	51.5886	51.5886 (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)	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918 (71)
Water heating gains (Table 5)	175.8175	172.9934	167.3652	154.7739	147.1167	139.0881	134.0450	138.0420	142.7491	151.6570	163.7134	174.1883 (72)
Total internal gains	613.3073	610.8519	592.7771	558.2588	525.0697	494.7453	476.6169	480.2451	497.3988	528.2337	565.8221	598.5927 (73)

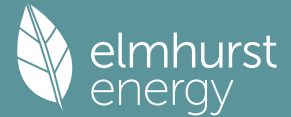
## 6. Solar gains

[Jan]	Area m <sup>2</sup>	Solar flux Table 6a W/m <sup>2</sup>	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W						
Northeast	2.9400	15.4493	0.7600	0.7000	0.7700	16.7456 (75)						
Southeast	0.6400	47.1180	0.7600	0.7000	0.7700	11.1176 (77)						
Southwest	3.8600	47.1180	0.7600	0.7000	0.7700	67.0532 (79)						
Southwest	7.2800	47.1180	0.7600	0.7000	0.7700	126.4630 (79)						
Northwest	3.6400	15.4493	0.7600	0.7000	0.7700	20.7326 (81)						
Northwest	0.7700	22.4901	0.7600	0.7000	1.0000	8.2916 (82)						
Solar gains	250.4036	379.6688	551.6652	757.6177	859.3475	944.1660	814.3045	764.1404	643.0324	445.7576	291.7296	211.8203 (83)
Total gains	863.7108	990.5207	1144.4423	1315.8765	1384.4172	1438.9113	1290.9214	1244.3855	1140.4312	973.9914	857.5517	810.4131 (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, <sub>m</sub> (see Table 9a)												
tau	39.2822	39.8063	40.2087	41.1800	41.1800	41.9029	41.9029	41.9029	41.3226	40.0737	39.8063	39.2822
alpha	3.6188	3.6538	3.6806	3.7453	3.7453	3.7935	3.7935	3.7935	3.7548	3.6716	3.6538	3.6188
util living area												

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	0.8817	0.8329	0.7389	0.6060	0.4745	0.3286	0.2731	0.2711	0.3961	0.6322	0.8072	0.8890 (86)
Living	20.1762	20.3705	20.6365	20.8468	20.9468	20.9897	20.9960	20.9962	20.9805	20.8559	20.5500	20.1763
Non living	19.1203	19.3558	19.6651	19.9081	20.0072	20.0585	20.0631	20.0633	20.0411	19.9058	19.5739	19.1236
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	20.5786	20.3705	20.6365	20.8468	20.9468	20.9897	20.9960	20.9962	20.9805	20.8559	20.5500	20.2915 (87)
Th 2	20.0088	20.0206	20.0294	20.0501	20.0501	20.0650	20.0650	20.0650	20.0531	20.0265	20.0206	20.0088 (88)
util rest of house	0.8608	0.8067	0.7042	0.5648	0.4275	0.2803	0.2182	0.2141	0.3355	0.5763	0.7717	0.8681 (89)
MIT 2	19.6546	19.3558	19.6651	19.9081	20.0072	20.0585	20.0631	20.0633	20.0411	19.9058	19.5739	19.2831 (90)
Living area fraction									fLA = Living area / (4) =			0.3790 (91)
MIT	20.0048	19.7404	20.0333	20.2639	20.3634	20.4115	20.4167	20.4170	20.3972	20.2659	19.9439	19.6653 (92)
Temperature adjustment												0.0000
adjusted MIT	20.0048	19.7404	20.0333	20.2639	20.3634	20.4115	20.4167	20.4170	20.3972	20.2659	19.9439	19.6653 (93)

## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8607	0.7985	0.7043	0.5744	0.4432	0.2983	0.2390	0.2356	0.3578	0.5907	0.7686	0.8599 (94)
Useful gains	743.3707	790.9289	806.0383	755.7961	613.5927	429.2625	308.4935	293.1998	408.0325	575.3076	659.1452	696.8804 (95)
Ext temp.	6.9000	7.1000	8.3000	9.9000	12.3000	14.8000	16.4000	16.6000	15.1000	12.5000	9.8000	7.4000 (96)
Heat loss rate W	1077.2718	1025.4149	942.2987	812.6966	632.2950	432.4350	309.5392	294.1452	413.9486	625.7816	822.8895	1008.2604 (97)
Space heating kWh	248.4224	157.5746	101.3777	40.9683	13.9145	0.0000	0.0000	0.0000	0.0000	37.5526	117.8959	231.6667 (98a)
Space heating requirement - total per year (kWh/year)												949.3729
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	248.4224	157.5746	101.3777	40.9683	13.9145	0.0000	0.0000	0.0000	0.0000	37.5526	117.8959	231.6667 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												949.3729
Space heating per m2												(98c) / (4) = 12.5912 (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 %)												392.1054 (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	248.4224	157.5746	101.3777	40.9683	13.9145	0.0000	0.0000	0.0000	0.0000	37.5526	117.8959	231.6667 (98)
Space heating efficiency (main heating system 1)	392.1054	392.1054	392.1054	392.1054	392.1054	0.0000	0.0000	0.0000	0.0000	392.1054	392.1054	392.1054 (210)
Space heating fuel (main heating system)	63.3560	40.1868	25.8547	10.4483	3.5487	0.0000	0.0000	0.0000	0.0000	9.5772	30.0674	59.0828 (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	313.8629	277.7815	294.9501	258.1701	249.6422	224.2040	220.3930	229.3367	232.1315	259.8016	277.5280	310.2175 (64)
Efficiency of water heater												190.8497 (216)
(217)m	190.8497	190.8497	190.8497	190.8497	190.8497	190.8497	190.8497	190.8497	190.8497	190.8497	190.8497	190.8497 (217)
Fuel for water heating, kWh/month	164.4555	145.5498	154.5457	135.2740	130.8057	117.4767	115.4798	120.1661	121.6305	136.1289	145.4170	162.5454 (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	16.4941	14.8979	16.4941	15.9621	16.4941	15.9621	16.4941	16.4941	15.9621	16.4941	15.9621	16.4941 (231)
Lighting	22.5215	18.0676	16.2679	11.9185	9.2062	7.5216	8.3982	10.9163	14.1792	18.6039	21.0131	23.1475 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-144.8944	-196.6749	-298.6633	-338.5941	-348.1238	-323.0979	-312.4955	-309.9637	-284.9269	-237.2204	-159.7094	-121.9059 (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)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												242.1219 (211)
Space heating fuel - main system 2												0.0000 (213)

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Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	190.8497
Water heating fuel used	1649.4752 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7280)	
mechanical ventilation fans (SFP = 0.7280)	194.2051 (230a)
Total electricity for the above, kWh/year	194.2051 (231)
Electricity for lighting (calculated in Appendix L)	181.7615 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-3076.2702 (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	-808.7066 (238)

## 10a. Fuel costs - using BEDF prices (528)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	242.1219	21.5100	52.0804 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1649.4752	21.5100	354.8021 (247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000 (247a)
Pumps, fans and electric keep-hot	194.2051	21.5100	41.7735 (249)
Energy for lighting	181.7615	21.5100	39.0969 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3076.2702	21.5100	-661.7057
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-661.7057 (252)
Total energy cost			-173.9528 (255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	242.1219	0.1576	38.1484 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1649.4752	0.1410	232.5296 (264)
Space and water heating			270.6780 (265)
Pumps, fans and electric keep-hot	194.2051	0.1387	26.9386 (267)
Energy for lighting	181.7615	0.1443	26.2338 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3076.2702	0.1347	-414.3371
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-414.3371 (269)
Total CO2, kg/year			-90.4866 (272)

## 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	242.1219	1.5832	383.3347 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1649.4752	1.5213	2509.2918 (278)
Space and water heating			2892.6265 (279)
Pumps, fans and electric keep-hot	194.2051	1.5128	293.7934 (281)
Energy for lighting	181.7615	1.5338	278.7919 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3076.2702	1.4978	-4607.6214
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-4607.6214 (283)
Total Primary energy kWh/year			-1142.4096 (286)

## SAP 10 EPC IMPROVEMENTS

709914\_Flat 2

Current energy efficiency rating: A 104  
 Current environmental impact rating: A 100

N Solar water heating Not applicable  
 U Solar photovoltaic panels Not applicable  
 V2 Wind turbine Not applicable

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

Recommended measures Typical annual savings Energy Environmental efficiency impact  
 (none) Total Savings £0 0.00 kg/m<sup>2</sup>

Potential energy efficiency rating: A 104  
 Potential environmental impact rating: A 100

Fuel prices for cost data on this page from database revision number 528 TEST (04 Oct 2023)  
 Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South West England):

	Current	Potential	Saving
Electricity	£488	£488	£0
Space heating	£94	£94	£0
Water heating	£355	£355	£0
Lighting	£39	£39	£0
Generated (PV)	-£662	-£662	£0
Total cost of fuels	-£174	-£174	£0
Total cost of uses	-£174	-£174	£0
Delivered energy	-11 kWh/m <sup>2</sup>	-11 kWh/m <sup>2</sup>	0 kWh/m <sup>2</sup>
Carbon dioxide emissions	-0.1 tonnes	-0.1 tonnes	0.0 tonnes
CO2 emissions per m <sup>2</sup>	-1 kg/m <sup>2</sup>	-1 kg/m <sup>2</sup>	0 kg/m <sup>2</sup>
Primary energy	-15 kWh/m <sup>2</sup>	-15 kWh/m <sup>2</sup>	0 kWh/m <sup>2</sup>

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

## 1. Overall dwelling characteristics

	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	75.4000 (1b)	2.9000 (2b)	218.6600 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	75.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	218.6600 (5)

## 2. Ventilation rate

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)

Pressure test  
 Pressure Test Method Measured/design AP50  
 Infiltration rate 3.0000 (17)  
 Number of sides sheltered 0.1500 (18)  
 0 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 1.0000 (20)  
 Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1500 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)

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Adj infiltr rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2772	0.2735	0.2698	0.2510	0.2472	0.2285	0.2285	0.2248	0.2360	0.2472	0.2548	0.2622 (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
Window (Uw = 1.20)			7.4400	1.1450	8.5191		(27)
Glazed Door (Uw = 1.20)			10.9200	1.1450	12.5038		(27)
NW			0.7700	1.1450	0.8817		(27a)
External Wall	98.7000	18.3600	80.3400	0.1400	11.2476	70.0000	5623.8000 (29a)
External Flat Roof	70.1100		70.1100	0.1100	7.7121	9.0000	630.9900 (30)
External Slope Roof	5.2300	0.7700	4.4600	0.1500	0.6690	9.0000	40.1400 (30)
Total net area of external elements Aum(A, m2)			174.0400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	41.5333	(33)
Party Wall 11.20			14.1000	0.0000	0.0000	70.0000	987.0000 (32)
Party Floor			75.4000			40.0000	3016.0000 (32d)
Internal Wall			147.4500			9.0000	1327.0500 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 11624.9800 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 154.1775 (35)

#### List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	11.2600	0.0040	0.0450
E3 Sill	11.2600	0.0150	0.1689
E4 Jamb	24.4200	0.0260	0.6349
E7 Party floor between dwellings (in blocks of flats)	40.9200	0.2800	11.4576
E14 Flat roof	34.8800	0.0390	1.3603
E16 Corner (normal)	14.5000	0.0320	0.4640
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	4.8600	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	4.8600	0.4800	2.3328
E11 Eaves (insulation at rafter level)	5.0000	0.0200	0.1000
E13 Gable (insulation at rafter level)	1.0400	0.0410	0.0426

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 16.6062 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 58.1395 (37)

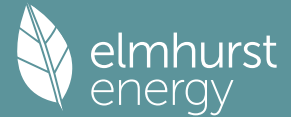
#### Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	20.0058	19.7352	19.4646	18.1116	17.8410	16.4881	16.4881	16.2175	17.0292	17.8410	18.3822	18.9234 (38)
Average = Sum(39)m / 12 =	78.1453	77.8747	77.6041	76.2511	75.9805	74.6276	74.6276	74.3570	75.1687	75.9805	76.5217	77.0629 (39)
HLP	1.0364	1.0328	1.0292	1.0113	1.0077	0.9898	0.9898	0.9862	0.9969	1.0077	1.0149	1.0221 (40)
HLP (average)												1.0104
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	95.9300	94.4884	92.3876	88.3682	85.4020	82.0941	80.2139	82.2987	84.5841	88.1358	92.2415	95.5625 (42a)
Hot water usage for baths	27.6253	27.2150	26.6372	25.5720	24.7743	23.8898	23.4121	23.9858	24.6104	25.5569	26.6441	27.5319 (42b)
Hot water usage for other uses	38.8991	37.4846	36.0700	34.6555	33.2410	31.8265	31.8265	33.2410	34.6555	36.0700	37.4846	38.8991 (42c)
Average daily hot water use (litres/day)												149.4200 (43)
Daily hot water use	162.4543	159.1879	155.0949	148.5957	143.4173	137.8104	135.4524	139.5255	143.8501	149.7627	156.3702	161.9934 (44)
Energy content (annual)	257.2879	226.6815	238.3751	203.4201	193.0672	169.4540	163.8180	172.7617	177.3815	203.2266	222.7780	253.6425 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 2481.8939
Water storage loss:	38.5932	34.0022	35.7563	30.5130	28.9601	25.4181	24.5727	25.9143	26.6072	30.4840	33.4167	38.0464 (46)
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9900 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0746 (55)
Total storage loss	33.3126	30.0888	33.3126	32.2380	33.3126	32.2380	33.3126	33.3126	32.2380	33.3126	32.2380	33.3126 (56)
If cylinder contains dedicated solar storage	33.3126	30.0888	33.3126	32.2380	33.3126	32.2380	33.3126	33.3126	32.2380	33.3126	32.2380	33.3126 (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	313.8629	277.7815	294.9501	258.1701	249.6422	224.2040	220.3930	229.3367	232.1315	259.8016	277.5280	310.2175 (62)
WVHRS	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)

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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	313.8629	277.7815	294.9501	258.1701	249.6422	224.2040	220.3930	229.3367	232.1315	259.8016	277.5280	310.2175	(64)
	Total per year (kWh/year) = Sum(64)m =											3148.0189 (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	130.8082	116.2516	124.5197	111.4372	109.4549	100.1434	99.7295	102.7033	102.7794	112.8328	117.8737	129.5961	(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	142.1877	142.1877	142.1877	142.1877	142.1877	142.1877	142.1877	142.1877	142.1877	142.1877	142.1877	142.1877	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.7302	22.8534	18.5856	14.0705	10.5179	8.8796	9.5947	12.4716	16.7394	21.2545	24.8071	26.4453	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	312.7751	316.0207	307.8418	290.4300	268.4506	247.7931	233.9927	230.7471	238.9259	256.3378	278.3171	298.9746	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.5886	51.5886	51.5886	51.5886	51.5886	51.5886	51.5886	51.5886	51.5886	51.5886	51.5886	51.5886	(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)	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	(71)
Water heating gains (Table 5)	175.8175	172.9934	167.3652	154.7739	147.1167	139.0881	134.0450	138.0420	142.7491	151.6570	163.7134	174.1883	(72)
Total internal gains	613.3073	610.8519	592.7771	558.2588	525.0697	494.7453	476.6169	480.2451	497.3988	528.2337	565.8221	598.5927	(73)

## 6. Solar gains

[Jan]	Area m <sup>2</sup>	Solar flux Table 6a W/m <sup>2</sup>	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	2.9400	11.2829	0.7600	0.7000	0.7700	12.2297 (75)
Southeast	0.6400	36.7938	0.7600	0.7000	0.7700	8.6816 (77)
Southwest	3.8600	36.7938	0.7600	0.7000	0.7700	52.3609 (79)
Southwest	7.2800	36.7938	0.7600	0.7000	0.7700	98.7532 (79)
Northwest	3.6400	11.2829	0.7600	0.7000	0.7700	15.1415 (81)
Northwest	0.7700	16.3666	0.7600	0.7000	1.0000	6.0340 (82)

Solar gains	193.2009	340.3248	495.7096	664.9691	791.4220	806.2690	768.7637	671.2318	553.7973	384.2150	233.4501	164.0226	(83)
Total gains	806.5081	951.1767	1088.4867	1223.2278	1316.4917	1301.0143	1245.3806	1151.4770	1051.1961	912.4487	799.2722	762.6154	(84)

## 7. Mean internal temperature (heating season)

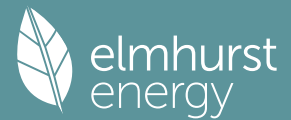
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	41.3226	41.4661	41.6107	42.3490	42.4999	43.2704	43.2704	43.4278	42.9588	42.4999	42.1993	41.9029	
alpha	3.7548	3.7644	3.7740	3.8233	3.8333	3.8847	3.8847	3.8952	3.8639	3.8333	3.8133	3.7935	
util living area	0.9302	0.8834	0.8035	0.6694	0.5127	0.3623	0.2626	0.2952	0.4766	0.7326	0.8881	0.9401	(86)
Living	19.8337	20.1299	20.4720	20.7804	20.9328	20.9868	20.9971	20.9955	20.9624	20.7421	20.2519	19.7808	
Non living	18.7309	19.0931	19.5008	19.8604	20.0201	20.0832	20.0906	20.0927	20.0590	19.8326	19.2609	18.6746	
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	20.4034	20.1299	20.4720	20.7804	20.9328	20.9868	20.9971	20.9955	20.9624	20.7421	20.2519	19.9513	(87)
Th 2	20.0531	20.0561	20.0590	20.0739	20.0769	20.0919	20.0919	20.0949	20.0859	20.0769	20.0710	20.0650	(88)
util rest of house	0.9186	0.8659	0.7769	0.6323	0.4676	0.3126	0.2089	0.2379	0.4187	0.6907	0.8683	0.9299	(89)
MIT 2	19.5260	19.0931	19.5008	19.8604	20.0201	20.0832	20.0906	20.0927	20.0590	19.8326	19.2609	18.9252	(90)
Living area fraction	19.8586	19.4861	19.8689	20.2091	20.3661	20.4257	20.4342	20.4349	20.4014	20.1774	19.6366	0.3790	(91)
MIT	19.8586	19.4861	19.8689	20.2091	20.3661	20.4257	20.4342	20.4349	20.4014	20.1774	19.6366	19.3141	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8586	19.4861	19.8689	20.2091	20.3661	20.4257	20.4342	20.4349	20.4014	20.1774	19.6366	19.3141	(93)

## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9160	0.8539	0.7712	0.6379	0.4820	0.3310	0.2292	0.2595	0.4390	0.6955	0.8577	0.9203	(94)
Useful gains	738.7474	812.2153	839.3954	780.2970	634.4938	430.6430	285.4083	298.8439	461.4599	634.6103	685.5510	701.8210	(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	1215.8283	1135.8847	1037.4825	862.3340	658.4527	434.7585	286.1365	300.0228	473.6703	727.6927	959.3191	1164.7388	(97)



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Space heating kWh	354.9482	217.5058	147.3768	59.0667	17.8254	0.0000	0.0000	0.0000	0.0000	69.2534	197.1130	344.4109 (98a)
Space heating requirement - total per year (kWh/year)												1407.5003
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	354.9482	217.5058	147.3768	59.0667	17.8254	0.0000	0.0000	0.0000	0.0000	69.2534	197.1130	344.4109 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1407.5003
Space heating per m2												(98c) / (4) = 18.6671 (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 %)	388.6691 (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	354.9482	217.5058	147.3768	59.0667	17.8254	0.0000	0.0000	0.0000	0.0000	69.2534	197.1130	344.4109 (98)
Space heating efficiency (main heating system 1)	388.6691	388.6691	388.6691	388.6691	388.6691	0.0000	0.0000	0.0000	0.0000	388.6691	388.6691	388.6691 (210)
Space heating fuel (main heating system)	91.3240	55.9617	37.9183	15.1972	4.5863	0.0000	0.0000	0.0000	0.0000	17.8181	50.7149	88.6129 (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	313.8629	277.7815	294.9501	258.1701	249.6422	224.2040	220.3930	229.3367	232.1315	259.8016	277.5280	310.2175 (64)
Efficiency of water heater (217)m	191.2533	191.2533	191.2533	191.2533	191.2533	191.2533	191.2533	191.2533	191.2533	191.2533	191.2533	191.2533 (216)
Fuel for water heating, kWh/month	164.1085	145.2427	154.2196	134.9886	130.5296	117.2288	115.2362	119.9126	121.3739	135.8416	145.1102	162.2024 (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	16.4941	14.8979	16.4941	15.9621	16.4941	15.9621	16.4941	16.4941	15.9621	16.4941	15.9621	16.4941 (231)
Lighting	22.5215	18.0676	16.2679	11.9185	9.2062	7.5216	8.3982	10.9163	14.1792	18.6039	21.0131	23.1475 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-112.1309	-176.9296	-276.0180	-318.2134	-339.1050	-311.8283	-307.5945	-295.5028	-262.0869	-210.5498	-129.3086	-94.1968 (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)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												362.1333 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												191.2533
Water heating fuel used												1645.9946 (219)
Space cooling fuel												0.0000 (221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7280)	
mechanical ventilation fans (SFP = 0.7280)	194.2051 (230a)
Total electricity for the above, kWh/year	194.2051 (231)
Electricity for lighting (calculated in Appendix L)	181.7615 (232)

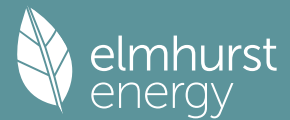
Energy saving/generation technologies (Appendices M ,N and Q)

PV generation	-2833.4645 (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	-449.3701 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	362.1333	16.4900	59.7158 (240)

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Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1645.9946	16.4900	271.4245 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	194.2051	16.4900	32.0244 (249)
Energy for lighting	181.7615	16.4900	29.9725 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2833.4645	16.4900	-467.2383
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-467.2383 (252)
Total energy cost			-74.1011 (255)

## 11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	-0.2216 (257)
SAP value		103.5916
SAP rating (Section 12)		104 (258)
SAP band		A

## 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	362.1333	0.1572	56.9449 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1645.9946	0.1410	232.0390 (264)
Space and water heating			288.9838 (265)
Pumps, fans and electric keep-hot	194.2051	0.1387	26.9386 (267)
Energy for lighting	181.7615	0.1443	26.2338 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2833.4645	0.1338	-379.2309
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-379.2309 (269)
Total CO2, kg/year			-37.0747 (272)
CO2 emissions per m2			-0.4900 (273)
EI value			100.4126
EI rating			100 (274)
EI band			A

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

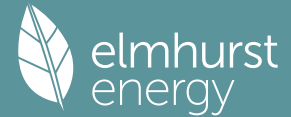
### 1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	75.4000 (1b)	2.9000 (2b)	218.6600 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	75.4000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 218.6600 (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	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	$= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =$
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
	3.0000 (17)

# Full SAP Calculation Printout



Infiltration rate													0.1500 (18)
Number of sides sheltered													0 (19)
Shelter factor													(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor													(21) = (18) x (20) = 0.1500 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	6.6000	6.2000	5.9000	5.2000	5.2000	4.7000	4.7000	4.7000	5.1000	6.0000	6.2000	6.6000	(22)
Wind factor	1.6500	1.5500	1.4750	1.3000	1.3000	1.1750	1.1750	1.1750	1.2750	1.5000	1.5500	1.6500	(22a)
Adj infilt rate	0.2475	0.2325	0.2213	0.1950	0.1950	0.1762	0.1762	0.1762	0.1912	0.2250	0.2325	0.2475	(22b)
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation													0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													82.8000 (23c)
Effective ac	0.3335	0.3185	0.3073	0.2810	0.2810	0.2622	0.2622	0.2622	0.2772	0.3110	0.3185	0.3335	(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	
Window (Uw = 1.20)			7.4400	1.1450	8.5191			(27)
Glazed Door (Uw = 1.20)			10.9200	1.1450	12.5038			(27)
NW			0.7700	1.1450	0.8817			(27a)
External Wall	98.7000	18.3600	80.3400	0.1400	11.2476	70.0000	5623.8000	(29a)
External Flat Roof	70.1100		70.1100	0.1100	7.7121	9.0000	630.9900	(30)
External Slope Roof	5.2300	0.7700	4.4600	0.1500	0.6690	9.0000	40.1400	(30)
Total net area of external elements Aum(A, m2)			174.0400					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 41.5333			(33)
Party Wall 11.20			14.1000	0.0000	0.0000	70.0000	987.0000	(32)
Party Floor			75.4000			40.0000	3016.0000	(32d)
Internal Wall			147.4500			9.0000	1327.0500	(32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11624.9800	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							154.1775	(35)

#### List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	11.2600	0.0040	0.0450
E2 Other lintels (including other steel lintels)	11.2600	0.0150	0.1689
E3 Sill	24.4200	0.0260	0.6349
E4 Jamb	40.9200	0.2800	11.4576
E7 Party floor between dwellings (in blocks of flats)	34.8800	0.0390	1.3603
E14 Flat roof	14.5000	0.0320	0.4640
E16 Corner (normal)	4.8600	0.0000	0.0000
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	4.8600	0.4800	2.3328
P4 Party wall - Roof (insulation at ceiling level)	5.0000	0.0200	0.1000
E11 Eaves (insulation at rafter level)	1.0400	0.0410	0.0426

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

Point Thermal bridges													16.6062 (36)
Total fabric heat loss													(33) + (36) + (36a) = 58.1395 (37)

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

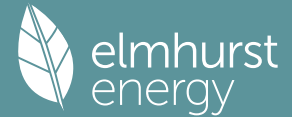
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	24.0646	22.9823	22.1705	20.2763	20.2763	18.9234	18.9234	18.9234	20.0058	22.4411	22.9823	24.0646	(38)
Heat transfer coeff	82.2041	81.1218	80.3100	78.4158	78.4158	77.0629	77.0629	77.0629	78.1453	80.5806	81.1218	82.2041	(39)
Average = Sum(39)m / 12 =													79.4757

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0902	1.0759	1.0651	1.0400	1.0400	1.0221	1.0221	1.0221	1.0364	1.0687	1.0759	1.0902	(40)
HLP (average)													1.0541
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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

Assumed occupancy													2.3698 (42)
Hot water usage for mixer showers	95.9300	94.4884	92.3876	88.3682	85.4020	82.0941	80.2139	82.2987	84.5841	88.1358	92.2415	95.5625	(42a)
Hot water usage for baths	27.6253	27.2150	26.6372	25.5720	24.7743	23.8898	23.4121	23.9858	24.6104	25.5569	26.6441	27.5319	(42b)
Hot water usage for other uses	38.8991	37.4846	36.0700	34.6555	33.2410	31.8265	31.8265	33.2410	34.6555	36.0700	37.4846	38.8991	(42c)
Average daily hot water use (litres/day)													149.4200 (43)
Daily hot water use	162.4543	159.1879	155.0949	148.5957	143.4173	137.8104	135.4524	139.5255	143.8501	149.7627	156.3702	161.9934	(44)
Energy conte	257.2879	226.6815	238.3751	203.4201	193.0672	169.4540	163.8180	172.7617	177.3815	203.2266	222.7780	253.6425	(45)
Energy content (annual)													Total = Sum(45)m = 2481.8939
Distribution loss (46)m = 0.15 x (45)m	38.5932	34.0022	35.7563	30.5130	28.9601	25.4181	24.5727	25.9143	26.6072	30.4840	33.4167	38.0464	(46)
Water storage loss:													
Store volume													250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.9900 (48)
Temperature factor from Table 2b													0.5400 (49)

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Enter (49) or (54) in (55)													1.0746 (55)
Total storage loss	33.3126	30.0888	33.3126	32.2380	33.3126	32.2380	33.3126	33.3126	32.2380	33.3126	32.2380	33.3126	(56)
If cylinder contains dedicated solar storage	33.3126	30.0888	33.3126	32.2380	33.3126	32.2380	33.3126	33.3126	32.2380	33.3126	32.2380	33.3126	(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	313.8629	277.7815	294.9501	258.1701	249.6422	224.2040	220.3930	229.3367	232.1315	259.8016	277.5280	310.2175	(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	313.8629	277.7815	294.9501	258.1701	249.6422	224.2040	220.3930	229.3367	232.1315	259.8016	277.5280	310.2175	(64)
													Total per year (kWh/year) = Sum(64)m = 3148.0189 (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	130.8082	116.2516	124.5197	111.4372	109.4549	100.1434	99.7295	102.7033	102.7794	112.8328	117.8737	129.5961	(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	142.1877	142.1877	142.1877	142.1877	142.1877	142.1877	142.1877	142.1877	142.1877	142.1877	142.1877	142.1877	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.7302	22.8534	18.5856	14.0705	10.5179	8.8796	9.5947	12.4716	16.7394	21.2545	24.8071	26.4453	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	312.7751	316.0207	307.8418	290.4300	268.4506	247.7931	233.9927	230.7471	238.9259	256.3378	278.3171	298.9746	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.5886	51.5886	51.5886	51.5886	51.5886	51.5886	51.5886	51.5886	51.5886	51.5886	51.5886	51.5886	(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)	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	-94.7918	(71)
Water heating gains (Table 5)	175.8175	172.9934	167.3652	154.7739	147.1167	139.0881	134.0450	138.0420	142.7491	151.6570	163.7134	174.1883	(72)
Total internal gains	613.3073	610.8519	592.7771	558.2588	525.0697	494.7453	476.6169	480.2451	497.3988	528.2337	565.8221	598.5927	(73)

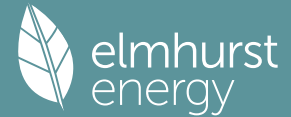
## 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W							
Northeast	2.9400	15.4493	0.7600	0.7000	0.7700	16.7456 (75)							
Southeast	0.6400	47.1180	0.7600	0.7000	0.7700	11.1176 (77)							
Southwest	3.8600	47.1180	0.7600	0.7000	0.7700	67.0532 (79)							
Southwest	7.2800	47.1180	0.7600	0.7000	0.7700	126.4630 (79)							
Northwest	3.6400	15.4493	0.7600	0.7000	0.7700	20.7326 (81)							
Northwest	0.7700	22.4901	0.7600	0.7000	1.0000	8.2916 (82)							
Solar gains	250.4036	379.6688	551.6652	757.6177	859.3475	944.1660	814.3045	764.1404	643.0324	445.7576	291.7296	211.8203	(83)
Total gains	863.7108	990.5207	1144.4423	1315.8765	1384.4172	1438.9113	1290.9214	1244.3855	1140.4312	973.9914	857.5517	810.4131	(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)													21.0000 (85)
tau	39.2822	39.8063	40.2087	41.1800	41.1800	41.9029	41.9029	41.9029	41.3226	40.0737	39.8063	39.2822	
alpha	3.6188	3.6538	3.6806	3.7453	3.7453	3.7935	3.7935	3.7935	3.7548	3.6716	3.6538	3.6188	
util living area	0.8817	0.8329	0.7389	0.6060	0.4745	0.3286	0.2731	0.2711	0.3961	0.6322	0.8072	0.8890	(86)
Living	20.1762	20.3705	20.6365	20.8468	20.9468	20.9897	20.9960	20.9962	20.9805	20.8559	20.5500	20.1763	
Non living	19.1203	19.3558	19.6651	19.9081	20.0072	20.0585	20.0631	20.0633	20.0411	19.9058	19.5739	19.1236	
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	20.5786	20.3705	20.6365	20.8468	20.9468	20.9897	20.9960	20.9962	20.9805	20.8559	20.5500	20.2915	(87)
Th 2	20.0088	20.0206	20.0294	20.0501	20.0501	20.0650	20.0650	20.0650	20.0531	20.0265	20.0206	20.0088	(88)
util rest of house	0.8608	0.8067	0.7042	0.5648	0.4275	0.2803	0.2182	0.2141	0.3355	0.5763	0.7717	0.8681	(89)
MIT 2	19.6546	19.3558	19.6651	19.9081	20.0072	20.0585	20.0631	20.0633	20.0411	19.9058	19.5739	19.2831	(90)
Living area fraction									fLA = Living area / (4) =			0.3790	(91)
MIT	20.0048	19.7404	20.0333	20.2639	20.3634	20.4115	20.4167	20.4170	20.3972	20.2659	19.9439	19.6653	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0048	19.7404	20.0333	20.2639	20.3634	20.4115	20.4167	20.4170	20.3972	20.2659	19.9439	19.6653	(93)

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## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8607	0.7985	0.7043	0.5744	0.4432	0.2983	0.2390	0.2356	0.3578	0.5907	0.7686	0.8599	(94)
Useful gains	743.3707	790.9289	806.0383	755.7961	613.5927	429.2625	308.4935	293.1998	408.0325	575.3076	659.1452	696.8804	(95)
Ext temp.	6.9000	7.1000	8.3000	9.9000	12.3000	14.8000	16.4000	16.6000	15.1000	12.5000	9.8000	7.4000	(96)
Heat loss rate W	1077.2718	1025.4149	942.2987	812.6966	632.2950	432.4350	309.5392	294.1452	413.9486	625.7816	822.8895	1008.2604	(97)
Space heating kWh	248.4224	157.5746	101.3777	40.9683	13.9145	0.0000	0.0000	0.0000	0.0000	37.5526	117.8959	231.6667	(98a)
Space heating requirement - total per year (kWh/year)												949.3729	
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	248.4224	157.5746	101.3777	40.9683	13.9145	0.0000	0.0000	0.0000	0.0000	37.5526	117.8959	231.6667	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												949.3729	
Space heating per m2										(98c) / (4) =		12.5912	(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 %)													392.1054	(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	248.4224	157.5746	101.3777	40.9683	13.9145	0.0000	0.0000	0.0000	0.0000	37.5526	117.8959	231.6667	(98)	
Space heating efficiency (main heating system 1)	392.1054	392.1054	392.1054	392.1054	392.1054	0.0000	0.0000	0.0000	0.0000	392.1054	392.1054	392.1054	(210)	
Space heating fuel (main heating system)	63.3560	40.1868	25.8547	10.4483	3.5487	0.0000	0.0000	0.0000	0.0000	9.5772	30.0674	59.0828	(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	313.8629	277.7815	294.9501	258.1701	249.6422	224.2040	220.3930	229.3367	232.1315	259.8016	277.5280	310.2175	(64)	
Efficiency of water heater	190.8497	190.8497	190.8497	190.8497	190.8497	190.8497	190.8497	190.8497	190.8497	190.8497	190.8497	190.8497	(216)	
Fuel for water heating, kWh/month	164.4555	145.5498	154.5457	135.2740	130.8057	117.4767	115.4798	120.1661	121.6305	136.1289	145.4170	162.5454	(219)	
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)	
Pumps and Fa	16.4941	14.8979	16.4941	15.9621	16.4941	15.9621	16.4941	16.4941	15.9621	16.4941	15.9621	16.4941	(231)	
Lighting	22.5215	18.0676	16.2679	11.9185	9.2062	7.5216	8.3982	10.9163	14.1792	18.6039	21.0131	23.1475	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)	-144.8944	-196.6749	-298.6633	-338.5941	-348.1238	-323.0979	-312.4955	-309.9637	-284.9269	-237.2204	-159.7094	-121.9059	(233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)	
Electricity generated by PVs (Appendix M) (negative quantity)	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)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)	
Annual totals kWh/year														
Space heating fuel - main system 1													242.1219	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													190.8497	
Water heating fuel used													1649.4752	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7280)														
mechanical ventilation fans (SFP = 0.7280)													194.2051	(230a)
Total electricity for the above, kWh/year													194.2051	(231)
Electricity for lighting (calculated in Appendix L)													181.7615	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-3076.2702	(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)

# Full SAP Calculation Printout



Total delivered energy for all uses

-808.7066 (238)

-----  
 10a. Fuel costs - using BEDF prices (528)  
 -----

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	242.1219	21.5100	52.0804 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1649.4752	21.5100	354.8021 (247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000 (247a)
Pumps, fans and electric keep-hot	194.2051	21.5100	41.7735 (249)
Energy for lighting	181.7615	21.5100	39.0969 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3076.2702	21.5100	-661.7057
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-661.7057 (252)
Total energy cost			-173.9528 (255)

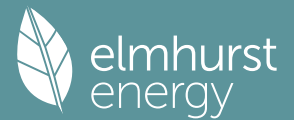
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 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP  
 -----

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	242.1219	0.1576	38.1484 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1649.4752	0.1410	232.5296 (264)
Space and water heating			270.6780 (265)
Pumps, fans and electric keep-hot	194.2051	0.1387	26.9386 (267)
Energy for lighting	181.7615	0.1443	26.2338 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3076.2702	0.1347	-414.3371
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-414.3371 (269)
Total CO2, kg/year			-90.4866 (272)

-----  
 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	242.1219	1.5832	383.3347 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1649.4752	1.5213	2509.2918 (278)
Space and water heating			2892.6265 (279)
Pumps, fans and electric keep-hot	194.2051	1.5128	293.7934 (281)
Energy for lighting	181.7615	1.5338	278.7919 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3076.2702	1.4978	-4607.6214
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-4607.6214 (283)
Total Primary energy kWh/year			-1142.4096 (286)

# Predicted Energy Assessment



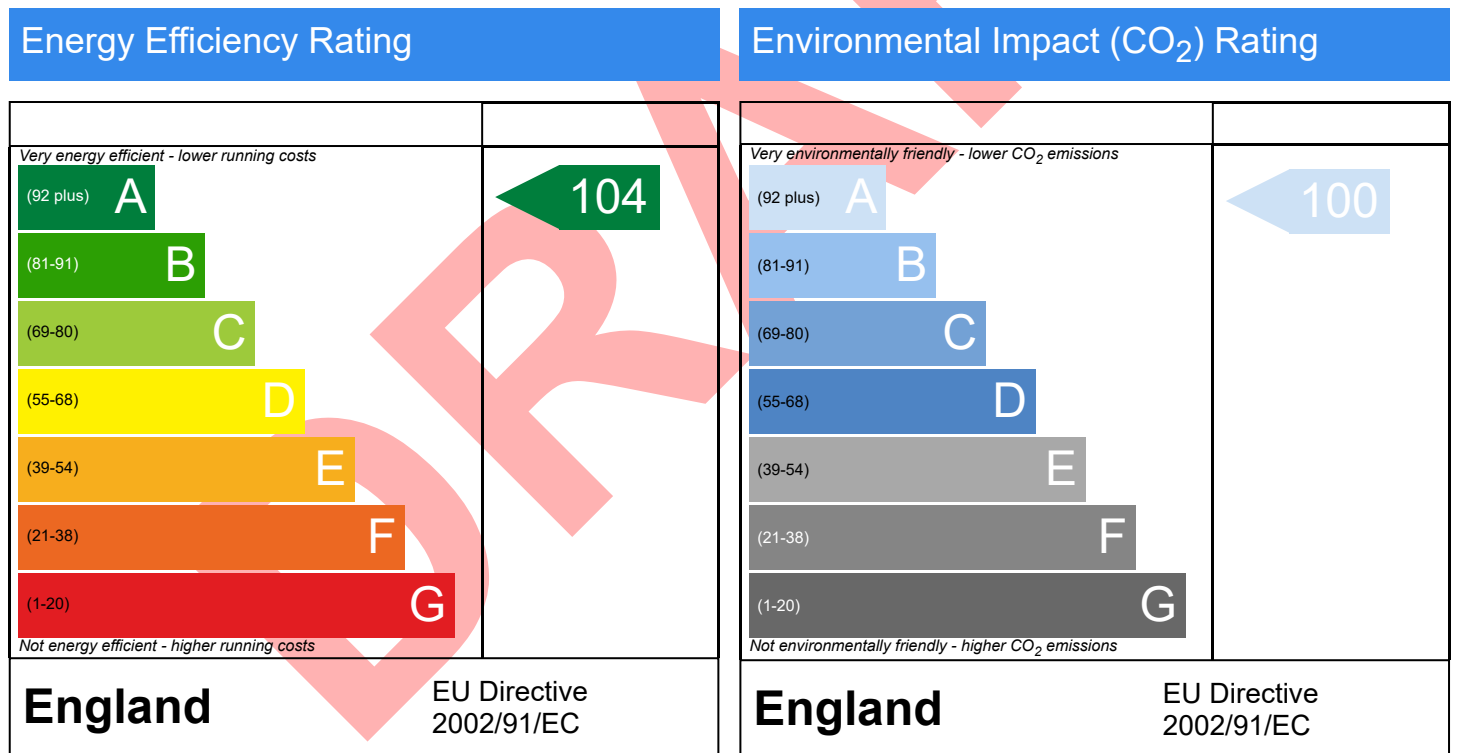
Block 3, 236 Henvver Road, Newquay, Cornwall, TR7 3EM

Dwelling type:  
Date of assessment:  
Produced by:  
Total floor area:  
DRRN:

Flat, Semi-Detached  
11/10/2023  
Kyle Jones  
75.4 m<sup>2</sup>

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

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



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

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