



Development of 4 Terraced Dwellings at 10 Palmerston Road, Sutton, SM1 4QL

Energy Strategy, Sustainable Design & Construction Statement

For

Canopy Planning

1st December 2023

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Energy Strategy, Sustainable Design & Construction Statement

Development at 10 Palmerston Road, Sutton.



Melin Consultants are a building and construction consultancy specialising in Part L of the Building Regulations. We are accredited to provide a range of energy modelling calculations, assessment, and testing services for local authorities, architects, builders & developers and have done so over several years. Our consultants are members of Chartered Institute of Building Service Engineers (CIBSE) Low Carbon Consultants which is recognised as the leading body of competent energy consultants.

Melin Consultants fully check all work prior to completion and a robust audit trail exists to demonstrate accountability.

All information within this document is based on evidence provided in the form of drawings and specifications.

CPD (Continual Professional Development) records are kept, and all technical staff are required to complete a minimum 20 hours per year in training activities.

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 Strategy, Sustainable Design & Construction Statement and SAP Calculations

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1 Executive Summary

1.1 Overview

This Energy Strategy provides a clear assessment of the proposed development's overall energy requirements and subsequent carbon dioxide (CO₂) emissions.

In formulating designed energy and carbon emissions, Elmhurst's SAP10.2 software has been used to calculate the estimated CO₂ reductions for the residential areas.

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, 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 Strategy concludes that a minimum 35% reduction in CO₂ emissions from the baseline dwelling can be achieved from on-site renewable energy, through the adoption of an efficient ASHP.

1.3 DER-TER, DFEE-TFEE & DPER-TPER Comparisons

The following ratings were averaged across the 4 dwellings and meet the requirements of a 35% reduction in CO₂ emissions along with a 10% reduction in fabric energy efficiency over the baseline set out in the London Plan (2021-):

Averaged	Result (kgCO ₂ /yr/m ²)
DER (Dwelling Emission Rate)	4.47
TER (Target Emission Rate)	11.02
% reduction	59.44
Overall Result	Pass

Averaged	Result (kWh/m ² /yr)
DFEE (Dwelling Fabric Energy Efficiency)	35.68
TFEE (Target Fabric Energy Efficiency)	36.39
% reduction	19.51
Overall Result	Pass

Averaged	Result (kWh/m ² /yr)
DPER (Dwelling Primary Energy Rate)	47.24
TPER (Target Primary Energy Rate)	57.62
% reduction	18.01
Overall Result	Pass

2 Introduction

2.1 Background

This Strategy has been prepared by Melin Consultants considering the London Borough of Sutton: Local Plan (2018-) and the London Plan (2021).

It is intended to provide a clear and straightforward assessment of the proposed development's energy requirements and subsequent CO₂ emissions.

This statement assesses expected energy demand at the site, showing how CO₂ emissions will be reduced through designing for minimum energy use and installing on-site renewable energy.

2.2 Policy Requirements

This Energy Strategy has been prepared by Melin Consultants considering national planning policy requirements and the requirements of Sutton's Local Plan and the London Plan (March 2021) and Sustainable Design and Construction SPG.

It assesses expected energy demand for the site, showing how energy and CO₂ emissions can be reduced through designing for

minimum energy use and installing on-site renewable and low carbon energy sources.

It is supported by a summary of the proposed thermal performance of the major fabric building materials, waste, and water management and how the development engages with issues around sustainable design in a wider context.

In summary, the London Borough of Sutton Local Plan & London Plan requires new developments to both mitigate and adapt to climate change. They should also include measures to reduce carbon dioxide emissions and incorporate sustainable design to maximise energy efficiency. Specifically, evidence is required to demonstrate how new developments will minimise their energy requirements and how they will reduce CO₂ emissions by a minimum 35% and fabric energy efficiency by a minimum 10% over a Building Regulations Part L compliant building.

2.2.1 Policy Context

CO₂, along with other greenhouse gases, is linked directly to a warming wetter climate. The use of fossil fuels to provide energy for lighting, heating and hot water in buildings contributes to carbon emissions. Thereby, reducing demand for energy will reduce total carbon emissions required to operate and condition a building. It is

estimated that buildings account for near half of the total UK carbon emissions with the domestic housing sector accounting for around 27% of the total UK carbon emissions.

To mitigate against the reliance on fossil fuels and further contributing to greenhouse gases, the UK has two measurable future targets which help share and develop sustainable construction standards:

- The EU Renewable Energy Directive (2009) requires the UK to meet a renewable energy target of 15% energy generation by 2020.
- The Climate Change Act (2008) is a legally binding commitment by the UK to reduce greenhouse gas emissions by 34% by 2020 and 80% by 2050 from a 1990 baseline.

2.2.2 The London Plan (March 2021)

Policy SI2: Minimising greenhouse gas emissions

A. Major development should be net zero-carbon. This means reducing carbon dioxide emissions from construction and operation, and minimising both annual and peak energy demand in accordance with the following energy hierarchy:

- 1) Be lean: use less energy and manage demand during construction and operation.
- 2) Be clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly. Development in Heat Network Priority Areas should follow the heating hierarchy in Policy SI3 Energy infrastructure.
- 3) Be green: generate, store, and use renewable energy on-site.

B. Major development should include a detailed energy strategy to demonstrate how the zero-carbon target will be met within the framework of the energy hierarchy and will be expected to monitor and report on energy performance.

C. In meeting the zero-carbon target a minimum on-site reduction of at least 35 per cent beyond Building Regulations is expected. Residential development should aim to achieve 10 per cent, and non-residential development should aim to achieve 15 per cent through energy efficiency.

The report is intended to provide a clear and straightforward assessment of the proposed development's energy usage and carbon emissions and will outline any proposed measures that have been included, to increase the sustainability of the proposed development.

3 Site Analysis

3.1 Location

The proposed development is located at 10 Palmerston Road in Sutton. Figure one below highlights the area of the development.



Figure 1: Map highlighting location of the site and its surroundings

Situated on 10 Palmerston Road, the site is close to several good transport links. Sutton train station is 1.2 miles from the site and provides services to London Victoria, Horsham, St. Albans City, Epsom Downs, London Blackfairs & Dorking. Moreover, several bus stops are located nearby including one on Lind Road less than 0.1

miles from the site entrance and provide additional links around the city.

3.2 The Proposed Development

The proposal is for the demolition of the existing garage at 10 Palmerston Road and the subsequent erection of 4 terraced three-storey dwellings.



Figure 2: 3D Views of the proposed development

4 Energy Efficient Design Measures

To supplement the London Borough of Sutton core 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. Where possible the following daylight factors will be met:

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 Insulation and Fabric Performance

High performance insulation will be specified throughout and will have a GWP of <5 and zero ODP. The effects of cold bridging and

air infiltration will be addressed prior to construction. Low U values have been specified to reduce the carbon emissions for the development.

4.4 Heating, Cooling & DHW Strategy

The proposed heating and domestic hot water strategy is likely to be from an Independent Air Source Heat Pump and a 200L hot water cylinder to each dwelling. There is no secondary heating system (i.e., log burner) present.

4.5 Ventilation Strategy

Natural ventilation will be used throughout all four dwellings.

4.6 Overheating

The SAP calculations have carried out basic solar gains calculations to determine which areas may be at risk from overheating. None of the areas on which calculation have been carried out show any risk of overheating. To reduce the risk of solar gains and reduce the need for mechanical ventilation or cooling, the London Plan Cooling Hierarchy has been used. The steps and measures included within the design are outlined below:

- *Minimise internal heat generation through energy efficient design* – the building has been designed in such a way to reduce the internal generation within rooms. Based on the usage of the rooms within the building it is unlikely that there will be significant amounts of internal heat generated.
- *Reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls* – the orientation of the building is such that there are windows that face South, where it is deemed necessary, these windows will incorporate solar glazing to reduce the solar gains.
- *Manage the heat within the building through exposed internal thermal mass and high ceilings* – the building design will include materials with a high thermal mass to help manage the heat within the building.
- *Passive ventilation* – the building will make use of a natural ventilation strategy to ensure all areas are ventilated to an adequate level and reduce heat levels within the building.
- *Mechanical ventilation* – the building has been designed not to use mechanical ventilation within the residential areas.

4.7 Water Use

To meet Building Regulations requirements, water usage must not exceed 105 Litres/person/day in line with Code for Sustainable Homes (Level 3/4) 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

Where there is an increase in impermeable area, the development will be required to demonstrate, with a hydrology report, that the peak rate of run-off over the development lifetime, allowing for climate change, will be no greater for the developed site than it was for the pre-development site. This should comply at the 1 year and 100-year return period events and where necessary incorporate an appropriate sustainable urban drainage system (SUDS).

4.8 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.

4.9 Energy Efficiency Measures

To reduce the energy demand within the proposed development, low U-values, an energy efficient heating system and renewables have been used:

- External Wall – 0.18 W/m²K
- Dormer/Secondary Wall – 0.18 W/m²K
- Sloped Roof - 0.15 W/m²K
- Dormer Roof – 0.15 W/m²K
- Secondary Plane Roof - 0.15 W/m²K

- Ground Floor - 0.13 W/m²K
- Window – 1.20 W/m²K
- Glazed Door – 1.00 W/m²K
- Bi fold - 1.20 W/m²K
- Roof-light - 1.30 W/m²K
- Thermal Bridging: Psi values have been taken from R.O.I Acceptable Construction Details for a cavity wall (2) & defaults.
- An Air Permeability of 5.00 m³/h/m² at 50 Pa has been allowed for Houses 1 & 4, whereas the mid-terrace houses 2 & 3 will require a 4.50 m³/h/m² at 50 Pa.
- Heating: Air Source Heat Pump with a minimum efficiency of 324.00%.

4.10 Reducing Surface Water Run-Off

A formal strategy to reduce surface water run-off is not yet available. A detailed design for the management of surface water will be provided prior to the development commencing and approved in writing by the local planning authority.

There is currently limited opportunity to incorporate any significant green roof area as the proposed space is dedicated to the siting of photovoltaic panels.

4.11 District Heating

There are currently no connection opportunities within the area to a district heating scheme as shown in the figure below:

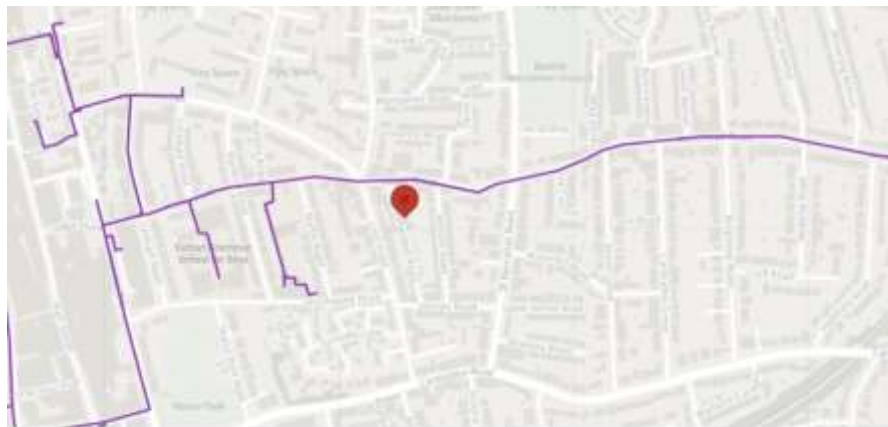


Figure 3: London heat map highlighting the location of existing schemes and network opportunities along with potential heat supplies.

By utilising a distribution of heat through water, this enables the scheme to become part of a future district heating scheme. The

location of the development is within an area of high density; therefore, the heat demand of the surrounding buildings would be sufficient for a district heating system to be considered within the area.

4.12 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 table one.

Table 1: Summary of renewable technologies

Solar PV
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 going to be significant during period of occupation and a 35% reduction in carbon emissions from the baseline dwelling is achievable by using this technology on its own, although this may require large areas of PV panels.
Solar Thermal

The proposed development would have medium to high hot water demand which, if sized correctly, lends itself too solar thermal. However, it is unlikely that the full 35% reduction in carbon emissions from the baseline dwelling could be achieved with this system alone as a large area of solar thermal panels would be required to achieve this.

Air Source Heat Pumps (ASHP)

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 the full 35% reduction in carbon emissions from the baseline dwelling from the baseline dwelling 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 the full 35% reduction in carbon emissions from the baseline dwelling could be achieved with this system alone.

Ground Source Heat Pumps (GSHP)

The energy demand of the proposed development could 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 the full 35% reduction in carbon emissions from the baseline dwelling could be achieved with this system alone.

Water Source Heat Pump (WSHP)

The energy demand of the proposed development could 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 unlikely that the full 35% reduction in carbon emissions from the baseline dwelling 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.

Combined Heat & Power (CHP)

Medium and high electricity demand makes CHP an unviable option for this development.

5 Baseline Energy Demand & CO₂ 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. SAP calculations have also been used to calculate the reductions in CO₂ emissions that have been achieved.

To demonstrate how the development has reduced carbon emissions by a prescribed amount, technical calculations in SAP10.2 provide estimated primary energy usage and CO₂ emissions for a building that is compliant with Part L (baseline building). This is followed by a final set of calculations which have been carried out which include the renewables. These calculations demonstrate how the required reduction of 35% can be achieved.

5.2 Baseline Calculations

Baseline calculations have been obtained from the notional dwelling results utilising the following system as per Appendix R under SAP10 conventions:

- Heating system: Mains gas regular condensing boiler
- External wall U-value is set at 0.18 W/m²K.
- Flat Roof U-value is set at 0.11 W/m²K.
- Ground Floor U-value is set at 0.13 W/m²K.
- Window U-value is set at 1.20 W/m²K.
- Glazed door U-value is set at 1.00 W/m²K.
- An air permeability figure of 5.00 m³/h/m² at 50 Pa has been assumed.
- Thermal bridging: Psi values have been taken from Table R2 under SAP10 conventions.
- Nominal PV calculated from Appendix R: 9.23 kWp.

The above were utilised by SAP10 to generate the TER, TFEE & DPER which were used as the baseline comparison to the proposed development.

5.3 Be Lean Calculations

These are set out in Section 4.9.

5.4 Be Green Calculations

Several renewable technologies have been considered for the proposed development (Solar Thermal, Solar PV, Wind, ASHP, GSHP, CHP and Biomass), the suitability of these technologies has been covered in Section 4.12 of this report. To achieve the 35% carbon reduction. An efficient ASHP has been considered the most suitable technology in terms of payback, site suitability and feasibility.

5.5 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 Strategy for the Chosen Technology

Based on the information provided in the above report, it has been decided that the most suitable and cost-effective renewable technology would be solar PV, below is a summary of the savings that have been achieved.

Table 1: Carbon dioxide (CO₂) emissions after each stage of the Energy Hierarchy for the development

	Total regulated carbon dioxide emissions across for the development (Tonnes CO ₂ per annum)
Baseline: Part L 2021 of the Building Regulations Compliant Development	4.50
After energy demand reduction (be lean)	0.90
After heat network connection (be clean)	0.90
After renewable energy (be green)	1.80

Table 2: Regulated carbon dioxide (CO₂) emissions savings after each stage of the Energy Hierarchy for the development

	Total Regulated carbon dioxide emissions savings	
	Tonnes CO ₂ per annum	%
Be lean: savings from energy demand reduction	3.60	81.00
Be clean: savings from heat network	0.00	0.00%
Be green: savings from renewable energy	-1.00	-21.00%
Cumulative on-site savings	2.70	59.00%
Annual savings from off-set payment	1.80	
Tonnes CO ₂		
Cumulative savings for off-set payment	54.00	
Cash in-lieu contribution (£)	5,168.00	

7 Conclusion

With the inclusion of energy efficient measures including low U-values and an efficient ASHP, the proposed development can demonstrate a potential to reduce carbon emissions by far greater than 35% over the baseline dwelling in addition to a greater than 10% saving from renewable energy. A summary of energy efficiency measured are stated in Table 3 below.

Table 3: Summary of energy efficient measures

Element or System	Part L Threshold U-values (W/m ² .K)	Proposed U-values (W/m ² .K)
External Wall	0.26	103mm Brick outer leaf, 115mm Celotex Thermaclass 21 full fill, 100mm medium dense concrete block inner leaf, 12.5mm plasterboard on dabs, skim finish. - 0.16
Dormer/Secondary Wall	0.26	Tiles hung vertically on 25x38mm battens, breather membrane, 12mm plywood, 150x50mm stud frame with 120mm Celotex XR4000 between & 25mm Celotex TB4000 over, VCL, 12.5mm plasterboard, skim finish. – 0.18
Ground Floor	0.18	65mm sand/cement screed, VCL, 120mm Kingspan Kooltherm K103, 100mm reinforced concrete slab. - 0.13
Sloped/Dormer Roof	0.16	Tiles, 25x38mm battens, 25mm counter battens, felt, 47x150mm rafters with 150mm Celotex XR4000 between and 30mm TB4000 below, 12.5mm foil back plasterboard, skim finish. - 0.15
Secondary Plane Roof	0.16	Cold roof space, 150mm Rockwool roll laid between joists, 150mm above, 12.5mm plasterboard below. – 0.15
Window/Bi fold	1.60	Double Glazed, low E Soft 0.1 – 1.20

		(g' value – 0.63)
Glazed Door	1.60	Triple Glazed, low E Soft 0.1 – 1.00 (g' value – 0.57)
Roof-light	2.20	Double glazed – 1.30 (g' value – 0.76)
Air Permeability (m ³ / (h.m ²))	A design air permeability rate of 4.50 – 5.00 m ³ / (h.m ²) at 50 Pa has been allowed for.	
Primary Heating	ASHP feeding radiators & underfloor heating: E.g., Grant AERONA HPID6	
Water Heating	From main system, 200L cylinder, assumed 2 kWh/day heat loss	
Ventilation	Natural	
Thermal Bridging	Psi values have been adopted from R.O.I Acceptable Construction Details for a Cavity Wall & defaults.	
Lighting	100% L.E.L fittings have been allowed for, Efficacy = 75 lm/W, Power = 10W as standard.	
Solar Photovoltaics (PV)	None	

Appendix A: Technical Drawings

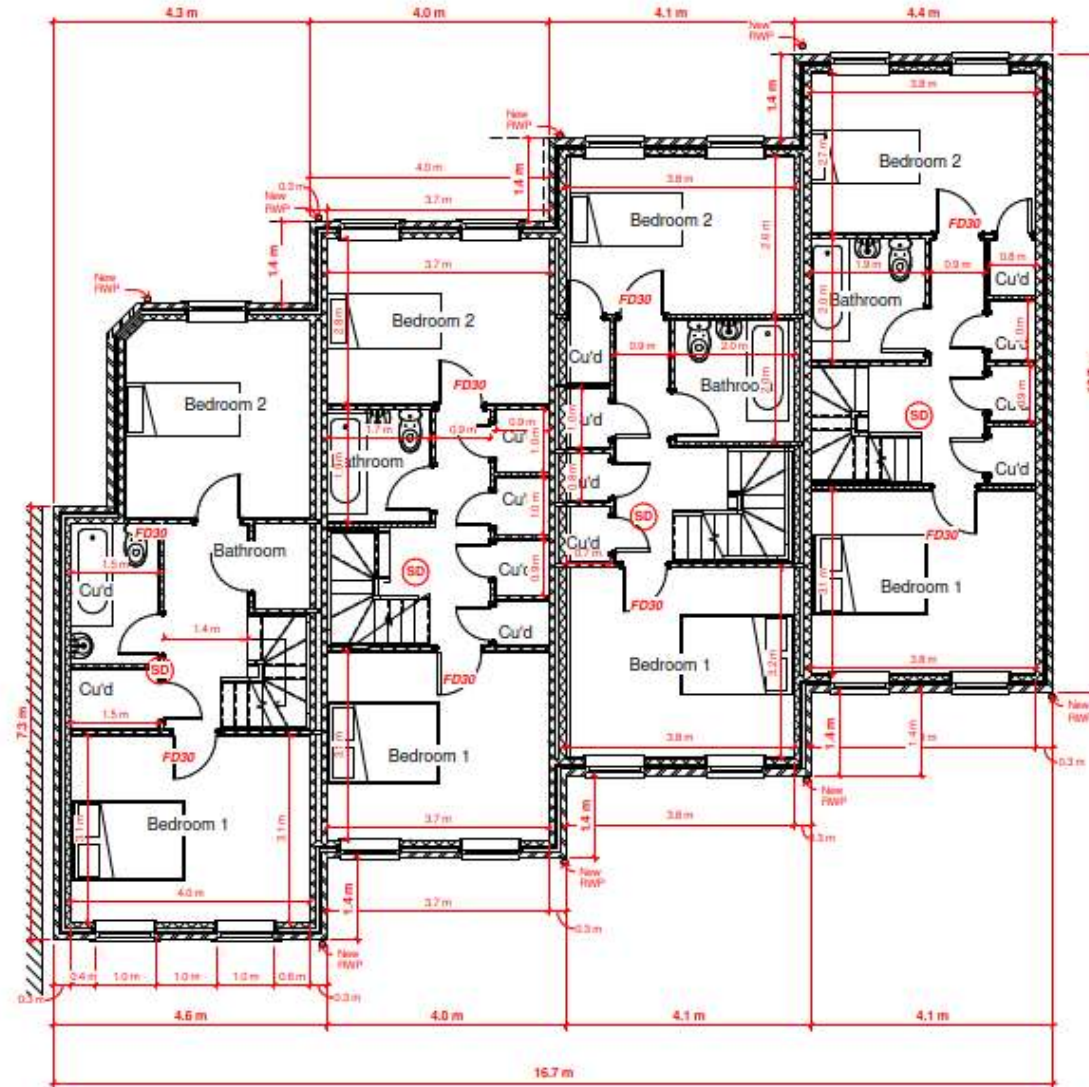
Proposed Ground Floor:

Drw No. – 2238/01



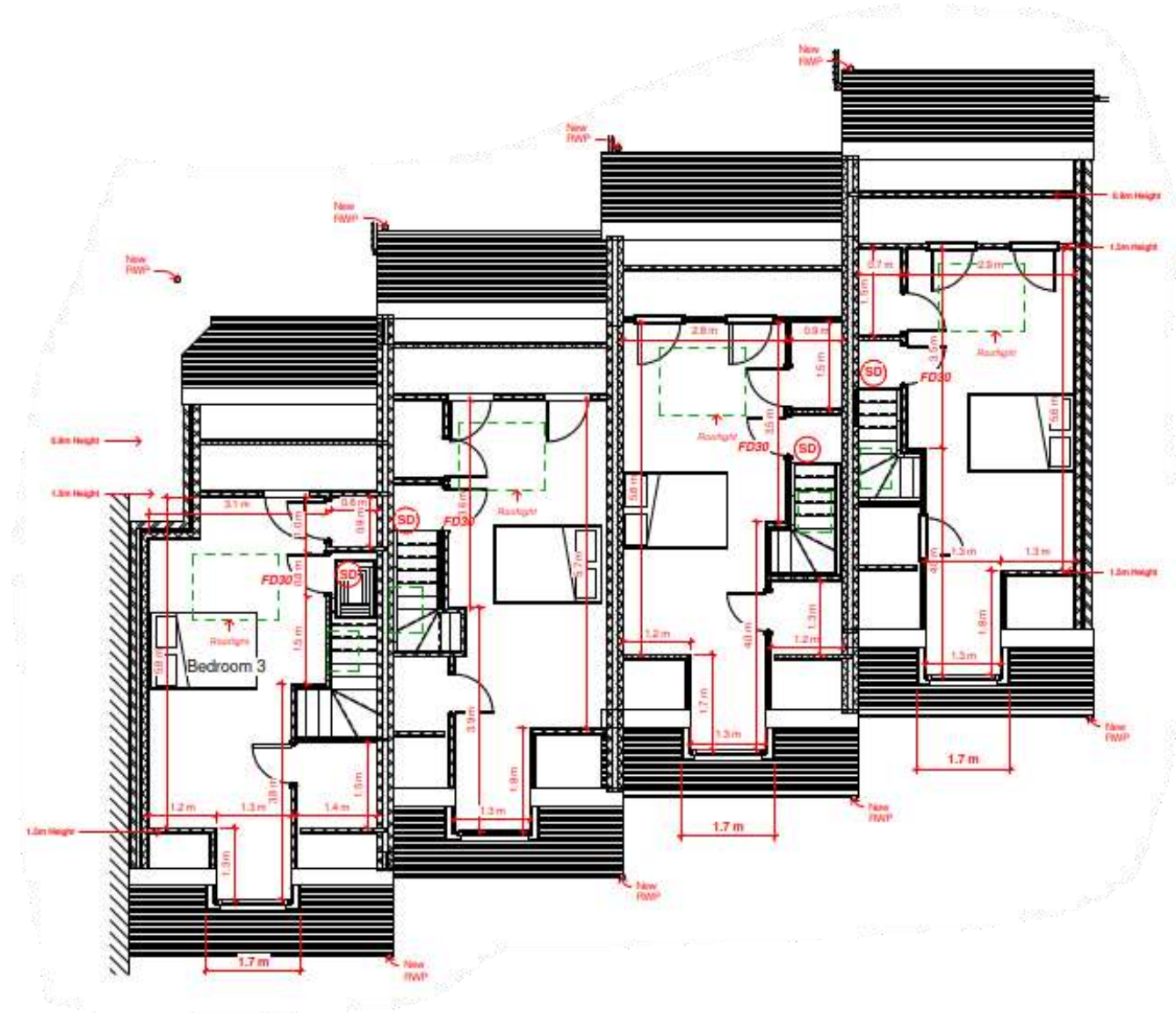
Proposed First Floor:

Drw No. – 2238/02



Proposed Second Floor:

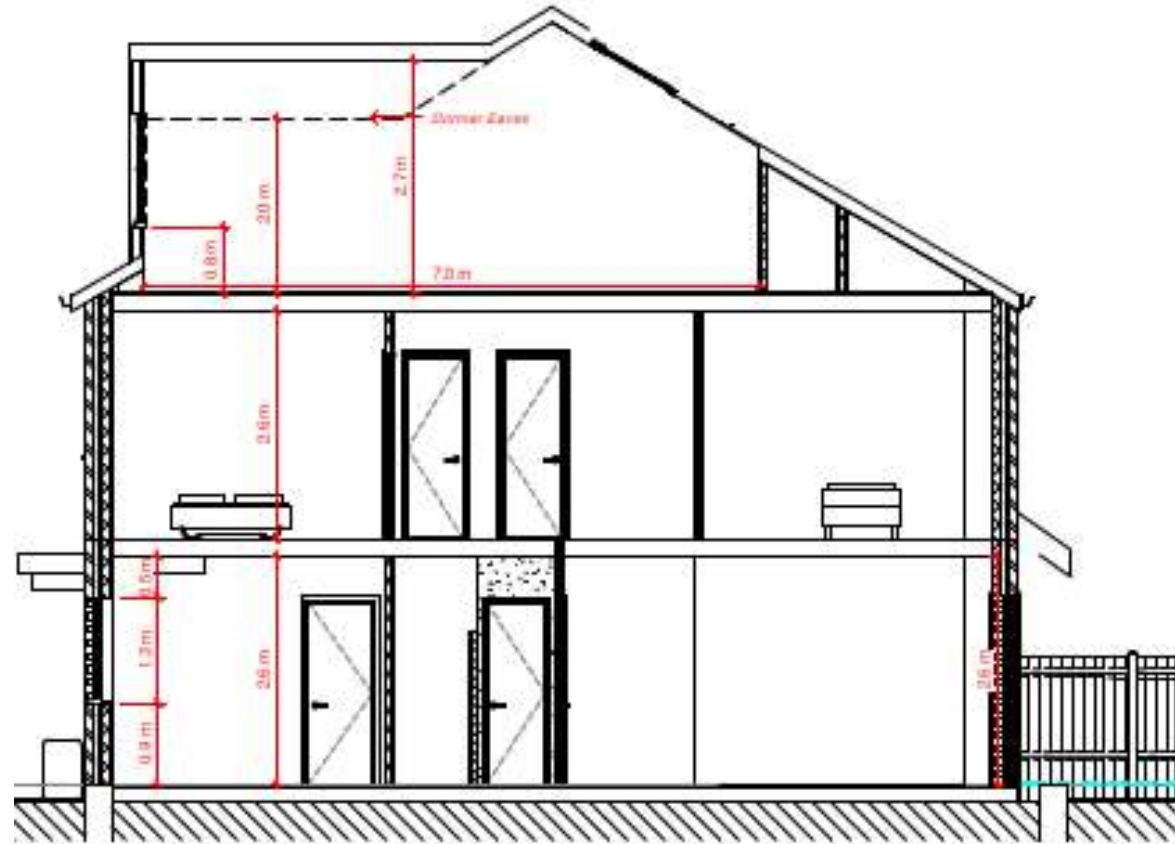
Drw No. – 2238/03



Cross section – House

Drw No. – 2238/05

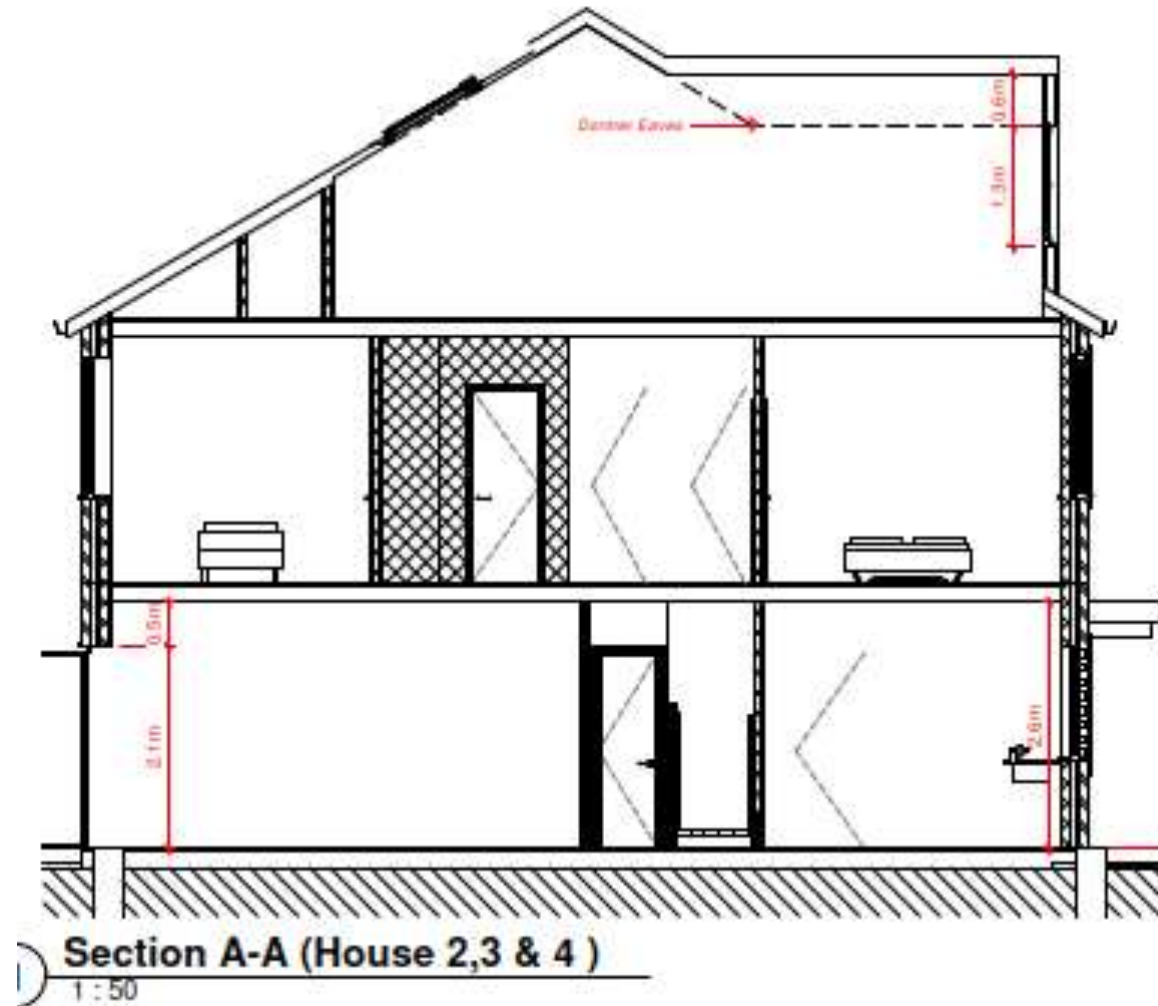
1:



Section A-A (House 1)

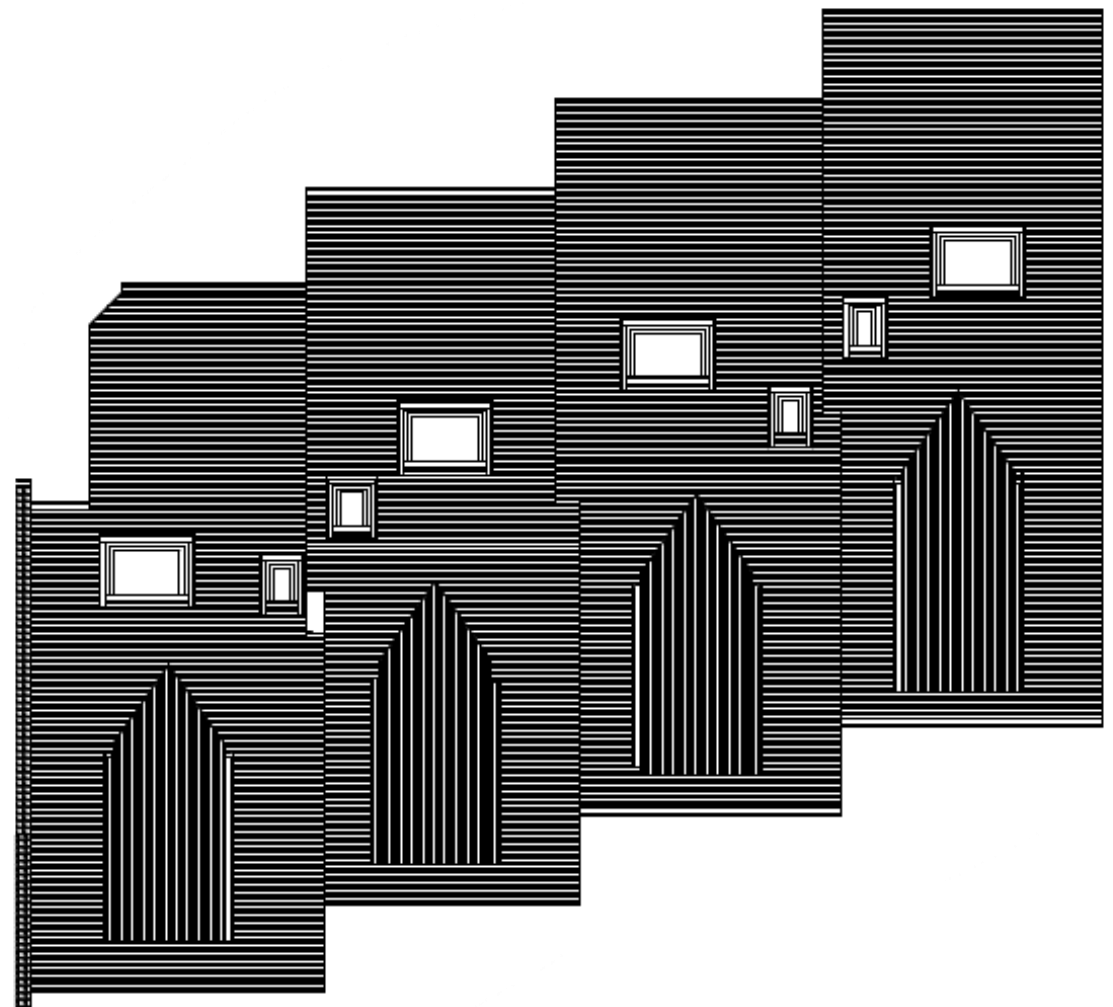
Cross section – House 2, 3 & 4:

Drw No. – 2238/05



Roof layout

Drw No. – 2238/06



Elevations

Drw No. 2338/07



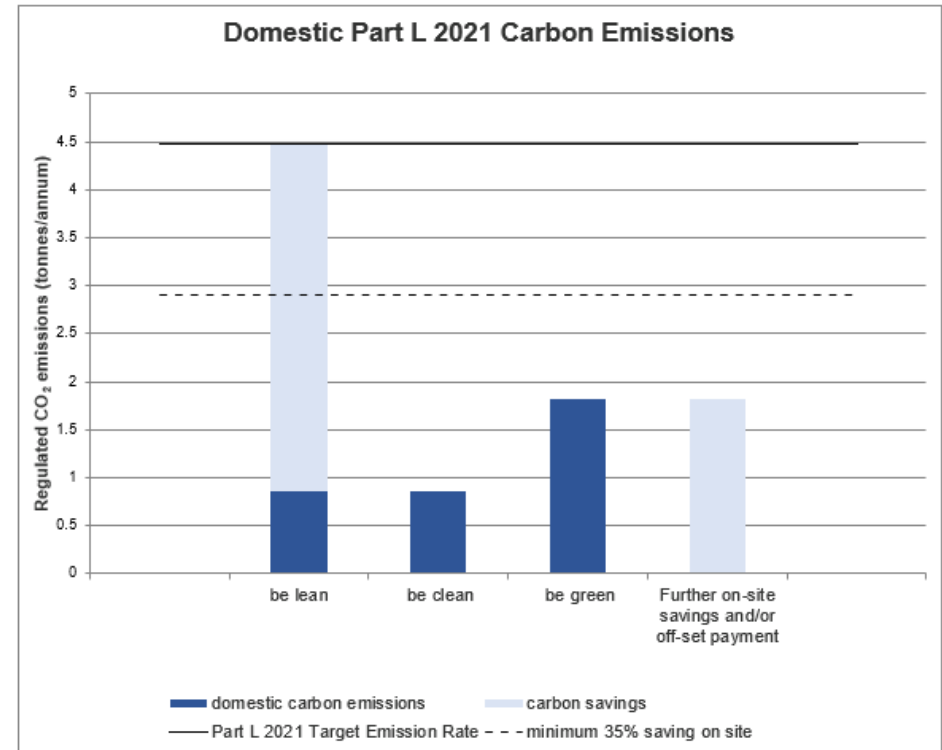
Appendix B: Residential
GLA Energy Summary
Tool Tables

Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for residential buildings

	Carbon Dioxide Emissions for residential buildings (Tonnes CO ₂ per annum)	
	Regulated	Unregulated
Baseline: Part L 2021 of the Building Regulations Compliant Development	4.5	
After energy demand reduction (be lean)	0.9	
After heat network connection (be clean)	0.9	
After renewable energy (be green)	1.8	

Table 2: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for residential buildings

	Regulated residential carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Be lean: savings from energy demand reduction	3.6	81%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	-1.0	-21%
Cumulative on site savings	2.7	59%
Annual savings from off-set payment	1.8	-
(Tonnes CO₂)		



Appendix C:

Software Outputs

Building Regulations England Part L (BREL) Compliance Report

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

Date: Fri 01 Dec 2023 16:15:29

Project Information			
Assessed By	Kyle Jones	Building Type	House, End-terrace
OCDEA Registration	EES/027281	Assessment Date	2023-12-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	99 m ²
Site Reference	304434 - House 1	Plot Reference	304434 - House 1
Address	House 1 10 Palmerston Road, Sutton, SM1 4QL		

Client Details	
Name	Canopy Planning
Company	Canopy Planning
Address	5 Palmerston Court, Palmerston Road, Sutton, SM1 4QL

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	11.67 kgCO ₂ /m ²	
Dwelling carbon dioxide emission rate	4.65 kgCO ₂ /m ²	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	61.1 kWh _{PE} /m ²	
Dwelling primary energy	49.03 kWh _{PE} /m ²	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	38.9 kWh/m ²	
Dwelling fabric energy efficiency	38.0 kWh/m ²	OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.16	Walls (2) (0.18)	OK
Party walls	0.2	0	Party Wall (1) (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	0.13	Ground floor (0.13)	OK
Roofs	0.16	0.15	Roof (1) (0.15)	OK
Windows, doors, and roof windows	1.6	1.18	W (1.2)	OK
Rooflights	2.2	1.3	E, East (1.3)	OK

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	Net area [m ²]	U-Value [W/m ² K]
Exposed wall: Walls (1)	103.59	0.16
Exposed wall: Walls (2)	7.31	0.18
Exposed wall: Walls (3)	8.21	0.18
Party wall: Party Wall (1)	61.23	0 (!)
Ground floor: Ground floor, Ground floor	36.57	0.13
Exposed roof: Roof (1)	26.49	0.15
Exposed roof: Roof (2)	1.84	0.15
Exposed roof: Roof (3)	10.23	0.15

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
W, Window	4.7	West	0.7	1.2
W, Half glazed door	1.78	West	N/A	1 (!)
W, Window	1.41	West	0.7	1.2
E, Roof-light	2.09	East	0.7	1.3
E, Bi-fold	6.08	East	0.7	1.2
E, Window	2.85	East	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)	Government-approved scheme	0.012 (!)	
External wall	E3: Sill	Government-approved scheme	0.015 (!)	
External wall	E4: Jamb	Government-approved scheme	0.026 (!)	
External wall	E5: Ground floor (normal)	Government-approved scheme	0.072	
External wall	E6: Intermediate floor within a dwelling	Government-approved scheme	0.02 (!)	
External wall	E11: Eaves (insulation at rafter level)	Government-approved scheme	0.02 (!)	
External wall	E13: Gable (insulation at rafter level)	Government-approved scheme	0.041	
External wall	E16: Corner (normal)	Government-approved scheme	0.032 (!)	
External wall	E17: Corner (inverted - internal area greater than external area)	Government-approved scheme	-0.053	
Party wall	P1: Ground floor	SAP table default	0.32	
Party wall	P2: Intermediate floor within a dwelling	SAP table default	0 (!)	
Party wall	P4: Roof (insulation at ceiling level)	SAP table default	0.48	
Roof	R1: Head of roof window	SAP table default	0.24	
Roof	R2: Sill of roof window	SAP table default	0.24	
Roof	R3: Jamb of roof window	SAP table default	0.24	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))				
Maximum permitted air permeability at 50Pa		8 m ³ /hm ²		
Dwelling air permeability at 50Pa		5 m ³ /hm ² , Design value		OK
Air permeability test certificate reference				

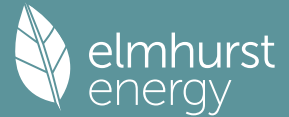
4 Space heating	
Main heating system 1: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	324.3%
Emitter type	Both radiators and underfloor
Flow temperature	35°C
System type	Heat Pump
Manufacturer	Grant Engineering (UK) Ltd
Model	AERONA3
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	200 litres
Declared heat loss	2 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		
System type: N/A		
Maximum permitted specific fan power	N/A	
Specific fan power	N/A	N/A
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model		
Commissioning		
9 Local generation		
N/A		
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	304434 - House 1		Issued on Date	01/12/2023	
Assessment Reference	304434 - House 1	Prop Type Ref	304434		
Property	House 1, 10 Palmerston Road, Sutton, Surrey, SM1 4QL				
SAP Rating	79 C	DER	4.65	TER	11.67
Environmental	96 A	% DER < TER			60.15
CO ₂ Emissions (t/year)	0.42	DFEE	38.04	TFEE	38.89
Compliance Check	See BREL	% DFEE < TFEE			2.18
% DPER < TPER	19.76	DPER	49.03	TPER	61.10
Assessor Details	Mr. Kyle Jones			Assessor ID	AV53-0001
Client	304434, Canopy Planning				

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	36.5700 (1b)	x 2.6000 (2b)	= 95.0820 (1b) - (3b)
First floor	36.5700 (1c)	x 2.8000 (2c)	= 102.3960 (1c) - (3c)
Second floor	26.3400 (1d)	x 2.1700 (2d)	= 57.1578 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	99.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 254.6358 (5)

2. Ventilation rate

	Value	Reference
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) =	0.1178 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3678 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3126 (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	0.3986	0.3908	0.3830	0.3439	0.3361	0.2970	0.2970	0.2892	0.3126	0.3361	0.3517	0.3674 (22b)
Effective ac	0.5794	0.5764	0.5733	0.5591	0.5565	0.5441	0.5441	0.5418	0.5489	0.5565	0.5619	0.5675 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			8.9600	1.1450	10.2595		(27)
Half glazed door			1.7800	1.0000	1.7800		(26a)
Bi-fold (Uw = 1.20)			6.0800	1.1450	6.9618		(27)
E			2.0900	1.2357	2.5827		(27a)
Ground floor			36.5700	0.1300	4.7541	110.0000	4022.7000 (28a)
External wall	119.0000	15.4100	103.5900	0.1600	16.5744	150.0000	15538.5000 (29a)
Dormer wall	8.7200	1.4100	7.3100	0.1800	1.3158	9.0000	65.7900 (29a)
Secondary wall	8.2100		8.2100	0.1800	1.4778	9.0000	73.8900 (29a)
Sloped roof	28.5800	2.0900	26.4900	0.1500	3.9735	9.0000	238.4100 (30)
Dormer sloped roof	1.8400		1.8400	0.1500	0.2760	9.0000	16.5600 (30)
Secondary plane roof	10.2300		10.2300	0.1500	1.5345	9.0000	92.0700 (30)
Total net area of external elements Aum(A, m ²)			213.1500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.4902		(33)
Party wall			61.2300	0.0000	0.0000	70.0000	4286.1000 (32)
Internal stud wall			186.2900			9.0000	1676.6100 (32c)
First floor			36.5700			18.0000	658.2600 (32d)
Second floor			26.3400			18.0000	474.1200 (32d)
Ground floor ceiling			36.5700			9.0000	329.1300 (32e)

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First floor ceiling 26.3400 9.0000 237.0600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 27709.2000 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 278.5404 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	10.3100	0.0120	0.1237
E3 Sill	6.6500	0.0150	0.0998
E4 Jamb	24.9800	0.0260	0.6495
E5 Ground floor (normal)	19.1100	0.0720	1.3759
E6 Intermediate floor within a dwelling	36.1400	0.0200	0.7228
E11 Eaves (insulation at rafter level)	9.1200	0.0200	0.1824
E13 Gable (insulation at rafter level)	11.5400	0.0410	0.4731
E16 Corner (normal)	37.4000	0.0320	1.1968
E17 Corner (inverted - internal area greater than external area)	10.2000	-0.0530	-0.5406
P1 Party wall - Ground floor	8.6700	0.3200	2.7744
P2 Party wall - Intermediate floor within a dwelling	8.6700	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	6.6400	0.4800	3.1872
R1 Head of roof window	2.0400	0.2400	0.4896
R2 Sill of roof window	2.0400	0.2400	0.4896
R3 Jamb of roof window	3.6800	0.2400	0.8832

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.1074 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 63.5976 (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	48.6910	48.4317	48.1776	46.9841	46.7608	45.7213	45.7213	45.5288	46.1217	46.7608	47.2125	47.6848 (38)
Average = Sum(39)m / 12 =	112.2886	112.0293	111.7752	110.5817	110.3584	109.3189	109.3189	109.1263	109.7193	110.3584	110.8101	111.2824 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1288	1.1261	1.1236	1.1116	1.1094	1.0989	1.0989	1.0970	1.1029	1.1094	1.1139	1.1186 (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 2.7347 (42)

Hot water usage for mixer showers 105.1066 103.5270 101.2253 96.8214 93.5714 89.9471 87.8870 90.1713 92.6753 96.5667 101.0652 104.7039 (42a)

Hot water usage for baths 30.2561 29.8067 29.1739 28.0072 27.1336 26.1649 25.6416 26.2700 26.9541 27.9907 29.1814 30.1538 (42b)

Hot water usage for other uses 42.6356 41.0853 39.5349 37.9845 36.4341 34.8837 34.8837 36.4341 37.9845 39.5349 41.0853 42.6356 (42c)

Average daily hot water use (litres/day) 163.7165 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	177.9983	174.4190	169.9341	162.8131	157.1391	150.9957	148.4124	152.8754	157.6139	164.0923	171.3319	177.4933 (44)
Energy content (annual)	281.9057	248.3703	261.1824	222.8830	211.5395	185.6668	179.4919	189.2917	194.3537	222.6717	244.0938	277.9116 (45)
Distribution loss (46)m = 0.15 x (45)m	42.2859	37.2555	39.1774	33.4325	31.7309	27.8500	26.9238	28.3937	29.1531	33.4008	36.6141	41.6867 (46)
Water storage loss:												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0800 (55)
Total storage loss	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (56)
If cylinder contains dedicated solar storage	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (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	338.6481	299.6215	317.9248	277.7950	268.2819	240.5788	236.2343	246.0341	249.2657	279.4141	299.0058	334.6540 (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	338.6481	299.6215	317.9248	277.7950	268.2819	240.5788	236.2343	246.0341	249.2657	279.4141	299.0058	334.6540 (64)
12Total per year (kWh/year)												3387.4581 (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	139.1276	123.5841	132.2371	118.0382	115.7308	105.6638	105.0750	108.3334	108.5522	119.4323	125.0908	137.7995 (65)

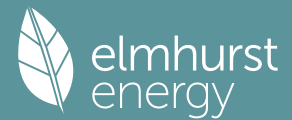
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	132.0383	146.1852	132.0383	136.4396	132.0383	136.4396	132.0383	132.0383	136.4396	132.0383	136.4396	132.0383 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	255.4844	258.1355	251.4547	237.2322	219.2788	202.4051	191.1325	188.4813	195.1621	209.3846	227.3380	244.2117 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.6733	36.6733	36.6733	36.6733	36.6733	36.6733	36.6733	36.6733	36.6733	36.6733	36.6733	36.6733 (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)	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864 (71)
Water heating gains (Table 5)	186.9994	183.9049	177.7380	163.9419	155.5521	146.7553	141.2298	145.6094	150.7670	160.5272	173.7372	185.2144 (72)
Total internal gains	638.5420	652.2455	625.2509	601.6336	570.8891	549.6199	528.4205	530.1489	546.3885	565.9701	601.5347	625.4843 (73)

6. Solar gains

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[Jan]		Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East		2.8500	19.6403	0.6300	0.7000	0.7700	17.1066 (76)
West		6.1100	19.6403	0.6300	0.7000	0.7700	36.6742 (80)
East		6.0800	19.6403	0.6300	0.7000	0.7700	36.4941 (76)
East		2.0900	26.6072	0.7600	0.7000	1.0000	26.6256 (82)

Solar gains	116.9005	230.4262	383.8404	566.6973	700.6605	719.9826	684.3298	583.7038	448.6596	274.5643	146.0736	95.9340 (83)
Total gains	755.4425	882.6717	1009.0913	1168.3309	1271.5496	1269.6025	1212.7502	1113.8527	995.0481	840.5344	747.6083	721.4183 (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	68.5466	68.7052	68.8614	69.6047	69.7455	70.4087	70.4087	70.5329	70.1518	69.7455	69.4612	69.1664
alpha	5.5698	5.5803	5.5908	5.6403	5.6497	5.6939	5.6939	5.7022	5.6768	5.6497	5.6307	5.6111
util living area	0.9962	0.9904	0.9721	0.9006	0.7461	0.5426	0.3954	0.4480	0.7149	0.9473	0.9911	0.9971 (86)
Living	20.1092	20.2527	20.4681	20.7317	20.8871	20.9375	20.9444	20.9434	20.9112	20.6828	20.3488	20.0876
Non living	18.9429	19.1269	19.3984	19.7189	19.8796	19.9279	19.9315	19.9328	19.9083	19.6730	19.2584	18.9220
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	20.5443	20.2527	20.4681	20.7317	20.8871	20.9375	20.9444	20.9434	20.9112	20.6828	20.3488	20.2152 (87)
Th 2	19.9774	19.9795	19.9816	19.9914	19.9932	20.0017	20.0017	20.0033	19.9984	19.9932	19.9895	19.9856 (88)
util rest of house	0.9948	0.9871	0.9622	0.8692	0.6843	0.4619	0.3064	0.3524	0.6294	0.9231	0.9874	0.9960 (89)
MIT 2	19.5650	19.1269	19.3984	19.7189	19.8796	19.9279	19.9315	19.9328	19.9083	19.6730	19.2584	19.1137 (90)
Living area fraction									FLA = Living area / (4) =			0.1625 (91)
MIT	19.7242	19.3099	19.5722	19.8835	20.0433	20.0920	20.0962	20.0971	20.0713	19.8371	19.4356	19.2927 (92)
Temperature adjustment												0.0000
adjusted MIT	19.7242	19.3099	19.5722	19.8835	20.0433	20.0920	20.0962	20.0971	20.0713	19.8371	19.4356	19.2927 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9944	0.9841	0.9572	0.8654	0.6876	0.4694	0.3148	0.3615	0.6361	0.9184	0.9846	0.9950 (94)
Useful gains	751.2331	868.6359	965.9147	1011.0553	874.3244	595.8995	381.8300	402.6644	632.9325	771.9297	736.0678	717.8147 (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	1731.9591	1614.3323	1461.1531	1214.5735	920.7576	600.3800	382.1953	403.4516	655.1694	1019.3968	1366.9130	1679.5555 (97)
Space heating kWh	729.6601	501.1080	368.4574	146.5331	34.5463	0.0000	0.0000	0.0000	0.0000	184.1155	454.2086	715.5352 (98a)
Space heating requirement - total per year (kWh/year)												3134.1643
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	729.6601	501.1080	368.4574	146.5331	34.5463	0.0000	0.0000	0.0000	0.0000	184.1155	454.2086	715.5352 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3134.1643
Space heating per m2										(98c) / (4) =		31.5055 (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 %) 324.3480 (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	729.6601	501.1080	368.4574	146.5331	34.5463	0.0000	0.0000	0.0000	0.0000	184.1155	454.2086	715.5352 (98)
Space heating efficiency (main heating system 1)	324.3480	324.3480	324.3480	324.3480	324.3480	0.0000	0.0000	0.0000	0.0000	324.3480	324.3480	324.3480 (210)
Space heating fuel (main heating system)	224.9621	154.4970	113.5994	45.1777	10.6510	0.0000	0.0000	0.0000	0.0000	56.7648	140.0374	220.6072 (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	338.6481	299.6215	317.9248	277.7950	268.2819	240.5788	236.2343	246.0341	249.2657	279.4141	299.0058	334.6540 (64)
Efficiency of water heater												171.6440 (216)
(217)m	171.6440	171.6440	171.6440	171.6440	171.6440	171.6440	171.6440	171.6440	171.6440	171.6440	171.6440	171.6440 (217)
Fuel for water heating, kWh/month	197.2969	174.5599	185.2234	161.8437	156.3014	140.1615	137.6304	143.3398	145.2225	162.7870	174.2012	194.9698 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	28.0705	22.5192	20.2760	14.8551	11.4745	9.3748	10.4674	13.6059	17.6728	23.1876	26.1904	28.8506 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)

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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												966.2967	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												171.6440	
Water heating fuel used												1973.5376	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:												0.0000	(231)
Total electricity for the above, kWh/year												226.5448	(232)
Electricity for lighting (calculated in Appendix L)													
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												3166.3790	(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	966.2967	0.1567	151.4600 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1973.5376	0.1410	278.2947 (264)
Space and water heating			429.7547 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	226.5448	0.1443	32.6974 (268)
Total CO2, kg/year			462.4521 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.6500 (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	966.2967	1.5803	1526.9934 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1973.5376	1.5214	3002.5818 (278)
Space and water heating			4529.5752 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	226.5448	1.5338	347.4819 (282)
Total Primary energy kWh/year			4877.0571 (286)
Dwelling Primary energy Rate (DPER)			49.0300 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	36.5700 (1b)	x 2.6000 (2b)	= 95.0820 (1b) - (3b)
First floor	36.5700 (1c)	x 2.8000 (2c)	= 102.3960 (1c) - (3c)
Second floor	26.3400 (1d)	x 2.1700 (2d)	= 57.1578 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	99.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	254.6358 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	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) = 0.1178 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3678 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)

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Infiltration rate adjusted to include shelter factor

(21) = (18) x (20) = 0.3126 (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													
Effective ac	0.3986	0.3908	0.3830	0.3439	0.3361	0.2970	0.2970	0.2892	0.3126	0.3361	0.3517	0.3674	(22b)
	0.5794	0.5764	0.5733	0.5591	0.5565	0.5441	0.5441	0.5418	0.5489	0.5565	0.5619	0.5675	(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 Semi-glazed door			1.7800	1.0000	1.7800			(26a)
TER Opening Type (Uw = 1.20)			15.0400	1.1450	17.2214			(27)
E			2.0900	2.0221	4.2261			(27a)
Ground floor			36.5700	0.1300	4.7541			(28a)
External wall	119.0000	15.4100	103.5900	0.1800	18.6462			(29a)
Dormer wall	8.7200	1.4100	7.3100	0.1800	1.3158			(29a)
Secondary wall	8.2100		8.2100	0.1800	1.4778			(29a)
Sloped roof	28.5800	2.0900	26.4900	0.1100	2.9139			(30)
Dormer sloped roof	1.8400		1.8400	0.1100	0.2024			(30)
Secondary plane roof	10.2300		10.2300	0.1100	1.1253			(30)
Total net area of external elements Aum(A, m2)			213.1500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	53.6630			(33)
Party wall			61.2300	0.0000	0.0000			(32)

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

278.5404 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	10.3100	0.0500	0.5155
E3 Sill	6.6500	0.0500	0.3325
E4 Jamb	24.9800	0.0500	1.2490
E5 Ground floor (normal)	19.1100	0.1600	3.0576
E6 Intermediate floor within a dwelling	36.1400	0.0000	0.0000
E11 Eaves (insulation at rafter level)	9.1200	0.0400	0.3648
E13 Gable (insulation at rafter level)	11.5400	0.0800	0.9232
E16 Corner (normal)	37.4000	0.0900	3.3660
E17 Corner (inverted - internal area greater than external area)	10.2000	-0.0900	-0.9180
P1 Party wall - Ground floor	8.6700	0.0800	0.6936
P2 Party wall - Intermediate floor within a dwelling	8.6700	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	6.6400	0.1200	0.7968
R1 Head of roof window	2.0400	0.0800	0.1632
R2 Sill of roof window	2.0400	0.0600	0.1224
R3 Jamb of roof window	3.6800	0.0800	0.2944

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

10.9610 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 64.6240 (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	48.6910	48.4317	48.1776	46.9841	46.7608	45.7213	45.7213	45.5288	46.1217	46.7608	47.2125	47.6848	(38)
Average = Sum(39)m / 12 =	113.3150	113.0557	112.8016	111.6081	111.3848	110.3452	110.3452	110.1527	110.7457	111.3848	111.8365	112.3088	(39)
												111.6070	(39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1391	1.1365	1.1339	1.1219	1.1197	1.1092	1.1092	1.1073	1.1132	1.1197	1.1242	1.1290	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	(40)

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.7347	(42)
Hot water usage for mixer showers													69.8026	(42a)
Hot water usage for baths													30.1538	(42b)
Hot water usage for other uses													42.6356	(42c)
Average daily hot water use (litres/day)													131.4150	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Energy conte	142.9628	139.9100	136.1924	130.5393	125.9486	121.0133	119.1167	122.8183	126.7222	131.9034	137.6435	142.5920	(44)	
Energy content (annual)	226.4181	199.2300	209.3226	178.7018	169.5511	148.8000	144.0613	152.0747	156.2611	178.9917	196.0984	223.2646	(45)	
Distribution loss (46)m = 0.15 x (45)m													2182.7753	
Water storage loss:													33.9627	(46)
Store volume													200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6525	(48)
Temperature factor from Table 2b													0.5400	(49)
Enter (49) or (54) in (55)													0.8924	(55)
Total storage loss													27.6637	(56)
If cylinder contains dedicated solar storage													27.6637	(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														
WWHRS	277.3441	245.2277	260.2486	227.9851	220.4772	198.0833	194.9874	203.0008	205.5444	229.9177	245.3817	274.1907	(62)	
PV diverter	-32.0336	-28.3307	-29.6663	-24.5649	-22.8936	-19.5269	-18.3627	-19.5269	-20.2688	-23.8947	-27.0697	-31.4403	(63a)	
Solar input	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)	
Output from w/h	245.3106	216.8970	230.5823	203.4202	197.5836	178.4931	176.6247	183.4739	185.2756	206.0231	218.3120	242.7503	(64)	
12Total per year (kWh/year)													2484.7464	(64)
Electric shower(s)													2485	(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)

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Heat gains from water heating, kWh/month
 116.0249 103.0422 110.3406 98.8450 97.1166 88.9026 88.6412 91.3057 91.3835 100.2556 104.6294 114.9763 (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	136.7330	136.7330	136.7330	136.7330	136.7330	136.7330	136.7330	136.7330	136.7330	136.7330	136.7330	136.7330 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	132.0383	146.1852	132.0383	136.4396	132.0383	136.4396	132.0383	132.0383	136.4396	132.0383	136.4396	132.0383 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	255.4844	258.1355	251.4547	237.2322	219.2788	202.4051	191.1325	188.4813	195.1621	209.3846	227.3380	244.2117 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.6733	36.6733	36.6733	36.6733	36.6733	36.6733	36.6733	36.6733	36.6733	36.6733	36.6733	36.6733 (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)	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864 (71)
Water heating gains (Table 5)	155.9474	153.3365	148.3073	137.2847	130.5331	123.4759	119.1415	122.7227	126.9215	134.7521	145.3186	154.5381 (72)
Total internal gains	610.4899	624.6772	598.8202	577.9763	548.8700	526.3405	506.3321	507.2622	522.5430	543.1950	576.1161	597.8080 (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						
East	8.9300	19.6403	0.6300	0.7000	0.7700	53.6007 (76)						
West	6.1100	19.6403	0.6300	0.7000	0.7700	36.6742 (80)						
East	2.0900	26.6072	0.6300	0.7000	1.0000	22.0713 (82)						
Solar gains	112.3461	221.2185	367.9307	542.3155	669.7275	687.8499	653.9302	558.2967	429.7733	263.4429	140.3414	92.2228 (83)
Total gains	722.8361	845.8957	966.7509	1120.2919	1218.5975	1214.1904	1160.2623	1065.5589	952.3163	806.6379	716.4575	690.0308 (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)	67.9257	68.0815	68.2348	68.9645	69.1028	69.7538	69.7538	69.8757	69.5016	69.1028	68.8237	68.5343
tau	5.5284	5.5388	5.5490	5.5976	5.6069	5.6503	5.6503	5.6584	5.6334	5.6069	5.5882	5.5690
util living area	0.9970	0.9923	0.9772	0.9155	0.7722	0.5699	0.4167	0.4718	0.7427	0.9561	0.9928	0.9977 (86)
MIT	19.8398	20.0284	20.3152	20.6774	20.9057	20.9859	20.9979	20.9960	20.9434	20.6154	20.1630	19.8114 (87)
Th 2	19.9691	19.9712	19.9732	19.9830	19.9848	19.9933	19.9933	19.9949	19.9900	19.9848	19.9811	19.9773 (88)
util rest of house	0.9959	0.9895	0.9688	0.8871	0.7113	0.4857	0.3223	0.3708	0.6571	0.9349	0.9898	0.9968 (89)
MIT 2	18.6277	18.8692	19.2316	19.6732	19.9134	19.9864	19.9928	19.9937	19.9562	19.6136	19.0494	18.5975 (90)
Living area fraction	18.8247	19.0576	19.4077	19.8364	20.0747	20.1488	20.1562	20.1566	20.1166	19.7764	19.2304	18.7948 (92)
MIT	18.8247	19.0576	19.4077	19.8364	20.0747	20.1488	20.1562	20.1566	20.1166	19.7764	19.2304	18.7948 (93)
Temperature adjustment												0.0000
adjusted MIT	18.8247	19.0576	19.4077	19.8364	20.0747	20.1488	20.1562	20.1566	20.1166	19.7764	19.2304	18.7948 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9940	0.9860	0.9628	0.8823	0.7171	0.4990	0.3377	0.3872	0.6687	0.9293	0.9865	0.9953 (94)
Useful gains	718.5280	834.0511	930.8104	988.4433	873.8323	605.8769	391.8365	412.6020	636.7923	749.6155	706.7725	686.7907 (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	1645.8684	1600.6023	1456.0141	1220.5905	932.8094	612.2859	392.4047	413.8036	666.3168	1022.1117	1356.6237	1639.1227 (97)
Space heating kWh	689.9413	515.1225	390.7515	167.1459	43.8790	0.0000	0.0000	0.0000	0.0000	202.7372	467.8929	708.5350 (98a)
Space heating requirement - total per year (kWh/year)												3186.0052
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	689.9413	515.1225	390.7515	167.1459	43.8790	0.0000	0.0000	0.0000	0.0000	202.7372	467.8929	708.5350 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3186.0052
Space heating per m2										(98c) / (4) =		32.0266 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fraction of space heat from main system(s)												0.0000 (201)
Efficiency of main space heating system 1 (in %)												1.0000 (202)
Efficiency of main space heating system 2 (in %)												92.3000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	689.9413	515.1225	390.7515	167.1459	43.8790	0.0000	0.0000	0.0000	0.0000	202.7372	467.8929	708.5350 (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)	747.4987	558.0958	423.3494	181.0899	47.5395	0.0000	0.0000	0.0000	0.0000	219.6503	506.9262	767.6435 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating														
Water heating requirement	245.3106	216.8970	230.5823	203.4202	197.5836	178.4931	176.6247	183.4739	185.2756	206.0231	218.3120	242.7503	242.7503	(64)
Efficiency of water heater														(216)
(217)m	86.2486	85.9285	85.2326	83.6228	81.2973	79.8000	79.8000	79.8000	79.8000	84.0237	85.7241	86.3158	86.3158	(217)
Fuel for water heating, kWh/month	284.4227	252.4156	270.5329	243.2592	243.0383	223.6756	221.3342	229.9171	232.1750	245.1963	254.6680	281.2350	281.2350	(219)
Space cooling fuel requirement														
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	(231)
Lighting	27.4349	22.0093	19.8170	14.5188	11.2147	9.1625	10.2304	13.2979	17.2727	22.6627	25.5974	28.1974	28.1974	(232)
Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)m	-35.8408	-51.3931	-75.1120	-85.8980	-93.8289	-87.9771	-86.8584	-81.3907	-71.9648	-59.3848	-39.6957	-30.8834	-30.8834	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)														
(233b)m	-17.7048	-37.5102	-75.0587	-113.4827	-150.8004	-151.8246	-150.0745	-126.7577	-92.4753	-53.9338	-23.7297	-13.9836	-13.9836	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year														
Space heating fuel - main system 1													3451.7933	(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													2981.8698	(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)													221.4157	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-1807.5639	(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													4933.5150	(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	3451.7933	0.2100	724.8766 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2981.8698	0.2100	626.1927 (264)
Space and water heating			1351.0693 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	221.4157	0.1443	31.9571 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-800.2277	0.1342	-107.4243
PV Unit electricity exported	-1007.3362	0.1257	-126.6175
Total			-234.0417 (269)
Total CO2, kg/year			1160.9139 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.6700 (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	3451.7933	1.1300	3900.5264 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2981.8698	1.1300	3369.5129 (278)
Space and water heating			7270.0393 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	221.4157	1.5338	339.6149 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-800.2277	1.4961	-1197.2343
PV Unit electricity exported	-1007.3362	0.4614	-464.7631
Total			-1661.9974 (283)
Total Primary energy kWh/year			6077.7576 (286)
Target Primary Energy Rate (TPER)			61.1000 (287)

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

1. Overall dwelling characteristics

Area (m ²)	Storey height (m)	Volume (m ³)
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Ground floor					36.5700 (1b)	x	2.6000 (2b)	=	95.0820 (1b)	-	(3b)
First floor					36.5700 (1c)	x	2.8000 (2c)	=	102.3960 (1c)	-	(3c)
Second floor					26.3400 (1d)	x	2.1700 (2d)	=	57.1578 (1d)	-	(3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)				99.4800							(4)
Dwelling volume									(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	254.6358 (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) =	0.1178 (8)
Pressure test											Yes	
Pressure Test Method											Blower Door	
Measured/design AP50											5.0000	(17)
Infiltration rate											0.3678	(18)
Number of sides sheltered											2	(19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.3126 (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 infiltr rate	0.3986	0.3908	0.3830	0.3439	0.3361	0.2970	0.2970	0.2892	0.3126	0.3361	0.3517	0.3674 (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	0.5794	0.5764	0.5733	0.5591	0.5565	0.5441	0.5441	0.5418	0.5489	0.5565	0.5619	0.5675 (25)

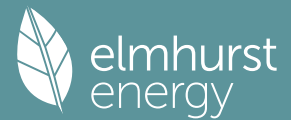
3. Heat losses and heat loss parameter

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)			8.9600	1.1450	10.2595		(27)
Half glazed door			1.7800	1.0000	1.7800		(26a)
Bi-fold (Uw = 1.20)			6.0800	1.1450	6.9618		(27)
E			2.0900	1.2357	2.5827		(27a)
Ground floor			36.5700	0.1300	4.7541	110.0000	4022.7000 (28a)
External wall	119.0000	15.4100	103.5900	0.1600	16.5744	150.0000	15538.5000 (29a)
Dormer wall	8.7200	1.4100	7.3100	0.1800	1.3158	9.0000	65.7900 (29a)
Secondary wall	8.2100		8.2100	0.1800	1.4778	9.0000	73.8900 (29a)
Sloped roof	28.5800	2.0900	26.4900	0.1500	3.9735	9.0000	238.4100 (30)
Dormer sloped roof	1.8400		1.8400	0.1500	0.2760	9.0000	16.5600 (30)
Secondary plane roof	10.2300		10.2300	0.1500	1.5345	9.0000	92.0700 (30)
Total net area of external elements Aum(A, m2)			213.1500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.4902		(33)
Party wall			61.2300	0.0000	0.0000	70.0000	4286.1000 (32)
Internal stud wall			186.2900			9.0000	1676.6100 (32c)
First floor			36.5700			18.0000	658.2600 (32d)
Second floor			26.3400			18.0000	474.1200 (32d)
Ground floor ceiling			36.5700			9.0000	329.1300 (32e)
First floor ceiling			26.3400			9.0000	237.0600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	27709.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							278.5404 (35)

List of Thermal Bridges			Length	Psi-value	Total
K1 Element			10.3100	0.0120	0.1237
E2 Other lintels (including other steel lintels)			6.6500	0.0150	0.0998
E3 Sill			24.9800	0.0260	0.6495
E4 Jamb			19.1100	0.0720	1.3759
E5 Ground floor (normal)			36.1400	0.0200	0.7228
E6 Intermediate floor within a dwelling			9.1200	0.0200	0.1824
E11 Eaves (insulation at rafter level)			11.5400	0.0410	0.4731
E13 Gable (insulation at rafter level)			37.4000	0.0320	1.1968
E16 Corner (normal)			10.2000	-0.0530	-0.5406
E17 Corner (inverted - internal area greater than external area)			8.6700	0.3200	2.7744
P1 Party wall - Ground floor			8.6700	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling			6.6400	0.4800	3.1872
P4 Party wall - Roof (insulation at ceiling level)			2.0400	0.2400	0.4896
R1 Head of roof window			2.0400	0.2400	0.4896
R2 Sill of roof window			3.6800	0.2400	0.8832
R3 Jamb of roof window					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)					12.1074 (36)
Point Thermal bridges					(36a) = 0.0000
Total fabric heat loss					(33) + (36) + (36a) = 63.5976 (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
	48.6910	48.4317	48.1776	46.9841	46.7608	45.7213	45.7213	45.5288	46.1217	46.7608	47.2125	47.6848 (38)
Heat transfer coeff	112.2886	112.0293	111.7752	110.5817	110.3584	109.3189	109.3189	109.1263	109.7193	110.3584	110.8101	111.2824 (39)
Average = Sum(39)m / 12 =												110.5806
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1.1288	1.1261	1.1236	1.1116	1.1094	1.0989	1.0989	1.0970	1.1029	1.1094	1.1139	1.1186 (40)
HLP (average)												1.1116
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Assumed occupancy													2.7347 (42)
Hot water usage for mixer showers													0.0000 (42a)
Hot water usage for baths	30.2561	29.8067	29.1739	28.0072	27.1336	26.1649	25.6416	26.2700	26.9541	27.9907	29.1814	30.1538	(42b)
Hot water usage for other uses	42.6356	41.0853	39.5349	37.9845	36.4341	34.8837	34.8837	36.4341	37.9845	39.5349	41.0853	42.6356	(42c)
Average daily hot water use (litres/day)													66.8118 (43)
Daily hot water use	72.8917	70.8920	68.7088	65.9917	63.5677	61.0486	60.5254	62.7041	64.9386	67.5256	70.2667	72.7894	(44)
Energy content (annual)	115.4427	100.9492	105.6029	90.3394	85.5743	75.0664	73.2002	77.6408	80.0758	91.6316	100.1078	113.9707	(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													
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	98.1263	85.8068	89.7625	76.7885	72.7382	63.8064	62.2201	65.9946	68.0645	77.8868	85.0916	96.8751	(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	98.1263	85.8068	89.7625	76.7885	72.7382	63.8064	62.2201	65.9946	68.0645	77.8868	85.0916	96.8751	(64)
12Total per year (kWh/year)													943 (64)
Electric shower(s)	56.1152	49.9991	54.5971	52.1014	53.0790	50.6322	52.3200	53.0790	52.1014	54.5971	53.5705	56.1152	(64a)
Heat gains from water heating, kWh/month	38.5604	33.9515	36.0899	32.2225	31.4543	28.6097	28.6350	29.7684	30.0415	33.1210	34.6655	38.2476	(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	136.7330	136.7330	136.7330	136.7330	136.7330	136.7330	136.7330	136.7330	136.7330	136.7330	136.7330	136.7330	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	132.0383	146.1852	132.0383	136.4396	132.0383	136.4396	132.0383	132.0383	136.4396	132.0383	136.4396	132.0383	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	255.4844	258.1355	251.4547	237.2322	219.2788	202.4051	191.1325	188.4813	195.1621	209.3846	227.3380	244.2117	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.6733	36.6733	36.6733	36.6733	36.6733	36.6733	36.6733	36.6733	36.6733	36.6733	36.6733	36.6733	(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)	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	(71)
Water heating gains (Table 5)	51.8285	50.5231	48.5079	44.7534	42.2773	39.7357	38.4879	40.0113	41.7242	44.5175	48.1466	51.4080	(72)
Total internal gains	503.3710	518.8637	496.0208	482.4451	457.6143	442.6002	425.6786	424.5508	437.3458	449.9603	475.9441	491.6779	(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							
East	2.8500	19.6403	0.6300	0.7000	0.7700	17.1066 (76)							
West	6.1100	19.6403	0.6300	0.7000	0.7700	36.6742 (80)							
East	6.0800	19.6403	0.6300	0.7000	0.7700	36.4941 (76)							
East	2.0900	26.6072	0.7600	0.7000	1.0000	26.6256 (82)							
Solar gains	116.9005	230.4262	383.8404	566.6973	700.6605	719.9826	684.3298	583.7038	448.6596	274.5643	146.0736	95.9340	(83)
Total gains	620.2715	749.2898	879.8612	1049.1423	1158.2747	1162.5829	1110.0084	1008.2547	886.0054	724.5246	622.0177	587.6119	(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	68.5466	68.7052	68.8614	69.6047	69.7455	70.4087	70.4087	70.5329	70.1518	69.7455	69.4612	69.1664	
alpha	5.5698	5.5803	5.5908	5.6403	5.6497	5.6939	5.6939	5.7022	5.6768	5.6497	5.6307	5.6111	
util living area	0.9986	0.9956	0.9847	0.9316	0.7938	0.5880	0.4312	0.4931	0.7761	0.9712	0.9964	0.9990	(86)
MIT	19.7544	19.9505	20.2511	20.6413	20.8937	20.9841	20.9977	20.9952	20.9309	20.5581	20.0847	19.7257	(87)
Th 2	19.9774	19.9795	19.9816	19.9914	19.9932	20.0017	20.0017	20.0033	19.9984	19.9932	19.9895	19.9856	(88)
util rest of house	0.9981	0.9940	0.9788	0.9072	0.7348	0.5026	0.3346	0.3889	0.6927	0.9562	0.9947	0.9986	(89)
MIT 2	18.8453	19.0422	19.3406	19.7181	19.9294	19.9955	20.0012	20.0022	19.9651	19.6510	19.1845	18.8233	(90)
Living area fraction													0.1625 (91)
MIT	18.9931	19.1899	19.4886	19.8681	20.0861	20.1562	20.1632	20.1636	20.1221	19.7985	19.3308	18.9699	(92)
Temperature adjustment													0.0000
adjusted MIT	18.9931	19.1899	19.4886	19.8681	20.0861	20.1562	20.1632	20.1636	20.1221	19.7985	19.3308	18.9699	(93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Utilisation	0.9973	0.9923	0.9751	0.9036	0.7407	0.5162	0.3503	0.4059	0.7040	0.9524	0.9932	0.9980 (94)
Useful gains	618.6039	743.4879	857.9730	948.0412	857.9240	600.1092	388.8745	409.2524	623.7532	690.0035	617.8004	586.4346 (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	1649.8668	1600.8838	1451.8060	1212.8747	925.4763	607.3997	389.5256	410.7090	660.7416	1015.1277	1355.3006	1643.6351 (97)
Space heating kWh	767.2596	576.1701	441.8117	190.6801	50.2589	0.0000	0.0000	0.0000	0.0000	241.8924	531.0001	786.5571 (98a)
Space heating requirement - total per year (kWh/year)												3585.6301
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	767.2596	576.1701	441.8117	190.6801	50.2589	0.0000	0.0000	0.0000	0.0000	241.8924	531.0001	786.5571 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3585.6301
Space heating per m2												(98c) / (4) = 36.0437 (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	1027.5972	808.9595	829.3603	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9250	0.9647	0.9428	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	950.5432	780.4039	781.9464	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1272.0442	1214.9406	1103.5628	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	231.4807	323.2953	239.2826	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	57.8702	80.8238	59.8207	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												198.5147 (107)
Energy for space heating												36.0437 (99)
Energy for space cooling												1.9955 (108)
Total												38.0393 (109)
Fabric Energy Efficiency (DFEE)												38.0 (109)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	36.5700 (1b)	x 2.6000 (2b)	= 95.0820 (1b) - (3b)
First floor	36.5700 (1c)	x 2.8000 (2c)	= 102.3960 (1c) - (3c)
Second floor	26.3400 (1d)	x 2.1700 (2d)	= 57.1578 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	99.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	254.6358 (5)

2. Ventilation rate

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) =	0.1178 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3678	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3126 (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	0.3986	0.3908	0.3830	0.3439	0.3361	0.2970	0.2970	0.2892	0.3126	0.3361	0.3517	0.3674 (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	0.5794	0.5764	0.5733	0.5591	0.5565	0.5441	0.5441	0.5418	0.5489	0.5565	0.5619	0.5675 (25)

3. Heat losses and heat loss parameter

Full SAP Calculation Printout



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 Semi-glazed door			1.7800	1.0000	1.7800		(26a)
TER Opening Type (Uw = 1.20)			15.0400	1.1450	17.2214		(27)
E			2.0900	2.0221	4.2261		(27a)
Ground floor			36.5700	0.1300	4.7541		(28a)
External wall	119.0000	15.4100	103.5900	0.1800	18.6462		(29a)
Dormer wall	8.7200	1.4100	7.3100	0.1800	1.3158		(29a)
Secondary wall	8.2100		8.2100	0.1800	1.4778		(29a)
Sloped roof	28.5800	2.0900	26.4900	0.1100	2.9139		(30)
Dormer sloped roof	1.8400		1.8400	0.1100	0.2024		(30)
Secondary plane roof	10.2300		10.2300	0.1100	1.1253		(30)
Total net area of external elements Aum(A, m2)			213.1500				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	53.6630	(33)
Party wall			61.2300	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 278.5404 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	10.3100	0.0500	0.5155
E3 Sill	6.6500	0.0500	0.3325
E4 Jamb	24.9800	0.0500	1.2490
E5 Ground floor (normal)	19.1100	0.1600	3.0576
E6 Intermediate floor within a dwelling	36.1400	0.0000	0.0000
E11 Eaves (insulation at rafter level)	9.1200	0.0400	0.3648
E13 Gable (insulation at rafter level)	11.5400	0.0800	0.9232
E16 Corner (normal)	37.4000	0.0900	3.3660
E17 Corner (inverted - internal area greater than external area)	10.2000	-0.0900	-0.9180
P1 Party wall - Ground floor	8.6700	0.0800	0.6936
P2 Party wall - Intermediate floor within a dwelling	8.6700	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	6.6400	0.1200	0.7968
R1 Head of roof window	2.0400	0.0800	0.1632
R2 Sill of roof window	2.0400	0.0600	0.1224
R3 Jamb of roof window	3.6800	0.0800	0.2944

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.9610 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 64.6240 (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	48.6910	48.4317	48.1776	46.9841	46.7608	45.7213	45.7213	45.5288	46.1217	46.7608	47.2125	47.6848 (38)
Average = Sum(39)m / 12 =	113.3150	113.0557	112.8016	111.6081	111.3848	110.3452	110.3452	110.1527	110.7457	111.3848	111.8365	112.3088 (39)
HLP	1.1391	1.1365	1.1339	1.1219	1.1197	1.1092	1.1092	1.1073	1.1132	1.1197	1.1242	1.1290 (40)
HLP (average)												1.1219
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7347 (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	30.2561	29.8067	29.1739	28.0072	27.1336	26.1649	25.6416	26.2700	26.9541	27.9907	29.1814	30.1538 (42b)
Hot water usage for other uses	42.6356	41.0853	39.5349	37.9845	36.4341	34.8837	34.8837	36.4341	37.9845	39.5349	41.0853	42.6356 (42c)
Average daily hot water use (litres/day)												66.8118 (43)
Daily hot water use	72.8917	70.8920	68.7088	65.9917	63.5677	61.0486	60.5254	62.7041	64.9386	67.5256	70.2667	72.7894 (44)
Energy content (annual)	115.4427	100.9492	105.6029	90.3394	85.5743	75.0664	73.2002	77.6408	80.0758	91.6316	100.1078	113.9707 (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												
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month												
WWHRS	98.1263	85.8068	89.7625	76.7885	72.7382	63.8064	62.2201	65.9946	68.0645	77.8868	85.0916	96.8751 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	98.1263	85.8068	89.7625	76.7885	72.7382	63.8064	62.2201	65.9946	68.0645	77.8868	85.0916	96.8751 (64)
12Total per year (kWh/year)												943.1614 (64)
Electric shower(s)	56.1152	49.9991	54.5971	52.1014	53.0790	50.6322	52.3200	53.0790	52.1014	54.5971	53.5705	56.1152 (64a)
Heat gains from water heating, kWh/month	38.5604	33.9515	36.0899	32.2225	31.4543	28.6097	28.6350	29.7684	30.0415	33.1210	34.6655	38.2476 (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	136.7330	136.7330	136.7330	136.7330	136.7330	136.7330	136.7330	136.7330	136.7330	136.7330	136.7330	136.7330 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	132.0383	146.1852	132.0383	136.4396	132.0383	136.4396	132.0383	132.0383	136.4396	132.0383	136.4396	132.0383 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	255.4844	258.1355	251.4547	237.2322	219.2788	202.4051	191.1325	188.4813	195.1621	209.3846	227.3380	244.2117 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.6733	36.6733	36.6733	36.6733	36.6733	36.6733	36.6733	36.6733	36.6733	36.6733	36.6733	36.6733 (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)	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864 (71)

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Water heating gains (Table 5)	51.8285	50.5231	48.5079	44.7534	42.2773	39.7357	38.4879	40.0113	41.7242	44.5175	48.1466	51.4080 (72)
Total internal gains	503.3710	518.8637	496.0208	482.4451	457.6143	442.6002	425.6786	424.5508	437.3458	449.9603	475.9441	491.6779 (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
East	8.9300	19.6403	0.6300		0.7000		0.7700	53.6007 (76)
West	6.1100	19.6403	0.6300		0.7000		0.7700	36.6742 (80)
East	2.0900	26.6072	0.6300		0.7000		1.0000	22.0713 (82)

Solar gains	112.3461	221.2185	367.9307	542.3155	669.7275	687.8499	653.9302	558.2967	429.7733	263.4429	140.3414	92.2228 (83)
Total gains	615.7171	740.0822	863.9515	1024.7606	1127.3417	1130.4501	1079.6088	982.8475	867.1191	713.4032	616.2855	583.9007 (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	67.9257	68.0815	68.2348	68.9645	69.1028	69.7538	69.7538	69.8757	69.5016	69.1028	68.8237	68.5343
alpha	5.5284	5.5388	5.5490	5.5976	5.6069	5.6503	5.6503	5.6584	5.6334	5.6069	5.5882	5.5690
util living area	0.9986	0.9959	0.9861	0.9386	0.8105	0.6075	0.4470	0.5096	0.7908	0.9736	0.9966	0.9990 (86)
MIT	19.7351	19.9270	20.2234	20.6141	20.8787	20.9807	20.9971	20.9942	20.9220	20.5392	20.0666	19.7071 (87)
Th 2	19.9691	19.9712	19.9732	19.9830	19.9848	19.9933	19.9933	19.9949	19.9900	19.9848	19.9811	19.9773 (88)
util rest of house	0.9981	0.9944	0.9807	0.9159	0.7527	0.5197	0.3463	0.4015	0.7081	0.9595	0.9950	0.9986 (89)
MIT 2	18.8195	19.0123	19.3068	19.6867	19.9110	19.9857	19.9927	19.9935	19.9519	19.6263	19.1598	18.7981 (90)
Living area fraction	18.9693	19.1610	19.4558	19.8374	20.0683	20.1475	20.1560	20.1562	20.1096	19.7747	19.3072	18.9459 (92)
Temperature adjustment	18.9683	19.1610	19.4558	19.8374	20.0683	20.1475	20.1560	20.1562	20.1096	19.7747	19.3072	18.9459 (93)
adjusted MIT	18.9683	19.1610	19.4558	19.8374	20.0683	20.1475	20.1560	20.1562	20.1096	19.7747	19.3072	18.9459 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9974	0.9927	0.9771	0.9120	0.7579	0.5336	0.3627	0.4191	0.7189	0.9556	0.9935	0.9980 (94)
Useful gains	614.1147	734.6854	844.2100	934.5492	854.4087	603.2156	391.5614	411.9542	623.4017	681.7451	612.2948	582.7613 (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	1662.1378	1612.2863	1461.4301	1220.7026	932.1014	612.1352	392.3826	413.7518	665.5395	1021.9247	1365.2112	1656.0895 (97)
Space heating kWh	779.7292	589.7478	459.2117	206.0304	57.8033	0.0000	0.0000	0.0000	0.0000	253.0936	542.0999	798.5561 (98a)
Space heating requirement - total per year (kWh/year)												3686.2721
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	779.7292	589.7478	459.2117	206.0304	57.8033	0.0000	0.0000	0.0000	0.0000	253.0936	542.0999	798.5561 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3686.2721
Space heating per m2												(98c) / (4) = 37.0554 (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	1037.2453	816.5548	837.1608	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9142	0.9585	0.9344	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	948.2335	782.7011	782.2621	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1239.9115	1184.5410	1078.1557	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	210.0082	298.9689	220.1448	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	52.5020	74.7422	55.0362	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												182.2805 (107)
Energy for space heating												37.0554 (99)
Energy for space cooling												1.8323 (108)
Total												38.8877 (109)
Fabric Energy Efficiency (TFEE)												38.9 (109)

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

1. Overall dwelling characteristics

Full SAP Calculation Printout



	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	36.5700 (1b)	x 2.6000 (2b)	= 95.0820 (1b) - (3b)
First floor	36.5700 (1c)	x 2.8000 (2c)	= 102.3960 (1c) - (3c)
Second floor	26.3400 (1d)	x 2.1700 (2d)	= 57.1578 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	99.4800		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 254.6358 (5)

2. Ventilation rate

		m ³ per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	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) = 0.1178 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3678 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3126 (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												
Effective ac	0.3986	0.3908	0.3830	0.3439	0.3361	0.2970	0.2970	0.2892	0.3126	0.3361	0.3517	0.3674 (22b)
	0.5794	0.5764	0.5733	0.5591	0.5565	0.5441	0.5441	0.5418	0.5489	0.5565	0.5619	0.5675 (25)

3. Heat losses and heat loss parameter

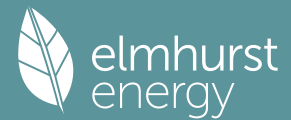
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			8.9600	1.1450	10.2595		(27)
Half glazed door			1.7800	1.0000	1.7800		(26a)
Bi-fold (Uw = 1.20)			6.0800	1.1450	6.9618		(27)
E			2.0900	1.2357	2.5827		(27a)
Ground floor			36.5700	0.1300	4.7541	110.0000	4022.7000 (28a)
External wall	119.0000	15.4100	103.5900	0.1600	16.5744	150.0000	15538.5000 (29a)
Dormer wall	8.7200	1.4100	7.3100	0.1800	1.3158	9.0000	65.7900 (29a)
Secondary wall	8.2100		8.2100	0.1800	1.4778	9.0000	73.8900 (29a)
Sloped roof	28.5800	2.0900	26.4900	0.1500	3.9735	9.0000	238.4100 (30)
Dormer sloped roof	1.8400		1.8400	0.1500	0.2760	9.0000	16.5600 (30)
Secondary plane roof	10.2300		10.2300	0.1500	1.5345	9.0000	92.0700 (30)
Total net area of external elements Aum(A, m ²)			213.1500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.4902		(33)
Party wall			61.2300	0.0000	0.0000	70.0000	4286.1000 (32)
Internal stud wall			186.2900			9.0000	1676.6100 (32c)
First floor			36.5700			18.0000	658.2600 (32d)
Second floor			26.3400			18.0000	474.1200 (32d)
Ground floor ceiling			36.5700			9.0000	329.1300 (32e)
First floor ceiling			26.3400			9.0000	237.0600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	27709.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							278.5404 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element	10.3100	0.0120	0.1237
E2 Other lintels (including other steel lintels)	6.6500	0.0150	0.0998
E3 Sill	24.9800	0.0260	0.6495
E4 Jamb	19.1100	0.0720	1.3759
E5 Ground floor (normal)	36.1400	0.0200	0.7228
E6 Intermediate floor within a dwelling	9.1200	0.0200	0.1824
E11 Eaves (insulation at rafter level)	11.5400	0.0410	0.4731
E13 Gable (insulation at rafter level)	37.4000	0.0320	1.1968
E16 Corner (normal)	10.2000	-0.0530	-0.5406
E17 Corner (inverted - internal area greater than external area)	8.6700	0.3200	2.7744
P1 Party wall - Ground floor	8.6700	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	6.6400	0.4800	3.1872
P4 Party wall - Roof (insulation at ceiling level)	2.0400	0.2400	0.4896
R1 Head of roof window	2.0400	0.2400	0.4896
R2 Sill of roof window	3.6800	0.2400	0.8832
R3 Jamb of roof window			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			12.1074 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss		(33) + (36) + (36a) =	63.5976 (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	48.6910	48.4317	48.1776	46.9841	46.7608	45.7213	45.7213	45.5288	46.1217	46.7608	47.2125	47.6848 (38)
Heat transfer coeff	112.2886	112.0293	111.7752	110.5817	110.3584	109.3189	109.3189	109.1263	109.7193	110.3584	110.8101	111.2824 (39)
Average = Sum(39)m / 12 =												110.5806

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1288	1.1261	1.1236	1.1116	1.1094	1.0989	1.0989	1.0970	1.1029	1.1094	1.1139	1.1186 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7347 (42)
Hot water usage for mixer showers												104.7039 (42a)
Hot water usage for baths												30.1538 (42b)
Hot water usage for other uses												42.6356 (42c)
Average daily hot water use (litres/day)												163.7165 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	177.9983	174.4190	169.9341	162.8131	157.1391	150.9957	148.4124	152.8754	157.6139	164.0923	171.3319	177.4933 (44)
Distribution loss (46)m = 0.15 x (45)m	281.9057	248.3703	261.1824	222.8830	211.5395	185.6668	179.4919	189.2917	194.3537	222.6717	244.0938	277.9116 (45)
Water storage loss:												2719.3621
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0800 (55)
Total storage loss												33.4800 (56)
If cylinder contains dedicated solar storage												33.4800 (57)
Primary loss												23.2624 (59)
Combi loss												0.0000 (61)
Total heat required for water heating calculated for each month												338.6481 (62)
WWHRS												0.0000 (63a)
PV diverter												0.0000 (63b)
Solar input												0.0000 (63c)
FGHRS												0.0000 (63d)
Output from w/h												338.6481 (64)
Electric shower(s)												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												139.1276 (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	164.0796	164.0796	164.0796	164.0796	164.0796	164.0796	164.0796	164.0796	164.0796	164.0796	164.0796	164.0796 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												32.0698 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												381.3199 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												54.1426 (69)
Pumps, fans												0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												-109.3864 (71)
Water heating gains (Table 5)												186.9994 (72)
Total internal gains												709.2250 (73)

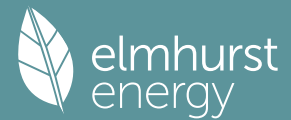
6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
East	2.8500	19.6403	0.6300	0.7000	0.7700	17.1066 (76)						
West	6.1100	19.6403	0.6300	0.7000	0.7700	36.6742 (80)						
East	6.0800	19.6403	0.6300	0.7000	0.7700	36.4941 (76)						
East	2.0900	26.6072	0.7600	0.7000	1.0000	26.6256 (82)						
Solar gains	116.9005	230.4262	383.8404	566.6973	700.6605	719.9826	684.3298	583.7038	448.6596	274.5643	146.0736	95.9340 (83)
Total gains	826.1255	936.9278	1068.8846	1211.0902	1305.4395	1288.7384	1231.6265	1135.0089	1020.4128	882.9330	798.8763	787.4404 (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)												0.9942 (86)
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	68.5466	68.7052	68.8614	69.6047	69.7455	70.4087	70.4087	70.5329	70.1518	69.7455	69.4612	69.1664
util living area	5.5698	5.5803	5.5908	5.6403	5.6497	5.6939	5.6939	5.7022	5.6768	5.6497	5.6307	5.6111
Living	20.1603	20.2906	20.5054	20.7494	20.8924	20.9380	20.9445	20.9436	20.9143	20.7056	20.3848	20.1357
Non living	19.0079	19.1745	19.4434	19.7376	19.8838	19.9282	19.9315	19.9329	19.9103	19.6984	19.3034	18.9833
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	20.5704	20.2906	20.5054	20.7494	20.8924	20.9380	20.9445	20.9436	20.9143	20.7056	20.3848	20.2566 (87)
Th 2	19.9774	19.9795	19.9816	19.9914	19.9932	20.0017	20.0017	20.0033	19.9984	19.9932	19.9895	19.9856 (88)
util rest of house	0.9921	0.9831	0.9524	0.8547	0.6700	0.4553	0.3017	0.3459	0.6159	0.9087	0.9829	0.9939 (89)
MIT 2	19.5909	19.1745	19.4434	19.7376	19.8838	19.9282	19.9315	19.9329	19.9103	19.6984	19.3034	19.1639 (90)
Living area fraction	19.7501	19.3559	19.6160	19.9021	20.0478	20.0923	20.0962	20.0972	20.0735	19.8621	19.4792	19.3415 (91)
Temperature adjustment												0.0000
adjusted MIT	19.7501	19.3559	19.6160	19.9021	20.0478	20.0923	20.0962	20.0972	20.0735	19.8621	19.4792	19.3415 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9915	0.9796	0.9471	0.8513	0.6735	0.4627	0.3100	0.3548	0.6227	0.9043	0.9795	0.9925	(94)
Useful gains	819.1294	917.7763	1012.3363	1031.0432	879.2766	596.2464	381.8620	402.7459	635.3755	798.4301	782.5299	781.5282	(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	1734.8714	1619.4836	1466.0416	1216.6265	921.2466	600.4147	382.1990	403.4605	655.4115	1022.1493	1371.7396	1684.9850	(97)
Space heating kWh	681.3120	471.5472	337.5567	133.6200	31.2256	0.0000	0.0000	0.0000	0.0000	166.4471	424.2310	672.1719	(98a)
Space heating requirement - total per year (kWh/year)												2918.1116	
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	681.3120	471.5472	337.5567	133.6200	31.2256	0.0000	0.0000	0.0000	0.0000	166.4471	424.2310	672.1719	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2918.1116	
Space heating per m2												29.3337	(99)

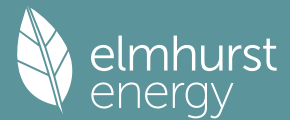
9a. Energy requirements - Individual heating systems, including micro-CHP

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 %)													324.3480	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement	681.3120	471.5472	337.5567	133.6200	31.2256	0.0000	0.0000	0.0000	0.0000	166.4471	424.2310	672.1719	(98)	
Space heating efficiency (main heating system 1)	324.3480	324.3480	324.3480	324.3480	324.3480	0.0000	0.0000	0.0000	0.0000	324.3480	324.3480	324.3480	(210)	
Space heating fuel (main heating system)	210.0559	145.3831	104.0724	41.1965	9.6272	0.0000	0.0000	0.0000	0.0000	51.3174	130.7950	207.2378	(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	338.6481	299.6215	317.9248	277.7950	268.2819	240.5788	236.2343	246.0341	249.2657	279.4141	299.0058	334.6540	(64)	
Efficiency of water heater (217)m	171.6440	171.6440	171.6440	171.6440	171.6440	171.6440	171.6440	171.6440	171.6440	171.6440	171.6440	171.6440	(216)	
Fuel for water heating, kWh/month	197.2969	174.5599	185.2234	161.8437	156.3014	140.1615	137.6304	143.3398	145.2225	162.7870	174.2012	194.9698	(219)	
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)	
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)	
Lighting	28.0705	22.5192	20.2760	14.8551	11.4745	9.3748	10.4674	13.6059	17.6728	23.1876	26.1904	28.8506	(232)	
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)	
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)	
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													899.6853	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													171.6440	
Water heating fuel used													1973.5376	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
Total electricity for the above, kWh/year													0.0000	(231)
Electricity for lighting (calculated in Appendix L)													226.5448	(232)
Energy saving/generation technologies (Appendices M, N and Q)														
PV generation													0.0000	(233)
Wind generation													0.0000	(234)
Hydro-electric generation (Appendix N)													0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)													0.0000	(235)
Appendix Q - special features														
Energy saved or generated													-0.0000	(236)
Energy used													0.0000	(237)
Total delivered energy for all uses													3099.7677	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	899.6853	16.4900	148.3581	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1973.5376	16.4900	325.4363	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	226.5448	16.4900	37.3572	(250)
Additional standing charges			0.0000	(251)

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Total energy cost

511.1517 (255)

 11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12): 0.3600 (256)
 Energy cost factor (ECF) $[(255) \times (256)] / [(4) + 45.0] = 1.2736 (257)$
 SAP value 79.3544
 SAP rating (Section 12) 79 (258)
 SAP band C

 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	899.6853	0.1568	141.0943 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1973.5376	0.1410	278.2947 (264)
Space and water heating			419.3890 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	226.5448	0.1443	32.6974 (268)
Total CO2, kg/year			452.0864 (272)
CO2 emissions per m2			4.5400 (273)
EI value			95.8071
EI rating			96 (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	36.5700 (1b)	x 2.6000 (2b)	= 95.0820 (1b) - (3b)
First floor	36.5700 (1c)	x 2.8000 (2c)	= 102.3960 (1c) - (3c)
Second floor	26.3400 (1d)	x 2.1700 (2d)	= 57.1578 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	99.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	254.6358 (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)

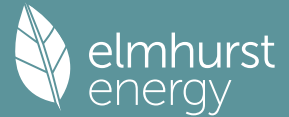
Air changes per hour
 Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 30.0000 / (5) = 0.1178 (8)
 Pressure test Yes
 Pressure Test Method Blower Door
 Measured/design AP50 5.0000 (17)
 Infiltration rate 0.3678 (18)
 Number of sides sheltered 2 (19)
 Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
 Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3126 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.7000	3.5000	3.4000	3.2000	3.1000	2.8000	3.0000	2.7000	2.6000	2.8000	2.9000	3.2000 (22)
Wind factor	0.9250	0.8750	0.8500	0.8000	0.7750	0.7000	0.7500	0.6750	0.6500	0.7000	0.7250	0.8000 (22a)
Adj infilt rate												
Effective ac	0.2892	0.2736	0.2657	0.2501	0.2423	0.2189	0.2345	0.2110	0.2032	0.2189	0.2267	0.2501 (22b)
	0.5418	0.5374	0.5353	0.5313	0.5294	0.5239	0.5275	0.5223	0.5206	0.5239	0.5257	0.5313 (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)			8.9600	1.1450	10.22595		(27)
Half glazed door			1.7800	1.0000	1.7800		(26a)
Bi-fold (Uw = 1.20)			6.0800	1.1450	6.9618		(27)
E			2.0900	1.2357	2.5827		(27a)
Ground floor			36.5700	0.1300	4.7541	110.0000	4022.7000 (28a)
External wall	119.0000	15.4100	103.5900	0.1600	16.5744	150.0000	15538.5000 (29a)
Dormer wall	8.7200	1.4100	7.3100	0.1800	1.3158	9.0000	65.7900 (29a)
Secondary wall	8.2100		8.2100	0.1800	1.4778	9.0000	73.8900 (29a)
Sloped roof	28.5800	2.0900	26.4900	0.1500	3.9735	9.0000	238.4100 (30)

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Dormer sloped roof	1.8400	1.8400	0.1500	0.2760	9.0000	16.5600 (30)
Secondary plane roof	10.2300	10.2300	0.1500	1.5345	9.0000	92.0700 (30)
Total net area of external elements Aum(A, m ²)		213.1500				(31)
Fabric heat loss, W/K = Sum (A x U)		(26)...(30) + (32) =	51.4902			(33)
Party wall		61.2300	0.0000	0.0000	70.0000	4286.1000 (32)
Internal stud wall		186.2900			9.0000	1676.6100 (32c)
First floor		36.5700			18.0000	658.2600 (32d)
Second floor		26.3400			18.0000	474.1200 (32d)
Ground floor ceiling		36.5700			9.0000	329.1300 (32e)
First floor ceiling		26.3400			9.0000	237.0600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 27709.2000 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 278.5404 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	10.3100	0.0120	0.1237
E3 Sill	6.6500	0.0150	0.0998
E4 Jamb	24.9800	0.0260	0.6495
E5 Ground floor (normal)	19.1100	0.0720	1.3759
E6 Intermediate floor within a dwelling	36.1400	0.0200	0.7228
E11 Eaves (insulation at rafter level)	9.1200	0.0200	0.1824
E13 Gable (insulation at rafter level)	11.5400	0.0410	0.4731
E16 Corner (normal)	37.4000	0.0320	1.1968
E17 Corner (inverted - internal area greater than external area)	10.2000	-0.0530	-0.5406
P1 Party wall - Ground floor	8.6700	0.3200	2.7744
P2 Party wall - Intermediate floor within a dwelling	8.6700	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	6.6400	0.4800	3.1872
R1 Head of roof window	2.0400	0.2400	0.4896
R2 Sill of roof window	2.0400	0.2400	0.4896
R3 Jamb of roof window	3.6800	0.2400	0.8832

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 63.5976 (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	45.5288	45.1592	44.9821	44.6432	44.4815	44.0272	44.3250	43.8861	43.7500	44.0272	44.1735	44.6432 (38)
Average = Sum(39)m / 12 =	109.1263	108.7567	108.5796	108.2408	108.0791	107.6248	107.9226	107.4836	107.3476	107.6248	107.7711	108.2408 (39)
HLP	1.0970	1.0933	1.0915	1.0881	1.0864	1.0819	1.0849	1.0805	1.0791	1.0819	1.0833	1.0881 (40)
HLP (average)												1.0863
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7347 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage for mixer showers	105.1066	103.5270	101.2253	96.8214	93.5714	89.9471	87.8870	90.1713	92.6753	96.5667	101.0652	104.7039 (42a)
Hot water usage for baths	30.2561	29.8067	29.1739	28.0072	27.1336	26.1649	25.6416	26.2700	26.9541	27.9907	29.1814	30.1538 (42b)
Hot water usage for other uses	42.6356	41.0853	39.5349	37.9845	36.4341	34.8837	34.8837	36.4341	37.9845	39.5349	41.0853	42.6356 (42c)
Average daily hot water use (litres/day)												163.7165 (43)
Daily hot water use	177.9983	174.4190	169.9341	162.8131	157.1391	150.9957	148.4124	152.8754	157.6139	164.0923	171.3319	177.4933 (44)
Energy conte	281.9057	248.3703	261.1824	222.8830	211.5395	185.6668	179.4919	189.2917	194.3537	222.6717	244.0938	277.9116 (45)
Energy content (annual)												Total = Sum(45)m = 2719.3621
Distribution loss (46)m = 0.15 x (45)m	42.2859	37.2555	39.1774	33.4325	31.7309	27.8500	26.9238	28.3937	29.1531	33.4008	36.6141	41.6867 (46)
Water storage loss:												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0800 (55)
Total storage loss	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (56)
If cylinder contains dedicated solar storage	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (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	338.6481	299.6215	317.9248	277.7950	268.2819	240.5788	236.2343	246.0341	249.2657	279.4141	299.0058	334.6540 (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	338.6481	299.6215	317.9248	277.7950	268.2819	240.5788	236.2343	246.0341	249.2657	279.4141	299.0058	334.6540 (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	139.1276	123.5841	132.2371	118.0382	115.7308	105.6638	105.0750	108.3334	108.5522	119.4323	125.0908	137.7995 (65)

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

Metabolic gains (Table 5), Watts

(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.0698	28.4841	23.1648	17.5372	13.1093	11.0674	11.9587	15.5444	20.8637	26.4913	30.9192	32.9611 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	381.3199	385.2769	375.3056	354.0779	327.2818	302.0972	285.2723	281.3154	291.2867	312.5144	339.3105	364.4951 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.1426	54.1426	54.1426	54.1426	54.1426	54.1426	54.1426	54.1426	54.1426	54.1426	54.1426	54.1426 (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)	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864 (71)
Water heating gains (Table 5)												

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Total internal gains	186.9994	183.9049	177.7380	163.9419	155.5521	146.7553	141.2298	145.6094	150.7670	160.5272	173.7372	185.2144 (72)
	709.2250	706.5016	685.0442	644.3929	604.7790	568.7557	547.2967	551.3051	571.7532	608.3687	652.8027	691.5064 (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						
East	2.8500	22.2970	0.6300	0.7000	0.7700	19.4206 (76)						
West	6.1100	22.2970	0.6300	0.7000	0.7700	41.6351 (80)						
East	6.0800	22.2970	0.6300	0.7000	0.7700	41.4307 (76)						
East	2.0900	30.4656	0.7600	0.7000	1.0000	30.4866 (82)						
Solar gains	132.9731	231.6205	387.4633	591.6727	713.9719	787.2728	744.7445	641.7582	494.2690	308.1290	170.2343	108.0564 (83)
Total gains	842.1981	938.1222	1072.5075	1236.0656	1318.7510	1356.0285	1292.0413	1193.0633	1066.0222	916.4976	823.0370	799.5628 (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	70.5329	70.7726	70.8881	71.1100	71.2163	71.5170	71.3197	71.6109	71.7016	71.5170	71.4199	71.1100
alpha	5.7022	5.7182	5.7259	5.7407	5.7478	5.7678	5.7546	5.7741	5.7801	5.7678	5.7613	5.7407
util living area	0.9908	0.9821	0.9458	0.8269	0.6138	0.3722	0.2338	0.2612	0.5456	0.8747	0.9772	0.9925 (86)
Living	20.2965	20.4063	20.6241	20.8359	20.9289	20.9454	20.9460	20.9462	20.9397	20.8210	20.5311	20.2837
Non living	19.2022	19.3425	19.6100	19.8474	19.9324	19.9464	19.9440	19.9479	19.9464	19.8443	19.5073	19.1922
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	20.6401	20.4063	20.6241	20.8359	20.9289	20.9454	20.9460	20.9462	20.9397	20.8210	20.5311	20.3839 (87)
Th 2	20.0033	20.0063	20.0078	20.0106	20.0119	20.0157	20.0132	20.0168	20.0179	20.0157	20.0145	20.0106 (88)
util rest of house	0.9874	0.9758	0.9274	0.7801	0.5420	0.2947	0.1515	0.1727	0.4523	0.8253	0.9675	0.9897 (89)
MIT 2	19.6839	19.3425	19.6100	19.8474	19.9324	19.9464	19.9440	19.9479	19.9464	19.8443	19.5073	19.3397 (90)
Living area fraction	FLA = Living area / (4) =											0.1625 (91)
MIT	19.8393	19.5154	19.7749	20.0081	20.0943	20.1088	20.1069	20.1101	20.1078	20.0031	19.6737	19.5094 (92)
Temperature adjustment												0.0000
adjusted MIT	19.8393	19.5154	19.7749	20.0081	20.0943	20.1088	20.1069	20.1101	20.1078	20.0031	19.6737	19.5094 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9867	0.9717	0.9222	0.7800	0.5481	0.3021	0.1593	0.1811	0.4610	0.8245	0.9631	0.9878 (94)
Useful gains	831.0150	911.6063	989.1185	964.0903	722.8617	409.6305	205.7922	216.0473	491.4891	755.6857	792.7036	789.8434 (95)
Ext temp.	5.4000	5.9000	7.7000	10.2000	13.3000	16.3000	18.2000	18.1000	15.5000	12.0000	8.4000	5.5000 (96)
Heat loss rate W	1575.7133	1480.7697	1311.0856	1061.6321	734.3272	409.9187	205.7966	216.0564	494.6390	861.3305	1214.9793	1516.3906 (97)
Space heating kWh	554.0556	382.4778	239.5436	70.2301	8.5303	0.0000	0.0000	0.0000	0.0000	78.5998	304.0385	540.5511 (98a)
Space heating requirement - total per year (kWh/year)												2178.0267
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	554.0556	382.4778	239.5436	70.2301	8.5303	0.0000	0.0000	0.0000	0.0000	78.5998	304.0385	540.5511 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2178.0267
Space heating per m2												(98c) / (4) = 21.8941 (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 %)												324.1710 (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	554.0556	382.4778	239.5436	70.2301	8.5303	0.0000	0.0000	0.0000	0.0000	78.5998	304.0385	540.5511 (98)
Space heating efficiency (main heating system 1)	324.1710	324.1710	324.1710	324.1710	324.1710	0.0000	0.0000	0.0000	0.0000	324.1710	324.1710	324.1710 (210)
Space heating fuel (main heating system)	170.9146	117.9864	73.8942	21.6645	2.6314	0.0000	0.0000	0.0000	0.0000	24.2464	93.7895	166.7488 (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	338.6481	299.6215	317.9248	277.7950	268.2819	240.5788	236.2343	246.0341	249.2657	279.4141	299.0058	334.6540 (64)
Efficiency of water heater (217)m	171.5680	171.5680	171.5680	171.5680	171.5680	171.5680	171.5680	171.5680	171.5680	171.5680	171.5680	171.5680 (216)
Fuel for water heating, kWh/month	197.3842	174.6372	185.3054	161.9154	156.3706	140.2236	137.6914	143.4032	145.2869	162.8591	174.2783	195.0562 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	28.0705	22.5192	20.2760	14.8551	11.4745	9.3748	10.4674	13.6059	17.6728	23.1876	26.1904	28.8506 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)

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Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)														
(233b)m	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	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year														
Space heating fuel - main system 1													671.8759	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													171.5680	
Water heating fuel used													1974.4115	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
Total electricity for the above, kWh/year													0.0000	(231)
Electricity for lighting (calculated in Appendix L)													226.5448	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													0.0000	(233)
Wind generation													0.0000	(234)
Hydro-electric generation (Appendix N)													0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)													0.0000	(235)
Appendix Q - special features														
Energy saved or generated													-0.0000	(236)
Energy used													0.0000	(237)
Total delivered energy for all uses													2872.8321	(238)

10a. Fuel costs - using BEDF prices (531)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	671.8759	21.5100	144.5205	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1974.4115	21.5100	424.6959	(247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	226.5448	21.5100	48.7298	(250)
Additional standing charges			0.0000	(251)
Total energy cost			617.9462	(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	671.8759	0.1580	106.1279	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1974.4115	0.1410	278.4179	(264)
Space and water heating			384.5458	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	226.5448	0.1443	32.6974	(268)
Total CO2, kg/year			417.2432	(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	671.8759	1.5847	1064.7390	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1974.4115	1.5214	3003.9114	(278)
Space and water heating			4068.6504	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	226.5448	1.5338	347.4819	(282)
Total Primary energy kWh/year			4416.1324	(286)

SAP 10 EPC IMPROVEMENTS

304434 - House 1

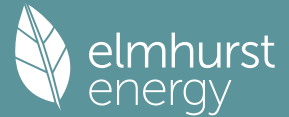
Current energy efficiency rating: C 79
 Current environmental impact rating: A 96

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 2.2	-£ 82	-47 kg (11.3%)
U Solar photovoltaic panels	+ 5.9	-£ 198	-123 kg (33.3%)

Recommended measures	Typical annual savings	Energy efficiency impact	Environmental impact
Solar water heating	£82	0.47 kg/m ²	B 82 A 96
Solar photovoltaic panels	£198	1.24 kg/m ²	B 88 A 97
Total Savings	£279	1.71 kg/m²	

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Potential energy efficiency rating: B 88
 Potential environmental impact rating: A 97

Fuel prices for cost data on this page from database revision number 531 TEST (31 Oct 2023)
 Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current £618	Potential £536	Saving £82
Electricity			
Space heating	£145	£162	-£17
Water heating	£425	£326	£99
Lighting	£49	£49	£0
Generated (PV)	-£10	-£198	£188
Total cost of fuels	£618	£338	£280
Total cost of uses	£619	£339	£280
Delivered energy	29 kWh/m ²	16 kWh/m ²	13 kWh/m ²
Carbon dioxide emissions	0.4 tonnes	0.2 tonnes	0.2 tonnes
CO2 emissions per m ²	4 kg/m ²	2 kg/m ²	2 kg/m ²
Primary energy	44 kWh/m ²	25 kWh/m ²	19 kWh/m ²

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 ²)	Storey height (m)	Volume (m ³)
Ground floor	36.5700 (1b)	x 2.6000 (2b)	= 95.0820 (1b) - (3b)
First floor	36.5700 (1c)	x 2.8000 (2c)	= 102.3960 (1c) - (3c)
Second floor	26.3400 (1d)	x 2.1700 (2d)	= 57.1578 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	99.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	254.6358 (5)

2. Ventilation rate

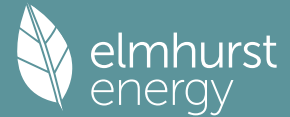
		m ³ per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	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) =	0.1178 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3678 (18)
Number of sides sheltered		2 (19)
Shelter factor (20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) =		0.3126 (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 infiltr rate	0.3986	0.3908	0.3830	0.3439	0.3361	0.2970	0.2970	0.2892	0.3126	0.3361	0.3517	0.3674 (22b)
Effective ac	0.5794	0.5764	0.5733	0.5591	0.5565	0.5441	0.5441	0.5418	0.5489	0.5565	0.5619	0.5675 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			8.9600	1.1450	10.2595		(27)
Half glazed door			1.7800	1.0000	1.7800		(26a)
Bi-fold (Uw = 1.20)			6.0800	1.1450	6.9618		(27)
E			2.0900	1.2357	2.5827		(27a)
Ground floor			36.5700	0.1300	4.7541	110.0000	4022.7000 (28a)
External wall	119.0000	15.4100	103.5900	0.1600	16.5744	150.0000	15538.5000 (29a)
Dormer wall	8.7200	1.4100	7.3100	0.1800	1.3158	9.0000	65.7900 (29a)
Secondary wall	8.2100		8.2100	0.1800	1.4778	9.0000	73.8900 (29a)
Sloped roof	28.5800	2.0900	26.4900	0.1500	3.9735	9.0000	238.4100 (30)
Dormer sloped roof	1.8400		1.8400	0.1500	0.2760	9.0000	16.5600 (30)
Secondary plane roof	10.2300		10.2300	0.1500	1.5345	9.0000	92.0700 (30)
Total net area of external elements Aum (A, m²)			213.1500				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	51.4902	(33)
Party wall			61.2300	0.0000	0.0000	70.0000	4286.1000 (32)
Internal stud wall			186.2900			9.0000	1676.6100 (32c)
First floor			36.5700			18.0000	658.2600 (32d)
Second floor			26.3400			18.0000	474.1200 (32d)
Ground floor ceiling			36.5700			9.0000	329.1300 (32e)

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First floor ceiling 26.3400 9.0000 237.0600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 27709.2000 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 278.5404 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	10.3100	0.0120	0.1237
E3 Sill	6.6500	0.0150	0.0998
E4 Jamb	24.9800	0.0260	0.6495
E5 Ground floor (normal)	19.1100	0.0720	1.3759
E6 Intermediate floor within a dwelling	36.1400	0.0200	0.7228
E11 Eaves (insulation at rafter level)	9.1200	0.0200	0.1824
E13 Gable (insulation at rafter level)	11.5400	0.0410	0.4731
E16 Corner (normal)	37.4000	0.0320	1.1968
E17 Corner (inverted - internal area greater than external area)	10.2000	-0.0530	-0.5406
P1 Party wall - Ground floor	8.6700	0.3200	2.7744
P2 Party wall - Intermediate floor within a dwelling	8.6700	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	6.6400	0.4800	3.1872
R1 Head of roof window	2.0400	0.2400	0.4896
R2 Sill of roof window	2.0400	0.2400	0.4896
R3 Jamb of roof window	3.6800	0.2400	0.8832

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.1074 (36)
 Point Thermal bridges 0.0000 (36a) =
 Total fabric heat loss (33) + (36) + (36a) = 63.5976 (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	48.6910	48.4317	48.1776	46.9841	46.7608	45.7213	45.7213	45.5288	46.1217	46.7608	47.2125	47.6848 (38)
Average = Sum(39)m / 12 =	112.2886	112.0293	111.7752	110.5817	110.3584	109.3189	109.3189	109.1263	109.7193	110.3584	110.8101	111.2824 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1288	1.1261	1.1236	1.1116	1.1094	1.0989	1.0989	1.0970	1.1029	1.1094	1.1139	1.1186 (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													2.7347 (42)
Hot water usage for mixer showers													
Hot water usage for baths													
Hot water usage for other uses													
Average daily hot water use (litres/day)													
Daily hot water use	177.9983	174.4190	169.9341	162.8131	157.1391	150.9957	148.4124	152.8754	157.6139	164.0923	171.3319	177.4933 (44)	
Energy content (annual)	281.9057	248.3703	261.1824	222.8830	211.5395	185.6668	179.4919	189.2917	194.3537	222.6717	244.0938	277.9116 (45)	
Distribution loss (46)m = 0.15 x (45)m	42.2859	37.2555	39.1774	33.4325	31.7309	27.8500	26.9238	28.3937	29.1531	33.4008	36.6141	41.6867 (46)	
Water storage loss:													
Store volume													200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.0000 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.0800 (55)
Total storage loss	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (56)	
If cylinder contains dedicated solar storage	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (57)	
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	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	338.6481	299.6215	316.5291	271.0414	255.4875	227.9721	223.2073	233.9376	243.8629	278.0184	299.0058	334.6540 (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)	
Aperture area of solar collector													3.0000 (H1)
Zero-loss collector efficiency													0.8000 (H2)
Collector linear heat loss coefficient													1.8000 (H3)
Collector 2nd order heat loss coefficient													0.0000 (H4)
Collector loop efficiency													0.9000 (H5)
Incidence angle modifier													1.0000 (H6)
Overshading factor													0.8000 (H8)
Overall heat loss coefficient of system													6.5000 (H10)
Heat loss coefficient of collector loop													3.9667 (H11)
Dedicated solar storage volume													75.0000 (H12)
Effective solar volume													75.0000 (H14)
Reference volume													225.0000 (H15)
Storage tank correction coefficient													1.3161 (H16)
Heat delivered to hot water													651.1094 (H24)
Heat delivered to space heating													0.0000 (H29)
Solar input													651.1094
Solar input	-0.0000	-16.1671	-59.8043	-83.4665	-110.8059	-102.4333	-101.8195	-88.0509	-59.6734	-28.8885	-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	338.6481	283.4545	256.7247	187.5749	144.6816	125.5388	121.3879	145.8867	184.1894	249.1299	299.0058	334.6540 (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	139.1276	123.5841	131.1205	112.6353	105.4953	95.5784	94.6534	98.6562	104.2299	118.3157	125.0908	137.7995 (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	164.0796	164.0796	164.0796	164.0796	164.0796	164.0796	164.0796	164.0796	164.0796	164.0796	164.0796	164.0796 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.0698	28.4841	23.1648	17.5372	13.1093	11.0674	11.9587	15.5444	20.8637	26.4913	30.9192	32.9611 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												

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	197.2969	165.1409	149.5682	109.2814	84.2917	73.1391	70.7207	84.9938	107.3090	145.1434	174.2012	194.9698	(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	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	28.0705	22.5192	20.2760	14.8551	11.4745	9.3748	10.4674	13.6059	17.6728	23.1876	26.1904	28.8506	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-38.6697	-57.6976	-86.1840	-97.9918	-104.7475	-97.5492	-96.0599	-90.5537	-79.9010	-66.2451	-43.3486	-33.0045	(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												901.1826	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												171.6440	
Water heating fuel used												1556.0561	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												226.5448	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-891.9526	(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												1871.8309	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	901.1826	16.4900	148.6050	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1556.0561	16.4900	256.5936	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	226.5448	16.4900	37.3572	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-891.9526	16.4900	-147.0830	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-147.0830	(252)
Total energy cost			308.6649	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.7691	(257)
SAP value		87.5329	
SAP rating (Section 12)		88	(258)
SAP band		B	

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	901.1826	0.1568	141.3051	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1556.0561	0.1448	225.2813	(264)
Space and water heating			366.5863	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	226.5448	0.1443	32.6974	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-891.9526	0.1343	-119.7536	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-119.7536	(269)
Total CO2, kg/year			290.6271	(272)
CO2 emissions per m2			2.9200	(273)
EI value			97.3045	
EI rating			97	(274)
EI band			A	

Full SAP Calculation Printout



1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	36.5700 (1b)	x 2.6000 (2b)	= 95.0820 (1b) - (3b)
First floor	36.5700 (1c)	x 2.8000 (2c)	= 102.3960 (1c) - (3c)
Second floor	26.3400 (1d)	x 2.1700 (2d)	= 57.1578 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	99.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 254.6358 (5)

2. Ventilation rate

		m ³ per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	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) = 0.1178 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	Yes	5.0000 (17)
Infiltration rate		0.3678 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3126 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.7000	3.5000	3.4000	3.2000	3.1000	2.8000	3.0000	2.7000	2.6000	2.8000	2.9000	3.2000 (22)
Wind factor	0.9250	0.8750	0.8500	0.8000	0.7750	0.7000	0.7500	0.6750	0.6500	0.7000	0.7250	0.8000 (22a)
Adj infilt rate												
Effective ac	0.2892	0.2736	0.2657	0.2501	0.2423	0.2189	0.2345	0.2110	0.2032	0.2189	0.2267	0.2501 (22b)
	0.5418	0.5374	0.5353	0.5313	0.5294	0.5239	0.5275	0.5223	0.5206	0.5239	0.5257	0.5313 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			8.9600	1.1450	10.2595		(27)
Half glazed door			1.7800	1.0000	1.7800		(26a)
Bi-fold (Uw = 1.20)			6.0800	1.1450	6.9618		(27)
E			2.0900	1.2357	2.5827		(27a)
Ground floor			36.5700	0.1300	4.7541	110.0000	4022.7000 (28a)
External wall	119.0000	15.4100	103.5900	0.1600	16.5744	150.0000	15538.5000 (29a)
Dormer wall	8.7200	1.4100	7.3100	0.1800	1.3158	9.0000	65.7900 (29a)
Secondary wall	8.2100		8.2100	0.1800	1.4778	9.0000	73.8900 (29a)
Sloped roof	28.5800	2.0900	26.4900	0.1500	3.9735	9.0000	238.4100 (30)
Dormer sloped roof	1.8400		1.8400	0.1500	0.2760	9.0000	16.5600 (30)
Secondary plane roof	10.2300		10.2300	0.1500	1.5345	9.0000	92.0700 (30)
Total net area of external elements Aum(A, m ²)			213.1500				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	51.4902	(33)
Party wall			61.2300	0.0000	0.0000	70.0000	4286.1000 (32)
Internal stud wall			186.2900			9.0000	1676.6100 (32c)
First floor			36.5700			18.0000	658.2600 (32d)
Second floor			26.3400			18.0000	474.1200 (32d)
Ground floor ceiling			36.5700			9.0000	329.1300 (32e)
First floor ceiling			26.3400			9.0000	237.0600 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 27709.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							278.5404 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	10.3100	0.0120	0.1237
E3 Sill	6.6500	0.0150	0.0998
E4 Jamb	24.9800	0.0260	0.6495
E5 Ground floor (normal)	19.1100	0.0720	1.3759
E6 Intermediate floor within a dwelling	36.1400	0.0200	0.7228
E11 Eaves (insulation at rafter level)	9.1200	0.0200	0.1824
E13 Gable (insulation at rafter level)	11.5400	0.0410	0.4731
E16 Corner (normal)	37.4000	0.0320	1.1968
E17 Corner (inverted - internal area greater than external area)	10.2000	-0.0530	-0.5406
P1 Party wall - Ground floor	8.6700	0.3200	2.7744
P2 Party wall - Intermediate floor within a dwelling	8.6700	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	6.6400	0.4800	3.1872
R1 Head of roof window	2.0400	0.2400	0.4896
R2 Sill of roof window	2.0400	0.2400	0.4896
R3 Jamb of roof window	3.6800	0.2400	0.8832

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

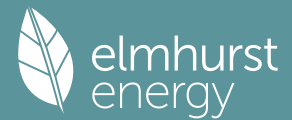
Point Thermal bridges	(36a) =	12.1074 (36)
Total fabric heat loss	(33) + (36) + (36a) =	63.5976 (37)

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	45.5288	45.1592	44.9821	44.6432	44.4815	44.0272	44.3250	43.8861	43.7500	44.0272	44.1735	44.6432 (38)
Average = Sum(39)m / 12 =	109.1263	108.7567	108.5796	108.2408	108.0791	107.6248	107.9226	107.4836	107.3476	107.6248	107.7711	108.2408 (39)
												108.0665

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1.0970	1.0933	1.0915	1.0881	1.0864	1.0819	1.0849	1.0805	1.0791	1.0819	1.0833	1.0881 (40)

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HLP (average)	31	28	31	30	31	30	31	31	30	31	30	1.0863
Days in mont												31

4. Water heating energy requirements (kWh/year)												

Assumed occupancy												2.7347 (42)
Hot water usage for mixer showers												104.7039 (42a)
Hot water usage for baths												30.1538 (42b)
Hot water usage for other uses												42.6356 (42c)
Average daily hot water use (litres/day)												163.7165 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	177.9983	174.4190	169.9341	162.8131	157.1391	150.9957	148.4124	152.8754	157.6139	164.0923	171.3319	177.4933 (44)
Energy content (annual)	281.9057	248.3703	261.1824	222.8830	211.5395	185.6668	179.4919	189.2917	194.3537	222.6717	244.0938	277.9116 (45)
Distribution loss (46)m = 0.15 x (45)m	42.2859	37.2555	39.1774	33.4325	31.7309	27.8500	26.9238	28.3937	29.1531	33.4008	36.6141	41.6867 (46)
Water storage loss:												200.0000 (47)
Store volume												2.0000 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												1.0800 (55)
Enter (49) or (54) in (55)												
Total storage loss	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (56)
If cylinder contains dedicated solar storage	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	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	338.6481	299.6215	316.5291	271.0414	255.4875	227.9721	223.2073	233.9376	243.8629	278.0184	299.0058	334.6540 (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)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												723.9097 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												723.9097
Solar input	-0.0000	-16.7815	-61.0627	-89.1060	-114.5827	-115.1531	-113.7575	-100.5749	-69.9575	-38.6272	-4.3065	-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	338.6481	282.8401	255.4664	181.9354	140.9048	112.8190	109.4498	133.3627	173.9053	239.3912	294.6993	334.6540 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	139.1276	123.5841	131.1205	112.6353	105.4953	95.5784	94.6534	98.6562	104.2299	118.3157	125.0908	137.7995 (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	164.0796	164.0796	164.0796	164.0796	164.0796	164.0796	164.0796	164.0796	164.0796	164.0796	164.0796	164.0796 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.0698	28.4841	23.1648	17.5372	13.1093	11.0674	11.9587	15.5444	20.8637	26.4913	30.9192	32.9611 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	381.3199	385.2769	375.3056	354.0779	327.2818	302.0972	285.2723	281.3154	291.2867	312.5144	339.3105	364.4951 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.1426	54.1426	54.1426	54.1426	54.1426	54.1426	54.1426	54.1426	54.1426	54.1426	54.1426	54.1426 (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)	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864	-109.3864 (71)
Water heating gains (Table 5)	186.9994	183.9049	176.2372	156.4379	141.7948	132.7478	127.2223	132.6025	144.7638	159.0264	173.7372	185.2144 (72)
Total internal gains	709.2250	706.5016	683.5434	636.8889	591.0217	554.7483	533.2892	538.2981	565.7500	606.8679	652.8027	691.5064 (73)

6. Solar gains												

[Jan]			Area	Solar flux	g	FF	Access	Gains				
			m2	Table 6a	Specific data	Specific data	factor	W				
				W/m2	or Table 6b	or Table 6c	Table 6d					
East			2.8500	22.2970	0.6300	0.7000	0.7700	19.4206 (76)				
West			6.1100	22.2970	0.6300	0.7000	0.7700	41.6351 (80)				
East			6.0800	22.2970	0.6300	0.7000	0.7700	41.4307 (76)				
East			2.0900	30.4656	0.7600	0.7000	1.0000	30.4866 (82)				

Solar gains	132.9731	231.6205	387.4633	591.6727	713.9719	787.2728	744.7445	641.7582	494.2690	308.1290	170.2343	108.0564 (83)
Total gains	842.1981	938.1222	1071.0067	1228.5616	1304.9936	1342.0210	1278.0338	1180.0563	1060.0190	914.9968	823.0370	799.5628 (84)

7. Mean internal temperature (heating season)												

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Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation		-919.0157 (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		1574.6035 (238)

10a. Fuel costs - using BEDF prices (531)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	672.7617	21.5100	144.7110 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1514.3128	21.5100	325.7287 (247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	21.5100	17.2080 (249)
Energy for lighting	226.5448	21.5100	48.7298 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-919.0157	21.5100	-197.6803
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-197.6803 (252)
Total energy cost			338.6972 (255)

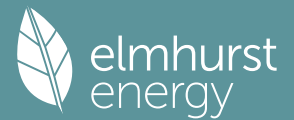
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	672.7617	0.1579	106.2543 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1514.3128	0.1453	220.0890 (264)
Space and water heating			326.3433 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	226.5448	0.1443	32.6974 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-919.0157	0.1342	-123.3424
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-123.3424 (269)
Total CO2, kg/year			246.7954 (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	672.7617	1.5847	1066.0934 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1514.3128	1.5376	2328.4261 (278)
Space and water heating			3394.5195 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	226.5448	1.5338	347.4819 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-919.0157	1.4960	-1374.8443
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1374.8443 (283)
Total Primary energy kWh/year			2488.1812 (286)

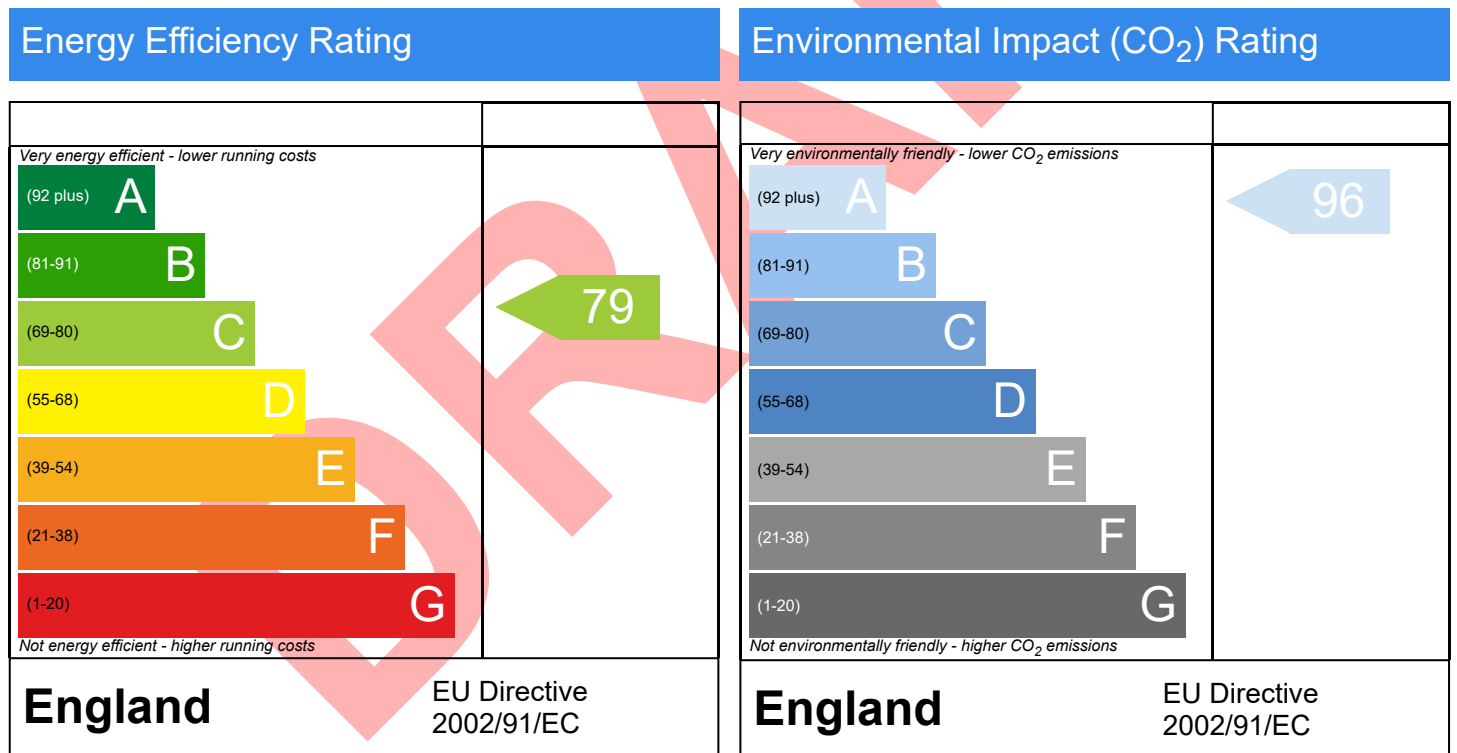
Predicted Energy Assessment



House 1, 10 Palmerston Road, Sutton, Surrey, SM1 4QL Dwelling type: House, End-Terrace
 Date of assessment: 01/12/2023
 Produced by: Kyle Jones
 Total floor area: 99.48 m²
 DRRN:

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

The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) 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 (CO₂) 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: Fri 01 Dec 2023 16:16:26

Project Information			
Assessed By	Kyle Jones	Building Type	House, Mid-terrace
OCDEA Registration	EES/027281	Assessment Date	2023-12-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	102 m ²
Site Reference	304434 - House 2	Plot Reference	304434 - House 2
Address	House 1 10 Palmerston Road, Sutton, SM1 4QL		

Client Details	
Name	Canopy Planning
Company	Canopy Planning
Address	5 Palmerston Court, Palmerston Road, Sutton, SM1 4QL

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	10.44 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	4.37 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	54.5 kWh _{PE} /m ²		
Dwelling primary energy	46.2 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	33.8 kWh/m ²		
Dwelling fabric energy efficiency	33.8 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.16	Walls (2) (0.18)	OK
Party walls	0.2	0	Party Wall (1) (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	0.13	Ground floor (0.13)	OK
Roofs	0.16	0.15	Roof (1) (0.15)	OK
Windows, doors, and roof windows	1.6	1.18	W (1.2)	OK
Rooflights	2.2	1.3	E, East (1.3)	OK

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	Net area [m ²]	U-Value [W/m ² K]
Exposed wall: Walls (1)	53.88	0.16
Exposed wall: Walls (2)	7.31	0.18
Exposed wall: Walls (3)	10.23	0.18
Party wall: Party Wall (1)	118.63	0 (!)
Ground floor: Ground floor, Ground floor	37.62	0.13
Exposed roof: Roof (1)	26.58	0.15
Exposed roof: Roof (2)	1.84	0.15
Exposed roof: Roof (3)	11.2	0.15

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
W, Window	4.7	West	0.7	1.2
W, Half glazed door	1.78	West	N/A	1 (!)
W, Window	1.41	West	0.7	1.2
E, Roof-light	2.09	East	0.7	1.3
E, Bi-fold	6.08	East	0.7	1.2
E, Window	2.85	East	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)	Government-approved scheme	0.012 (!)	
External wall	E3: Sill	Government-approved scheme	0.015 (!)	
External wall	E4: Jamb	Government-approved scheme	0.026 (!)	
External wall	E5: Ground floor (normal)	Government-approved scheme	0.072	
External wall	E6: Intermediate floor within a dwelling	Government-approved scheme	0.02 (!)	
External wall	E11: Eaves (insulation at rafter level)	Government-approved scheme	0.02 (!)	
External wall	E13: Gable (insulation at rafter level)	Government-approved scheme	0.041	
External wall	E16: Corner (normal)	Government-approved scheme	0.032 (!)	
External wall	E17: Corner (inverted - internal area greater than external area)	Government-approved scheme	-0.053	
Party wall	P1: Ground floor	Government-approved scheme	0.072	
Party wall	P2: Intermediate floor within a dwelling	SAP table default	0 (!)	
Party wall	P4: Roof (insulation at ceiling level)	SAP table default	0.48	
Roof	R1: Head of roof window	SAP table default	0.24	
Roof	R2: Sill of roof window	SAP table default	0.24	
Roof	R3: Jamb of roof window	SAP table default	0.24	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))			
Maximum permitted air permeability at 50Pa	8 m ³ /hm ²		
Dwelling air permeability at 50Pa	4.5 m ³ /hm ² , Design value		OK
Air permeability test certificate reference			

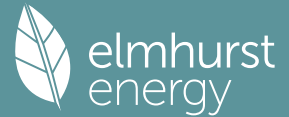
4 Space heating	
Main heating system 1: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	323.8%
Emitter type	Both radiators and underfloor
Flow temperature	35°C
System type	Heat Pump
Manufacturer	Grant Engineering (UK) Ltd
Model	AERONA3
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	200 litres
Declared heat loss	2 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		
System type: N/A		
Maximum permitted specific fan power	N/A	
Specific fan power	N/A	N/A
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model		
Commissioning		
9 Local generation		
N/A		
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		

Full SAP Calculation Printout



Property Reference	304434 - House 2		Issued on Date	01/12/2023	
Assessment Reference	304434 - House 2	Prop Type Ref	304434		
Property	House 1, 10 Palmerston Road, Sutton, Surrey, SM1 4QL				
SAP Rating	80 C	DER	4.37	TER	10.44
Environmental	96 A	% DER < TER			58.14
CO ₂ Emissions (t/year)	0.4	DFEE	33.78	TFEE	33.83
Compliance Check	See BREL	% DFEE < TFEE			0.17
% DPER < TPER	15.23	DPER	46.20	TPER	54.50
Assessor Details	Mr. Kyle Jones			Assessor ID	AV53-0001
Client	304434, Canopy Planning				

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	37.6200 (1b)	x 2.6000 (2b)	= 97.8120 (1b) - (3b)
First floor	37.6200 (1c)	x 2.8000 (2c)	= 105.3360 (1c) - (3c)
Second floor	26.4200 (1d)	x 2.1700 (2d)	= 57.3314 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.4794 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	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) = 0.1152 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.5000 (17)
Infiltration rate	0.3402 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2891 (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	0.3687	0.3614	0.3542	0.3181	0.3108	0.2747	0.2747	0.2675	0.2891	0.3108	0.3253	0.3397 (22b)
Effective ac	0.5680	0.5653	0.5627	0.5506	0.5483	0.5377	0.5377	0.5358	0.5418	0.5483	0.5529	0.5577 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			8.9600	1.1450	10.2595		(27)
Half glazed door			1.7800	1.0000	1.7800		(26a)
Bi-fold (Uw = 1.20)			6.0800	1.1450	6.9618		(27)
E			2.0900	1.2357	2.5827		(27a)
Ground floor			37.6200	0.1300	4.8906	110.0000	4138.2000 (28a)
External wall	69.2900	15.4100	53.8800	0.1600	8.6208	150.0000	8082.0000 (29a)
Dormer wall	8.7200	1.4100	7.3100	0.1800	1.3158	9.0000	65.7900 (29a)
Secondary wall	10.2300		10.2300	0.1800	1.8414	9.0000	92.0700 (29a)
Sloped roof	28.6700	2.0900	26.5800	0.1500	3.9870	9.0000	239.2200 (30)
Dormer sloped roof	1.8400		1.8400	0.1500	0.2760	9.0000	16.5600 (30)
Secondary plane roof	11.2000		11.2000	0.1500	1.6800	9.0000	100.8000 (30)
Total net area of external elements Aum (A, m ²)			167.5700				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	44.1957	(33)
Party wall			118.6300	0.0000	0.0000	70.0000	8304.1000 (32)
Internal stud wall			200.5600			9.0000	1805.0400 (32c)
First floor			37.6200			18.0000	677.1600 (32d)
Second floor			26.4200			18.0000	475.5600 (32d)
Ground floor ceiling			37.6200			9.0000	338.5800 (32e)

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First floor ceiling 26.4200 9.0000 237.7800 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 24572.8600 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 241.7161 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	10.3100	0.0120	0.1237
E3 Sill	6.6500	0.0150	0.0998
E4 Jamb	24.9800	0.0260	0.6495
E5 Ground floor (normal)	10.2600	0.0720	0.7387
E6 Intermediate floor within a dwelling	22.7600	0.0200	0.4552
E11 Eaves (insulation at rafter level)	8.5800	0.0200	0.1716
E13 Gable (insulation at rafter level)	4.5300	0.0410	0.1857
E16 Corner (normal)	17.9000	0.0320	0.5728
E17 Corner (inverted - internal area greater than external area)	4.4000	-0.0530	-0.2332
P1 Party wall - Ground floor	17.3400	0.0720	1.2485
P2 Party wall - Intermediate floor within a dwelling	17.3400	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	11.5200	0.4800	5.5296
R1 Head of roof window	2.0400	0.2400	0.4896
R2 Sill of roof window	2.0400	0.2400	0.4896
R3 Jamb of roof window	3.6800	0.2400	0.8832

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.4043 (36)
 Point Thermal bridges 0.0000 (36a) =
 Total fabric heat loss (33) + (36) + (36a) = 55.6000 (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	48.8205	48.5936	48.3713	47.3270	47.1316	46.2221	46.2221	46.0536	46.5724	47.1316	47.5269	47.9401 (38)
Average = Sum(39)m / 12 =	104.4204	104.1936	103.9712	102.9269	102.7316	101.8220	101.8220	101.6536	102.1724	102.7316	103.1268	103.5400 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0272	1.0249	1.0227	1.0125	1.0105	1.0016	1.0016	0.9999	1.0050	1.0105	1.0144	1.0185 (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 2.7544 (42)

Hot water usage for mixer showers 105.6023 104.0153 101.7027 97.2781 94.0128 90.3713 88.3015 90.5966 93.1124 97.0222 101.5419 105.1977 (42a)

Hot water usage for baths 30.3982 29.9467 29.3110 28.1388 27.2611 26.2878 25.7621 26.3934 27.0808 28.1222 29.3185 30.2954 (42b)

Hot water usage for other uses 42.8375 41.2798 39.7221 38.1643 36.6066 35.0489 35.0489 36.6066 38.1643 39.7221 41.2798 42.8375 (42c)

Average daily hot water use (litres/day) 164.4889 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	178.8380	175.2418	170.7358	163.5812	157.8804	151.7080	149.1125	153.5966	158.3575	164.8664	172.1402	178.3306 (44)
Energy content (annual)	283.2357	249.5420	262.4145	223.9344	212.5374	186.5427	180.3386	190.1846	195.2706	223.7222	245.2453	279.2226 (45)
Distribution loss (46)m = 0.15 x (45)m	42.4853	37.4313	39.3622	33.5902	31.8806	27.9814	27.0508	28.5277	29.2906	33.5583	36.7868	41.8834 (46)
Water storage loss:												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0800 (55)
Total storage loss	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (56)
If cylinder contains dedicated solar storage	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (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	339.9781	300.7932	319.1569	278.8464	269.2798	241.4547	237.0810	246.9270	250.1826	280.4646	300.1573	335.9650 (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	339.9781	300.7932	319.1569	278.8464	269.2798	241.4547	237.0810	246.9270	250.1826	280.4646	300.1573	335.9650 (64)
12Total per year (kWh/year)												3400.2867 (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	139.5698	123.9737	132.6467	118.3878	116.0626	105.9550	105.3565	108.6303	108.8571	119.7815	125.4737	138.2354 (65)

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

Metabolic gains (Table 5), Watts

(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	134.3455	148.7396	134.3455	138.8236	134.3455	138.8236	134.3455	134.3455	138.8236	134.3455	138.8236	134.3455 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	258.9838	261.6712	254.8990	240.4816	222.2823	205.1775	193.7505	191.0630	197.8353	212.2526	230.4519	247.5567 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719 (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)	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748 (71)
Water heating gains (Table 5)	187.5938	184.4846	178.2886	164.4275	155.9981	147.1598	141.6082	146.0085	151.1904	160.9967	174.2690	185.8003 (72)
Total internal gains	645.2386	659.2110	631.8486	608.0483	576.9414	555.4765	534.0197	535.7325	552.1649	571.9104	607.8601	632.0181 (73)

6. Solar gains

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[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m2	Table 6a	Specific data	Specific data	factor	W						
		W/m2	or Table 6b	or Table 6c	Table 6d							
East	2.8500	19.6403	0.6300	0.7000	0.7700	17.1066 (76)						
West	6.1100	19.6403	0.6300	0.7000	0.7700	36.6742 (80)						
East	6.0800	19.6403	0.6300	0.7000	0.7700	36.4941 (76)						
East	2.0900	26.6072	0.7600	0.7000	1.0000	26.6256 (82)						
Solar gains	116.9005	230.4262	383.8404	566.6973	700.6605	719.9826	684.3298	583.7038	448.6596	274.5643	146.0736	95.9340 (83)
Total gains	762.1391	889.6372	1015.6890	1174.7456	1277.6019	1275.4591	1218.3495	1119.4363	1000.8245	846.4747	753.9337	727.9521 (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)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	65.3684	65.5107	65.6508	66.3169	66.4430	67.0365	67.0365	67.1476	66.8067	66.4430	66.1884	65.9242
util living area	5.3579	5.3674	5.3767	5.4211	5.4295	5.4691	5.4691	5.4765	5.4538	5.4295	5.4126	5.3949
Living	0.9933	0.9841	0.9576	0.8678	0.7018	0.5045	0.3667	0.4157	0.6700	0.9244	0.9851	0.9947 (86)
Non living	20.1219	20.2753	20.4972	20.7545	20.8938	20.9364	20.9423	20.9415	20.9144	20.7045	20.3671	20.0971
24 / 16	19.0369	19.2325	19.5099	19.8189	19.9631	20.0056	20.0089	20.0101	19.9882	19.7722	19.3575	19.0112
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	3	0	0	0	0	0	0	0	0	0	0	0
MIT	28	0	0	0	0	0	0	0	0	0	0	10
MIT 2	20.5508	20.2753	20.4972	20.7545	20.8938	20.9364	20.9423	20.9415	20.9144	20.7045	20.3671	20.2234 (87)
Th 2	20.0608	20.0626	20.0644	20.0730	20.0746	20.0820	20.0820	20.0834	20.0791	20.0746	20.0713	20.0680 (88)
util rest of house	0.9913	0.9794	0.9454	0.8351	0.6455	0.4349	0.2908	0.3339	0.5936	0.8970	0.9799	0.9931 (89)
MIT 2	19.6526	19.2325	19.5099	19.8189	19.9631	20.0056	20.0089	20.0101	19.9882	19.7722	19.3575	19.2016 (90)
Living area fraction	19.8168	19.4232	19.6905	19.9900	20.1333	20.1758	20.1796	20.1804	20.1575	19.9427	19.5421	0.1829 (91)
Temperature adjustment	19.8168	19.4232	19.6905	19.9900	20.1333	20.1758	20.1796	20.1804	20.1575	19.9427	19.5421	19.3885 (92)
adjusted MIT	19.8168	19.4232	19.6905	19.9900	20.1333	20.1758	20.1796	20.1804	20.1575	19.9427	19.5421	19.3885 (93)
8. Space heating requirement												
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9906	0.9754	0.9395	0.8319	0.6493	0.4422	0.2989	0.3426	0.6004	0.8923	0.9760	0.9915 (94)
Ext temp.	754.9842	867.7083	954.2046	977.2436	829.4915	563.9520	364.1356	383.5655	600.9303	755.3039	735.8480	721.7775 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	1620.2757	1513.2210	1371.4295	1141.4563	866.3700	567.7379	364.4832	384.2891	618.9132	959.7879	1283.1130	1572.6169 (97)
Solar heating kWh	643.7769	433.7845	310.4153	118.2331	27.4376	0.0000	0.0000	0.0000	0.0000	152.1361	394.0308	633.0245 (98a)
Solar heating contribution - total per year (kWh/year)												2712.8388
Space heating requirement - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Space heating kWh	643.7769	433.7845	310.4153	118.2331	27.4376	0.0000	0.0000	0.0000	0.0000	152.1361	394.0308	633.0245 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2712.8388
Space heating per m2												(98c) / (4) = 26.6854 (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 %)												323.7828 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating efficiency (main heating system 1)	643.7769	433.7845	310.4153	118.2331	27.4376	0.0000	0.0000	0.0000	0.0000	152.1361	394.0308	633.0245 (98)
Space heating fuel (main heating system)	198.8299	133.9739	95.8715	36.5162	8.4741	0.0000	0.0000	0.0000	0.0000	46.9871	121.6960	195.5090 (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	339.9781	300.7932	319.1569	278.8464	269.2798	241.4547	237.0810	246.9270	250.1826	280.4646	300.1573	335.9650 (64)
Efficiency of water heater	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013 (216)
Fuel for water heating, kWh/month	198.3520	175.4906	186.2045	162.6863	157.1048	140.8709	138.3192	144.0637	145.9631	163.6303	175.1196	196.0108 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	28.5610	22.9127	20.6303	15.1147	11.6750	9.5386	10.6503	13.8437	17.9816	23.5928	26.6480	29.3548 (232)
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 (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)

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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												837.8576	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												171.4013	
Water heating fuel used												1983.8157	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												230.5033	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												3052.1767	(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	837.8576	0.1569	131.4881 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1983.8157	0.1410	279.7482 (264)
Space and water heating			411.2364 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	230.5033	0.1443	33.2688 (268)
Total CO2, kg/year			444.5051 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.3700 (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	837.8576	1.5809	1324.6105 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1983.8157	1.5214	3018.2351 (278)
Space and water heating			4342.8456 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	230.5033	1.5338	353.5537 (282)
Total Primary energy kWh/year			4696.3993 (286)
Dwelling Primary energy Rate (DPER)			46.2000 (287)

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

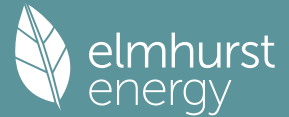
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	37.6200 (1b)	x 2.6000 (2b)	= 97.8120 (1b) - (3b)
First floor	37.6200 (1c)	x 2.8000 (2c)	= 105.3360 (1c) - (3c)
Second floor	26.4200 (1d)	x 2.1700 (2d)	= 57.3314 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.6600		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 260.4794 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1536 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4036 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)

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Infiltration rate adjusted to include shelter factor

(21) = (18) x (20) = 0.3430 (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													
Effective ac	0.4374	0.4288	0.4202	0.3773	0.3688	0.3259	0.3259	0.3173	0.3430	0.3688	0.3859	0.4031	(22b)
	0.5956	0.5919	0.5883	0.5712	0.5680	0.5531	0.5531	0.5503	0.5588	0.5680	0.5745	0.5812	(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 Semi-glazed door			1.7800	1.0000	1.7800			(26a)
TER Opening Type (Uw = 1.20)			15.0400	1.1450	17.2214			(27)
E			2.0900	2.0221	4.2261			(27a)
Ground floor			37.6200	0.1300	4.8906			(28a)
External wall	69.2900	15.4100	53.8800	0.1800	9.6984			(29a)
Dormer wall	8.7200	1.4100	7.3100	0.1800	1.3158			(29a)
Secondary wall	10.2300		10.2300	0.1800	1.8414			(29a)
Sloped roof	28.6700	2.0900	26.5800	0.1100	2.9238			(30)
Dormer sloped roof	1.8400		1.8400	0.1100	0.2024			(30)
Secondary plane roof	11.2000		11.2000	0.1100	1.2320			(30)
Total net area of external elements Aum(A, m2)			167.5700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.3319			(33)
Party wall			118.6300	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							241.7161	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	10.3100	0.0500	0.5155
E2 Other lintels (including other steel lintels)	6.6500	0.0500	0.3325
E3 Sill	24.9800	0.0500	1.2490
E4 Jamb	10.2600	0.1600	1.6416
E5 Ground floor (normal)	22.7600	0.0000	0.0000
E6 Intermediate floor within a dwelling	8.5800	0.0400	0.3432
E11 Eaves (insulation at rafter level)	4.5300	0.0800	0.3624
E13 Gable (insulation at rafter level)	17.9000	0.0900	1.6110
E16 Corner (normal)	4.4000	-0.0900	-0.3960
E17 Corner (inverted - internal area greater than external area)	17.3400	0.0800	1.3872
P1 Party wall - Ground floor	17.3400	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	11.5200	0.1200	1.3824
P4 Party wall - Roof (insulation at ceiling level)	2.0400	0.0800	0.1632
R1 Head of roof window	2.0400	0.0600	0.1224
R2 Sill of roof window	3.6800	0.0800	0.2944
R3 Jamb of roof window			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			9.0088
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	54.3407

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	51.2004	50.8811	50.5682	49.0984	48.8234	47.5433	47.5433	47.3062	48.0364	48.8234	49.3797	49.9613	(38)
Heat transfer coeff	105.5410	105.2218	104.9089	103.4391	103.1641	101.8840	101.8840	101.6469	102.3771	103.1641	103.7204	104.3020	(39)
Average = Sum(39)m / 12 =												103.4378	(39)
HLP	1.0382	1.0350	1.0320	1.0175	1.0148	1.0022	1.0022	0.9999	1.0071	1.0148	1.0203	1.0260	(40)
HLP (average)												1.0175	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	(40)

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.7544	(42)
Hot water usage for mixer showers													70.1318	(42a)
Hot water usage for baths													30.2954	(42b)
Hot water usage for other uses													42.8375	(42c)
Average daily hot water use (litres/day)													132.0349	(43)
Daily hot water use	143.6372	140.5700	136.8349	131.1551	126.5428	121.5842	119.6786	123.3977	127.3200	132.5257	138.2929	143.2647	(44)	
Energy conte	227.4862	200.1699	210.3101	179.5448	170.3510	149.5020	144.7409	152.7921	156.9983	179.8361	197.0236	224.3179	(45)	
Energy content (annual)										Total = Sum(45)m =		2193.0730	(45)	
Distribution loss (46)m = 0.15 x (45)m	34.1229	30.0255	31.5465	26.9317	25.5526	22.4253	21.7111	22.9188	23.5497	26.9754	29.5535	33.6477	(46)	
Water storage loss:													200.0000	(47)
Store volume													1.6525	(48)
a) If manufacturer declared loss factor is known (kWh/day):													0.5400	(49)
Temperature factor from Table 2b													0.8924	(55)
Enter (49) or (54) in (55)														(55)
Total storage loss	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)	
If cylinder contains dedicated solar storage	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(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	278.4123	246.1676	261.2362	228.8281	221.2770	198.7853	195.6670	203.7182	206.2816	230.7622	246.3069	275.2440	(62)	
WWHRS	-32.1846	-28.4644	-29.8062	-24.6807	-23.0016	-19.6826	-18.4493	-19.6190	-20.3644	-24.0074	-27.1974	-31.5886	(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	246.2277	217.7032	231.4299	204.1474	198.2755	179.1027	177.2177	184.0992	185.9172	206.7548	219.1095	243.6554	(64)	
Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2493.6402	(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)	

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Heat gains from water heating, kWh/month
 116.3800 103.3547 110.6690 99.1253 97.3826 89.1360 88.8672 91.5442 91.6286 100.5364 104.9370 115.3266 (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	137.7185	137.7185	137.7185	137.7185	137.7185	137.7185	137.7185	137.7185	137.7185	137.7185	137.7185	137.7185 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	134.3455	148.7396	134.3455	138.8236	134.3455	138.8236	134.3455	134.3455	138.8236	134.3455	138.8236	134.3455 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	258.9838	261.6712	254.8990	240.4816	222.2823	205.1775	193.7505	191.0630	197.8353	212.2526	230.4519	247.5567 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719 (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)	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748 (71)
Water heating gains (Table 5)	156.4248	153.8016	148.7486	137.6740	130.8905	123.8001	119.4452	123.0433	127.2619	135.1295	145.7458	155.0088 (72)
Total internal gains	617.0696	631.5280	605.3086	584.2948	554.8338	532.1168	511.8567	512.7674	528.2364	549.0432	582.3370	604.2266 (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						
East	8.9300	19.6403	0.6300	0.7000	0.7700	53.6007 (76)						
West	6.1100	19.6403	0.6300	0.7000	0.7700	36.6742 (80)						
East	2.0900	26.6072	0.6300	0.7000	1.0000	22.0713 (82)						
Solar gains	112.3461	221.2185	367.9307	542.3155	669.7275	687.8499	653.9302	558.2967	429.7733	263.4429	140.3414	92.2228 (83)
Total gains	729.4157	852.7465	973.2393	1126.6104	1224.5613	1219.9667	1165.7869	1071.0641	958.0096	812.4861	722.6783	696.4494 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, T _{hl} (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)	64.6743	64.8705	65.0640	65.9885	66.1644	66.9958	66.9958	67.1520	66.6731	66.1644	65.8096	65.4426
tau	5.3116	5.3247	5.3376	5.3992	5.4110	5.4664	5.4664	5.4768	5.4449	5.4110	5.3873	5.3628
util living area	0.9946	0.9870	0.9647	0.8845	0.7262	0.5262	0.3833	0.4339	0.6945	0.9352	0.9878	0.9957 (86)
MIT	19.8530	20.0567	20.3552	20.7167	20.9221	20.9888	20.9983	20.9969	20.9543	20.6522	20.1922	19.8263 (87)
Th 2	20.0516	20.0542	20.0568	20.0688	20.0710	20.0815	20.0815	20.0834	20.0775	20.0710	20.0665	20.0617 (88)
util rest of house	0.9929	0.9831	0.9542	0.8541	0.6701	0.4543	0.3039	0.3488	0.6175	0.9105	0.9834	0.9944 (89)
MIT 2	18.7202	18.9804	19.3555	19.7938	20.0096	20.0754	20.0810	20.0823	20.0483	19.7327	19.1633	18.6935 (90)
Living area fraction	18.9273	19.1772	19.5383	19.9626	20.1765	20.2424	20.2487	20.2496	20.2140	19.9009	19.3515	18.9006 (92)
MIT	18.9273	19.1772	19.5383	19.9626	20.1765	20.2424	20.2487	20.2496	20.2140	19.9009	19.3515	18.9006 (93)
Temperature adjustment												0.0000
adjusted MIT	18.9273	19.1772	19.5383	19.9626	20.1765	20.2424	20.2487	20.2496	20.2140	19.9009	19.3515	18.9006 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9901	0.9782	0.9470	0.8502	0.6768	0.4671	0.3185	0.3644	0.6295	0.9050	0.9788	0.9920 (94)
Useful gains	722.1793	834.1500	921.6272	957.8761	828.7652	569.8633	371.2564	390.2955	603.0859	735.2932	707.3599	690.8938 (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	1543.7843	1502.2709	1367.8343	1144.3008	874.4698	574.8743	371.7466	391.2970	625.9344	959.5142	1270.7294	1533.3064 (97)
Space heating kWh	611.2742	448.9773	331.9781	134.2258	34.0042	0.0000	0.0000	0.0000	0.0000	166.8204	405.6260	626.7550 (98a)
Space heating requirement - total per year (kWh/year)												2759.6610
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	611.2742	448.9773	331.9781	134.2258	34.0042	0.0000	0.0000	0.0000	0.0000	166.8204	405.6260	626.7550 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2759.6610
Space heating per m2										(98c) / (4) =		27.1460 (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	611.2742	448.9773	331.9781	134.2258	34.0042	0.0000	0.0000	0.0000	0.0000	166.8204	405.6260	626.7550 (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)	662.2689	486.4326	359.6729	145.4234	36.8410	0.0000	0.0000	0.0000	0.0000	180.7372	439.4648	679.0411 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating														
Water heating requirement	246.2277	217.7032	231.4299	204.1474	198.2755	179.1027	177.2177	184.0992	185.9172	206.7548	219.1095	243.6554		(64)
Efficiency of water heater														(216)
(217)m	86.0144	85.6458	84.8683	83.1427	81.0018	79.8000	79.8000	79.8000	79.8000	83.5828	85.4211	86.0823		(217)
Fuel for water heating, kWh/month	286.2632	254.1903	272.6930	245.5387	244.7790	224.4394	222.0773	230.7008	232.9790	247.3652	256.5050	283.0494		(219)
Space cooling fuel requirement														
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685		(231)
Lighting	27.9143	22.3939	20.1632	14.7725	11.4107	9.3226	10.4092	13.5303	17.5745	23.0587	26.0447	28.6902		(232)
Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)m	-36.7540	-52.6414	-76.8469	-87.7745	-95.7845	-89.7742	-88.6305	-83.0964	-73.5432	-60.7774	-40.6849	-31.6771		(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(235c)
Electricity generated by PVs (Appendix M) (negative quantity)														
(233b)m	-18.3291	-38.8145	-77.6355	-117.3309	-155.8686	-156.9127	-155.1053	-131.0284	-95.6183	-55.7948	-24.5616	-14.4781		(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													2989.8819	(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													3000.5803	(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)													225.2847	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-1859.4628	(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													4442.2841	(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	2989.8819	0.2100	627.8752	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3000.5803	0.2100	630.1219	(264)
Space and water heating			1257.9971	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	225.2847	0.1443	32.5155	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-817.9851	0.1343	-109.8289	
PV Unit electricity exported	-1041.4777	0.1257	-130.9210	
Total			-240.7499	(269)
Total CO2, kg/year			1061.6920	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.4400	(273)

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

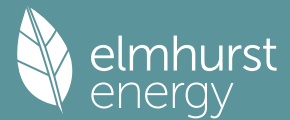
	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2989.8819	1.1300	3378.5665	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3000.5803	1.1300	3390.6557	(278)
Space and water heating			6769.2223	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	225.2847	1.5338	345.5491	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-817.9851	1.4962	-1223.8795	
PV Unit electricity exported	-1041.4777	0.4614	-480.5603	
Total			-1704.4398	(283)
Total Primary energy kWh/year			5540.4324	(286)
Target Primary Energy Rate (TPER)			54.5000	(287)

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

1. Overall dwelling characteristics

Area (m2)	Storey height (m)	Volume (m3)
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Ground floor		37.6200 (1b)	x	2.6000 (2b)	=	97.8120 (1b)	-	(3b)
First floor		37.6200 (1c)	x	2.8000 (2c)	=	105.3360 (1c)	-	(3c)
Second floor		26.4200 (1d)	x	2.1700 (2d)	=	57.3314 (1d)	-	(3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.6600							(4)
Dwelling volume						(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	260.4794 (5)

2. Ventilation rate

		m3 per hour										
Number of open chimneys		0 * 80	=	0.0000 (6a)								
Number of open flues		0 * 20	=	0.0000 (6b)								
Number of chimneys / flues attached to closed fire		0 * 10	=	0.0000 (6c)								
Number of flues attached to solid fuel boiler		0 * 20	=	0.0000 (6d)								
Number of flues attached to other heater		0 * 35	=	0.0000 (6e)								
Number of blocked chimneys		0 * 20	=	0.0000 (6f)								
Number of intermittent extract fans		4 * 10	=	40.0000 (7a)								
Number of passive vents		0 * 10	=	0.0000 (7b)								
Number of flueless gas fires		0 * 40	=	0.0000 (7c)								
		Air changes per hour										
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		40.0000 / (5)	=	0.1536 (8)								
Pressure test		Yes										
Pressure Test Method		Blower Door										
Measured/design AP50		4.5000 (17)										
Infiltration rate		0.3786 (18)										
Number of sides sheltered		2 (19)										
Shelter factor		(20) = 1 - [0.075 x (19)]	=	0.8500 (20)								
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20)	=	0.3218 (21)								
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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 (22)
Adj infiltr rate	0.4103	0.4022	0.3942	0.3540	0.3459	0.3057	0.3057	0.2976	0.3218	0.3459	0.3620	0.3781 (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	0.5842	0.5809	0.5777	0.5626	0.5598	0.5467	0.5467	0.5443	0.5518	0.5598	0.5655	0.5715 (25)

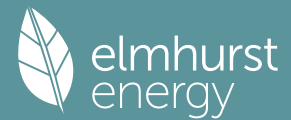
3. Heat losses and heat loss parameter

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)			8.9600	1.1450	10.2595		(27)
Half glazed door			1.7800	1.0000	1.7800		(26a)
Bi-fold (Uw = 1.20)			6.0800	1.1450	6.9618		(27)
E			2.0900	1.2357	2.5827		(27a)
Ground floor			37.6200	0.1300	4.8906	110.0000	4138.2000 (28a)
External wall	69.2900	15.4100	53.8800	0.1600	8.6208	150.0000	8082.0000 (29a)
Dormer wall	8.7200	1.4100	7.3100	0.1800	1.3158	9.0000	65.7900 (29a)
Secondary wall	10.2300		10.2300	0.1800	1.8414	9.0000	92.0700 (29a)
Sloped roof	28.6700	2.0900	26.5800	0.1500	3.9870	9.0000	239.2200 (30)
Dormer sloped roof	1.8400		1.8400	0.1500	0.2760	9.0000	16.5600 (30)
Secondary plane roof	11.2000		11.2000	0.1500	1.6800	9.0000	100.8000 (30)
Total net area of external elements Aum(A, m2)			167.5700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.1957		(33)
Party wall			118.6300	0.0000	0.0000	70.0000	8304.1000 (32)
Internal stud wall			200.5600			9.0000	1805.0400 (32c)
First floor			37.6200			18.0000	677.1600 (32d)
Second floor			26.4200			18.0000	475.5600 (32d)
Ground floor ceiling			37.6200			9.0000	338.5800 (32e)
First floor ceiling			26.4200			9.0000	237.7800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	24572.8600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							241.7161 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element	10.3100	0.0120	0.1237
E2 Other lintels (including other steel lintels)	6.6500	0.0150	0.0998
E3 Sill	24.9800	0.0260	0.6495
E4 Jamb	10.2600	0.0720	0.7387
E5 Ground floor (normal)	22.7600	0.0200	0.4552
E6 Intermediate floor within a dwelling	8.5800	0.0200	0.1716
E11 Eaves (insulation at rafter level)	4.5300	0.0410	0.1857
E13 Gable (insulation at rafter level)	17.9000	0.0320	0.5728
E16 Corner (normal)	4.4000	-0.0530	-0.2332
E17 Corner (inverted - internal area greater than external area)	17.3400	0.0720	1.2485
P1 Party wall - Ground floor	17.3400	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	11.5200	0.4800	5.5296
P4 Party wall - Roof (insulation at ceiling level)	2.0400	0.2400	0.4896
R1 Head of roof window	2.0400	0.2400	0.4896
R2 Sill of roof window	3.6800	0.2400	0.8832
R3 Jamb of roof window			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			11.4043 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 55.6000 (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	50.2133	49.9324	49.6571	48.3637	48.1218	46.9953	46.9953	46.7867	47.4292	48.1218	48.6113	49.1230 (38)
Average = Sum(39)m / 12 =	105.8133	105.5324	105.2570	103.9637	103.7217	102.5953	102.5953	102.3867	103.0292	103.7217	104.2112	104.7230 (39)
												103.9625
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0409	1.0381	1.0354	1.0227	1.0203	1.0092	1.0092	1.0071	1.0135	1.0203	1.0251	1.0301 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7544 (42)
Hot water usage for mixer showers												0.0000 (42a)
Hot water usage for baths												30.3982 (42b)
Hot water usage for other uses												42.8375 (42c)
Average daily hot water use (litres/day)												67.1271 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	73.2357	71.2265	69.0330	66.3031	63.8677	61.3367	60.8110	63.0000	65.2451	67.8442	70.5983	73.1329
Energy content (annual)	115.9874	101.4256	106.1012	90.7656	85.9781	75.4206	73.5456	78.0071	80.4537	92.0640	100.5802	114.5085
Distribution loss (46)m = 0.15 x (45)m												1114.8377
Total storage loss												0.0000 (46)
Water storage loss:												
Total storage loss												0.0000 (56)
If cylinder contains dedicated solar storage												
Primary loss												0.0000 (57)
Combi loss												0.0000 (59)
Total heat required for water heating calculated for each month	98.5893	86.2118	90.1860	77.1508	73.0814	64.1075	62.5137	66.3061	68.3857	78.2544	85.4932	97.3322
WWHRs	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Output from w/h	98.5893	86.2118	90.1860	77.1508	73.0814	64.1075	62.5137	66.3061	68.3857	78.2544	85.4932	97.3322
12 Total per year (kWh/year)												947.6121 (64)
Electric shower(s)	56.3799	50.2349	54.8546	52.3471	53.3294	50.8711	52.5668	53.3294	52.3471	54.8546	53.8232	56.3799
Total Energy used by instantaneous electric shower(s)												641.3180 (64a)
Heat gains from water heating, kWh/month	38.7423	34.1117	36.2602	32.3745	31.6027	28.7446	28.7701	29.9089	30.1832	33.2773	34.8291	38.4280

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	137.7185	137.7185	137.7185	137.7185	137.7185	137.7185	137.7185	137.7185	137.7185	137.7185	137.7185	137.7185
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	134.3455	148.7396	134.3455	138.8236	134.3455	138.8236	134.3455	134.3455	138.8236	134.3455	138.8236	134.3455
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	258.9838	261.6712	254.8990	240.4816	222.2823	205.1775	193.7505	191.0630	197.8353	212.2526	230.4519	247.5567
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Losses e.g. evaporation (negative values) (Table 5)	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748
Water heating gains (Table 5)	52.0730	50.7614	48.7368	44.9646	42.4767	39.9231	38.6695	40.2001	41.9211	44.7275	48.3737	51.6506
Total internal gains	509.7178	525.4878	502.2968	488.5854	463.4201	448.2398	431.0810	429.9241	442.8956	455.6411	481.9649	497.8683

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W						
East	2.8500	19.6403	0.6300	0.7000	0.7700	17.1066 (76)						
West	6.1100	19.6403	0.6300	0.7000	0.7700	36.6742 (80)						
East	6.0800	19.6403	0.6300	0.7000	0.7700	36.4941 (76)						
East	2.0900	26.6072	0.7600	0.7000	1.0000	26.6256 (82)						
Solar gains	116.9005	230.4262	383.8404	566.6973	700.6605	719.9826	684.3298	583.7038	448.6596	274.5643	146.0736	95.9340
Total gains	626.6183	755.9140	886.1371	1055.2826	1164.0805	1168.2225	1115.4108	1013.6279	891.5552	730.2054	628.0385	593.8023

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	64.5079	64.6796	64.8488	65.6556	65.8087	66.5313	66.5313	66.6668	66.2511	65.8087	65.4996	65.1795
alpha	5.3005	5.3120	5.3233	5.3770	5.3872	5.4354	5.4354	5.4445	5.4167	5.3872	5.3666	5.3453
util living area	0.9973	0.9924	0.9760	0.9070	0.7549	0.5510	0.4029	0.4608	0.7355	0.9570	0.9936	0.9980
MIT	19.7375	19.9506	20.2682	20.6664	20.9047	20.9857	20.9978	20.9956	20.9387	20.5784	20.0858	19.7077
Th 2	20.0494	20.0517	20.0540	20.0645	20.0665	20.0757	20.0757	20.0774	20.0721	20.0665	20.0625	20.0583
util rest of house	0.9965	0.9901	0.9684	0.8804	0.6994	0.4762	0.3192	0.3704	0.6585	0.9388	0.9912	0.9974
MIT 2	18.8975	19.1110	19.4249	19.8076	20.0070	20.0696	20.0751	20.0762	20.0408	19.7376	19.2549	18.8748
Living area fraction	19.0511	19.2645	19.5791	19.9646	20.1711	20.2371	20.2439	20.2443	20.2050	19.8913	19.4069	19.0271
Temperature adjustment												0.0000
adjusted MIT	19.0511	19.2645	19.5791	19.9646	20.1711	20.2371	20.2439	20.2443	20.2050	19.8913	19.4069	19.0271

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Utilisation	0.9952	0.9874	0.9636	0.8771	0.7060	0.4895	0.3346	0.3869	0.6704	0.9345	0.9888	0.9964 (94)
Useful gains	623.6360	746.3921	853.8891	925.6409	821.8977	571.8744	373.1882	392.2077	597.6570	682.3954	621.0177	591.6452 (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	1560.8645	1515.9196	1376.6658	1150.3170	878.6418	578.3382	373.8419	393.6070	628.9933	963.7110	1282.5136	1552.7357 (97)
Space heating kWh	697.2980	517.1224	388.9459	161.7668	42.2176	0.0000	0.0000	0.0000	0.0000	209.2988	476.2771	715.0513 (98a)
Space heating requirement - total per year (kWh/year)												3207.9779
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	697.2980	517.1224	388.9459	161.7668	42.2176	0.0000	0.0000	0.0000	0.0000	209.2988	476.2771	715.0513 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3207.9779
Space heating per m2												31.5560 (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	964.3957	759.2051	778.1388	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9364	0.9699	0.9516	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	903.0134	736.3415	740.5054	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1277.1036	1219.7799	1108.4205	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	269.3449	359.6782	273.7288	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	67.3362	89.9195	68.4322	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												225.6880 (107)
Energy for space heating												31.5560 (99)
Energy for space cooling												2.2200 (108)
Total												33.7760 (109)
Fabric Energy Efficiency (DFEE)												33.8 (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	37.6200 (1b)	x 2.6000 (2b)	= 97.8120 (1b) - (3b)
First floor	37.6200 (1c)	x 2.8000 (2c)	= 105.3360 (1c) - (3c)
Second floor	26.4200 (1d)	x 2.1700 (2d)	= 57.3314 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	260.4794 (5)

2. Ventilation rate

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1536 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.4036	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3430 (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	0.4374	0.4288	0.4202	0.3773	0.3688	0.3259	0.3259	0.3173	0.3430	0.3688	0.3859	0.4031 (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	0.5956	0.5919	0.5883	0.5712	0.5680	0.5531	0.5531	0.5503	0.5588	0.5680	0.5745	0.5812 (25)

3. Heat losses and heat loss parameter

Full SAP Calculation Printout



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 Semi-glazed door			1.7800	1.0000	1.7800		(26a)
TER Opening Type (Uw = 1.20)			15.0400	1.1450	17.2214		(27)
E			2.0900	2.0221	4.2261		(27a)
Ground floor			37.6200	0.1300	4.8906		(28a)
External wall	69.2900	15.4100	53.8800	0.1800	9.6984		(29a)
Dormer wall	8.7200	1.4100	7.3100	0.1800	1.3158		(29a)
Secondary wall	10.2300		10.2300	0.1800	1.8414		(29a)
Sloped roof	28.6700	2.0900	26.5800	0.1100	2.9238		(30)
Dormer sloped roof	1.8400		1.8400	0.1100	0.2024		(30)
Secondary plane roof	11.2000		11.2000	0.1100	1.2320		(30)
Total net area of external elements Aum(A, m2)			167.5700				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	45.3319	(33)
Party wall			118.6300	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 241.7161 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	10.3100	0.0500	0.5155
E3 Sill	6.6500	0.0500	0.3325
E4 Jamb	24.9800	0.0500	1.2490
E5 Ground floor (normal)	10.2600	0.1600	1.6416
E6 Intermediate floor within a dwelling	22.7600	0.0000	0.0000
E11 Eaves (insulation at rafter level)	8.5800	0.0400	0.3432
E13 Gable (insulation at rafter level)	4.5300	0.0800	0.3624
E16 Corner (normal)	17.9000	0.0900	1.6110
E17 Corner (inverted - internal area greater than external area)	4.4000	-0.0900	-0.3960
P1 Party wall - Ground floor	17.3400	0.0800	1.3872
P2 Party wall - Intermediate floor within a dwelling	17.3400	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	11.5200	0.1200	1.3824
R1 Head of roof window	2.0400	0.0800	0.1632
R2 Sill of roof window	2.0400	0.0600	0.1224
R3 Jamb of roof window	3.6800	0.0800	0.2944

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.0088 (36)
 Point Thermal bridges 0.0000 (36a) =
 Total fabric heat loss (33) + (36) + (36a) = 54.3407 (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	51.2004	50.8811	50.5682	49.0984	48.8234	47.5433	47.5433	47.3062	48.0364	48.8234	49.3797	49.9613 (38)
Heat transfer coeff	105.5410	105.2218	104.9089	103.4391	103.1641	101.8840	101.8840	101.6469	102.3771	103.1641	103.7204	104.3020 (39)
Average = Sum(39)m / 12 =												103.4378
HLP	1.0382	1.0350	1.0320	1.0175	1.0148	1.0022	1.0022	0.9999	1.0071	1.0148	Nov 1.0203	Dec 1.0260 (40)
HLP (average)												1.0175
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7544 (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	30.3982	29.9467	29.3110	28.1388	27.2611	26.2878	25.7621	26.3934	27.0808	28.1222	29.3185	30.2954	(42b)
Hot water usage for other uses	42.8375	41.2798	39.7221	38.1643	36.6066	35.0489	35.0489	36.6066	38.1643	39.7221	41.2798	42.8375	(42c)
Average daily hot water use (litres/day)													67.1271 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	73.2357	71.2265	69.0330	66.3031	63.8677	61.3367	60.8110	63.0000	65.2451	67.8442	70.5983	73.1329 (44)	
Energy content (annual)	115.9874	101.4256	106.1012	90.7656	85.9781	75.4206	73.5456	78.0071	80.4537	92.0640	100.5802	114.5085 (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													
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)	
Total heat required for water heating calculated for each month													
WWHRs	98.5893	86.2118	90.1860	77.1508	73.0814	64.1075	62.5137	66.3061	68.3857	78.2544	85.4932	97.3322 (62)	
FV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)	
FGHRs	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)	
Output from w/h	98.5893	86.2118	90.1860	77.1508	73.0814	64.1075	62.5137	66.3061	68.3857	78.2544	85.4932	97.3322 (64)	
12Total per year (kWh/year)													
Electric shower(s)	56.3799	50.2349	54.8546	52.3471	53.3294	50.8711	52.5668	53.3294	52.3471	54.8546	53.8232	56.3799 (64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												641.3180 (64a)	
Heat gains from water heating, kWh/month	38.7423	34.1117	36.2602	32.3745	31.6027	28.7446	28.7701	29.9089	30.1832	33.2773	34.8291	38.4280 (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	137.7185	137.7185	137.7185	137.7185	137.7185	137.7185	137.7185	137.7185	137.7185	137.7185	137.7185	137.7185 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	134.3455	148.7396	134.3455	138.8236	134.3455	138.8236	134.3455	134.3455	138.8236	134.3455	138.8236	134.3455 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	258.9838	261.6712	254.8990	240.4816	222.2823	205.1775	193.7505	191.0630	197.8353	212.2526	230.4519	247.5567 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719 (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)	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748 (71)

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Water heating gains (Table 5)	52.0730	50.7614	48.7368	44.9646	42.4767	39.9231	38.6695	40.2001	41.9211	44.7275	48.3737	51.6506 (72)
Total internal gains	509.7178	525.4878	502.2968	488.5854	463.4201	448.2398	431.0810	429.9241	442.8956	455.6411	481.9649	497.8683 (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				
East	8.9300	19.6403	0.6300	0.7000	0.7700	53.6007 (76)						
West	6.1100	19.6403	0.6300	0.7000	0.7700	36.6742 (80)						
East	2.0900	26.6072	0.6300	0.7000	1.0000	22.0713 (82)						
Solar gains	112.3461	221.2185	367.9307	542.3155	669.7275	687.8499	653.9302	558.2967	429.7733	263.4429	140.3414	92.2228 (83)
Total gains	622.0639	746.7063	870.2274	1030.9009	1133.1475	1136.0897	1085.0112	988.2208	872.6688	719.0841	622.3063	590.0911 (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	64.6743	64.8705	65.0640	65.9885	66.1644	66.9958	66.9958	67.1520	66.6731	66.1644	65.8096	65.4426
alpha	5.3116	5.3247	5.3376	5.3992	5.4110	5.4664	5.4664	5.4768	5.4449	5.4110	5.3873	5.3628
util living area	0.9974	0.9928	0.9776	0.9130	0.7663	0.5619	0.4112	0.4690	0.7439	0.9590	0.9938	0.9981 (86)
MIT	19.7369	19.9457	20.2577	20.6553	20.8988	20.9847	20.9977	20.9954	20.9363	20.5742	20.0864	19.7104 (87)
Th 2	20.0516	20.0542	20.0568	20.0688	20.0710	20.0815	20.0815	20.0834	20.0775	20.0710	20.0665	20.0617 (88)
util rest of house	0.9966	0.9906	0.9705	0.8875	0.7116	0.4864	0.3264	0.3777	0.6675	0.9416	0.9915	0.9974 (89)
MIT 2	18.8987	19.1082	19.4171	19.8019	20.0074	20.0749	20.0809	20.0822	20.0447	19.7377	19.2587	18.8802 (90)
Living area fraction	19.0520	19.2613	19.5708	19.9580	20.1704	20.2413	20.2485	20.2492	20.2077	19.8907	19.4101	19.0320 (92)
Temperature adjustment	19.0520	19.2613	19.5708	19.9580	20.1704	20.2413	20.2485	20.2492	20.2077	19.8907	19.4101	19.0320 (93)
adjusted MIT	19.0520	19.2613	19.5708	19.9580	20.1704	20.2413	20.2485	20.2492	20.2077	19.8907	19.4101	19.0320 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9954	0.9880	0.9658	0.8841	0.7178	0.4998	0.3420	0.3944	0.6791	0.9373	0.9892	0.9965 (94)
Useful gains	619.1978	737.7511	840.4882	911.3826	813.4045	567.8226	371.0281	389.7739	592.6146	674.0075	615.5961	588.0090 (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	1556.9383	1511.1257	1371.2466	1143.8292	873.8406	574.7563	371.7287	391.2557	625.2912	958.4654	1276.8041	1547.0100 (97)
Space heating kWh	697.6790	519.7077	394.8842	167.3616	44.9645	0.0000	0.0000	0.0000	0.0000	211.6367	476.0698	713.4967 (98a)
Space heating requirement - total per year (kWh/year)												3225.8002
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	697.6790	519.7077	394.8842	167.3616	44.9645	0.0000	0.0000	0.0000	0.0000	211.6367	476.0698	713.4967 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3225.8002
Space heating per m2												(98c) / (4) = 31.7313 (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	957.7094	753.9415	772.5166	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9327	0.9680	0.9492	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	893.2089	729.8373	733.3074	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1244.9709	1189.3803	1083.0134	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	253.2687	341.9000	260.1813	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	63.3172	85.4750	65.0453	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												213.8375 (107)
Energy for space heating												31.7313 (99)
Energy for space cooling												2.1035 (108)
Total												33.8347 (109)
Fabric Energy Efficiency (TFEE)												33.8 (109)

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

1. Overall dwelling characteristics

Full SAP Calculation Printout



	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	37.6200 (1b)	x 2.6000 (2b)	= 97.8120 (1b) - (3b)
First floor	37.6200 (1c)	x 2.8000 (2c)	= 105.3360 (1c) - (3c)
Second floor	26.4200 (1d)	x 2.1700 (2d)	= 57.3314 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.6600		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 260.4794 (5)

2. Ventilation rate

		m ³ per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	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) = 0.1152 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.5000 (17)
Infiltration rate		0.3402 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2891 (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												
Effective ac	0.3687	0.3614	0.3542	0.3181	0.3108	0.2747	0.2747	0.2675	0.2891	0.3108	0.3253	0.3397 (22b)
	0.5680	0.5653	0.5627	0.5506	0.5483	0.5377	0.5377	0.5358	0.5418	0.5483	0.5529	0.5577 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			8.9600	1.1450	10.2595		(27)
Half glazed door			1.7800	1.0000	1.7800		(26a)
Bi-fold (Uw = 1.20)			6.0800	1.1450	6.9618		(27)
E			2.0900	1.2357	2.5827		(27a)
Ground floor			37.6200	0.1300	4.8906	110.0000	4138.2000 (28a)
External wall	69.2900	15.4100	53.8800	0.1600	8.6208	150.0000	8082.0000 (29a)
Dormer wall	8.7200	1.4100	7.3100	0.1800	1.3158	9.0000	65.7900 (29a)
Secondary wall	10.2300		10.2300	0.1800	1.8414	9.0000	92.0700 (29a)
Sloped roof	28.6700	2.0900	26.5800	0.1500	3.9870	9.0000	239.2200 (30)
Dormer sloped roof	1.8400		1.8400	0.1500	0.2760	9.0000	16.5600 (30)
Secondary plane roof	11.2000		11.2000	0.1500	1.6800	9.0000	100.8000 (30)
Total net area of external elements Aum(A, m ²)			167.5700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.1957		(33)
Party wall			118.6300	0.0000	0.0000	70.0000	8304.1000 (32)
Internal stud wall			200.5600			9.0000	1805.0400 (32c)
First floor			37.6200			18.0000	677.1600 (32d)
Second floor			26.4200			18.0000	475.5600 (32d)
Ground floor ceiling			37.6200			9.0000	338.5800 (32e)
First floor ceiling			26.4200			9.0000	237.7800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	24572.8600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							241.7161 (35)

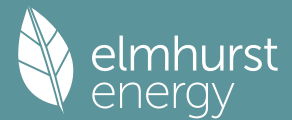
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	10.3100	0.0120	0.1237
E3 Sill	6.6500	0.0150	0.0998
E4 Jamb	24.9800	0.0260	0.6495
E5 Ground floor (normal)	10.2600	0.0720	0.7387
E6 Intermediate floor within a dwelling	22.7600	0.0200	0.4552
E11 Eaves (insulation at rafter level)	8.5800	0.0200	0.1716
E13 Gable (insulation at rafter level)	4.5300	0.0410	0.1857
E16 Corner (normal)	17.9000	0.0320	0.5728
E17 Corner (inverted - internal area greater than external area)	4.4000	-0.0530	-0.2332
P1 Party wall - Ground floor	17.3400	0.0720	1.2485
P2 Party wall - Intermediate floor within a dwelling	17.3400	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	11.5200	0.4800	5.5296
R1 Head of roof window	2.0400	0.2400	0.4896
R2 Sill of roof window	2.0400	0.2400	0.4896
R3 Jamb of roof window	3.6800	0.2400	0.8832
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			11.4043 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 55.6000 (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	48.8205	48.5936	48.3713	47.3270	47.1316	46.2221	46.2221	46.0536	46.5724	47.1316	47.5269	47.9401 (38)
Heat transfer coeff	104.4204	104.1936	103.9712	102.9269	102.7316	101.8220	101.8220	101.6536	102.1724	102.7316	103.1268	103.5400 (39)
Average = Sum(39)m / 12 =	102.9260											

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0272	1.0249	1.0227	1.0125	1.0105	1.0016	1.0016	0.9999	1.0050	1.0105	1.0144	1.0185 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7544 (42)
Hot water usage for mixer showers												105.1977 (42a)
Hot water usage for baths												30.2954 (42b)
Hot water usage for other uses												42.8375 (42c)
Average daily hot water use (litres/day)												164.4889 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	178.8380	175.2418	170.7358	163.5812	157.8804	151.7080	149.1125	153.5966	158.3575	164.8664	172.1402	178.3306 (44)
Distribution loss (46)m = 0.15 x (45)m	283.2357	249.5420	262.4145	223.9344	212.5374	186.5427	180.3386	190.1846	195.2706	223.7222	245.2453	279.2226 (45)
Water storage loss:												2732.1907
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0800 (55)
Total storage loss												33.4800 (56)
If cylinder contains dedicated solar storage												33.4800 (57)
Primary loss												23.2624 (59)
Combi loss												0.0000 (61)
Total heat required for water heating calculated for each month												339.9781 (62)
WWHRS												0.0000 (63a)
PV diverter												0.0000 (63b)
Solar input												0.0000 (63c)
FGHRS												0.0000 (63d)
Output from w/h												339.9781 (64)
Electric shower(s)												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												139.5698 (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	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.6301	28.9818	23.5696	17.8437	13.3384	11.2608	12.1677	15.8160	21.2283	26.9541	31.4595	33.5370 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	386.5430	390.5541	380.4462	358.9278	331.7646	306.2351	289.1798	285.1687	295.2765	316.7950	343.9581	369.4877 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806 (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)	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748 (71)
Water heating gains (Table 5)	187.5938	184.4846	178.2886	164.4275	155.9981	147.1598	141.6082	146.0085	151.1904	160.9967	174.2690	185.8003 (72)
Total internal gains	716.1349	713.3885	691.6724	650.5670	610.4691	574.0237	552.3237	556.3612	577.0632	614.1138	659.0546	698.1930 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East	2.8500	19.6403	0.6300	0.7000	0.7700	17.1066 (76)
West	6.1100	19.6403	0.6300	0.7000	0.7700	36.6742 (80)
East	6.0800	19.6403	0.6300	0.7000	0.7700	36.4941 (76)
East	2.0900	26.6072	0.7600	0.7000	1.0000	26.6256 (82)
Solar gains	116.9005	230.4262	383.8404	566.6973	700.6605	719.9826
Total gains	833.0354	943.8147	1075.5128	1217.2642	1311.1296	1294.0063
						684.3298
						583.7038
						448.6596
						274.5643
						888.6781
						146.0736
						805.1282
						95.9340 (83)
						794.1270 (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	65.3684	65.5107	65.6508	66.3169	66.4430	67.0365	67.0365	67.1476	66.8067	66.4430	66.1884	65.9242
alpha	5.3579	5.3674	5.3767	5.4211	5.4295	5.4691	5.4691	5.4765	5.4538	5.4295	5.4126	5.3949
util living area	0.9899	0.9795	0.9472	0.8538	0.6879	0.4977	0.3614	0.4083	0.6568	0.9108	0.9802	0.9920 (86)
Living	20.1781	20.3160	20.5357	20.7709	20.8983	20.9369	20.9424	20.9416	20.9170	20.7269	20.4059	20.1502
Non living	19.1081	19.2833	19.5558	19.8362	19.9669	20.0058	20.0090	20.0101	19.9899	19.7968	19.4056	19.0786
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	20.5795	20.3160	20.5357	20.7709	20.8983	20.9369	20.9424	20.9416	20.9170	20.7269	20.4059	20.2690 (87)
Th 2	20.0608	20.0626	20.0644	20.0730	20.0746	20.0820	20.0820	20.0834	20.0791	20.0746	20.0713	20.0680 (88)
util rest of house	0.9870	0.9737	0.9328	0.8193	0.6316	0.4289	0.2865	0.3279	0.5808	0.8802	0.9735	0.9897 (89)
MIT 2	19.6810	19.2833	19.5558	19.8362	19.9669	20.0058	20.0090	20.0101	19.9899	19.7968	19.4056	19.2568 (90)
Living area fraction												0.1829 (91)
MIT	19.8453	19.4721	19.7350	20.0072	20.1372	20.1761	20.1796	20.1805	20.1595	19.9669	19.5885	19.4419 (92)
Temperature adjustment												0.0000
adjusted MIT	19.8453	19.4721	19.7350	20.0072	20.1372	20.1761	20.1796	20.1805	20.1595	19.9669	19.5885	19.4419 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9862	0.9690	0.9267	0.8166	0.6356	0.4360	0.2945	0.3365	0.5877	0.8760	0.9690	0.9876	(94)
Useful gains	821.5003	914.5634	996.6988	994.0197	833.3818	564.2282	364.1640	383.6359	602.8482	778.4860	780.1608	784.3007	(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	1623.2451	1518.3221	1376.0619	1143.2265	866.7649	567.7662	364.4864	384.2968	619.1089	962.2717	1287.8969	1578.1510	(97)
Space heating kWh	596.4981	405.7258	282.2462	107.4289	24.8370	0.0000	0.0000	0.0000	0.0000	136.7366	365.5700	590.6246	(98a)
Space heating requirement - total per year (kWh/year)													2509.6673
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	596.4981	405.7258	282.2462	107.4289	24.8370	0.0000	0.0000	0.0000	0.0000	136.7366	365.5700	590.6246	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)													2509.6673
Space heating per m2													(98c) / (4) = 24.6869 (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 %)													323.7828 (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	596.4981	405.7258	282.2462	107.4289	24.8370	0.0000	0.0000	0.0000	0.0000	136.7366	365.5700	590.6246	(98)
Space heating efficiency (main heating system 1)	323.7828	323.7828	323.7828	323.7828	323.7828	0.0000	0.0000	0.0000	0.0000	323.7828	323.7828	323.7828	(210)
Space heating fuel (main heating system)	184.2279	125.3080	87.1715	33.1793	7.6709	0.0000	0.0000	0.0000	0.0000	42.2310	112.9059	182.4138	(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	339.9781	300.7932	319.1569	278.8464	269.2798	241.4547	237.0810	246.9270	250.1826	280.4646	300.1573	335.9650	(64)
Efficiency of water heater (217)m	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	(216)
Fuel for water heating, kWh/month	198.3520	175.4906	186.2045	162.6863	157.1048	140.8709	138.3192	144.0637	145.9631	163.6303	175.1196	196.0108	(219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	28.5610	22.9127	20.6303	15.1147	11.6750	9.5386	10.6503	13.8437	17.9816	23.5928	26.6480	29.3548	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
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													775.1083 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													171.4013
Water heating fuel used													1983.8157 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year													0.0000 (231)
Electricity for lighting (calculated in Appendix L)													230.5033 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													0.0000 (233)
Wind generation													0.0000 (234)
Hydro-electric generation (Appendix N)													0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)													0.0000 (235)
Appendix Q - special features													
Energy saved or generated													-0.0000 (236)
Energy used													0.0000 (237)
Total delivered energy for all uses													2989.4274 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	775.1083	16.4900	127.8154	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1983.8157	16.4900	327.1312	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	230.5033	16.4900	38.0100	(250)
Additional standing charges			0.0000	(251)

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Total energy cost 492.9566 (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] = 1.2100 (257)
 SAP value 80.3853
 SAP rating (Section 12) 80 (258)
 SAP band C

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	775.1083	0.1570	121.6985 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1983.8157	0.1410	279.7482 (264)
Space and water heating			401.4468 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	230.5033	0.1443	33.2688 (268)
Total CO2, kg/year			434.7155 (272)
CO2 emissions per m2			4.2800 (273)
EI value			96.0281
EI rating			96 (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	37.6200 (1b)	x 2.6000 (2b)	= 97.8120 (1b) - (3b)
First floor	37.6200 (1c)	x 2.8000 (2c)	= 105.3360 (1c) - (3c)
Second floor	26.4200 (1d)	x 2.1700 (2d)	= 57.3314 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.4794 (5)

2. Ventilation rate

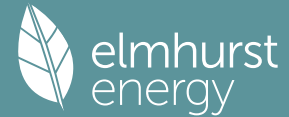
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number 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) = 0.1152 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.5000 (17)
Infiltration rate	0.3402 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2891 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.7000	3.5000	3.4000	3.2000	3.1000	2.8000	3.0000	2.7000	2.6000	2.8000	2.9000	3.2000 (22)
Wind factor	0.9250	0.8750	0.8500	0.8000	0.7750	0.7000	0.7500	0.6750	0.6500	0.7000	0.7250	0.8000 (22a)
Adj infilt rate	0.2675	0.2530	0.2458	0.2313	0.2241	0.2024	0.2169	0.1952	0.1879	0.2024	0.2096	0.2313 (22b)
Effective ac	0.5358	0.5320	0.5302	0.5268	0.5251	0.5205	0.5235	0.5190	0.5177	0.5205	0.5220	0.5268 (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)			8.9600	1.1450	10.2595		(27)
Half glazed door			1.7800	1.0000	1.7800		(26a)
Bi-fold (Uw = 1.20)			6.0800	1.1450	6.9618		(27)
E			2.0900	1.2357	2.5827		(27a)
Ground floor			37.6200	0.1300	4.8906	110.0000	4138.2000 (28a)
External wall	69.2900	15.4100	53.8800	0.1600	8.6208	150.0000	8082.0000 (29a)
Dormer wall	8.7200	1.4100	7.3100	0.1800	1.3158	9.0000	65.7900 (29a)
Secondary wall	10.2300		10.2300	0.1800	1.8414	9.0000	92.0700 (29a)
Sloped roof	28.6700	2.0900	26.5800	0.1500	3.9870	9.0000	239.2200 (30)

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Dormer sloped roof	1.8400	1.8400	0.1500	0.2760	9.0000	16.5600 (30)
Secondary plane roof	11.2000	11.2000	0.1500	1.6800	9.0000	100.8000 (30)
Total net area of external elements Aum(A, m2)		167.5700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =	44.1957		(33)
Party wall		118.6300	0.0000	0.0000	70.0000	8304.1000 (32)
Internal stud wall		200.5600			9.0000	1805.0400 (32c)
First floor		37.6200			18.0000	677.1600 (32d)
Second floor		26.4200			18.0000	475.5600 (32d)
Ground floor ceiling		37.6200			9.0000	338.5800 (32e)
First floor ceiling		26.4200			9.0000	237.7800 (32e)

Heat capacity Cm = Sum(A x k)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K (28) ... (30) + (32) + (32a) ... (32e) = 24572.8600 (34)
 List of Thermal Bridges 241.7161 (35)

	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	10.3100	0.0120	0.1237
E3 Sill	6.6500	0.0150	0.0998
E4 Jamb	24.9800	0.0260	0.6495
E5 Ground floor (normal)	10.2600	0.0720	0.7387
E6 Intermediate floor within a dwelling	22.7600	0.0200	0.4552
E11 Eaves (insulation at rafter level)	8.5800	0.0200	0.1716
E13 Gable (insulation at rafter level)	4.5300	0.0410	0.1857
E16 Corner (normal)	17.9000	0.0320	0.5728
E17 Corner (inverted - internal area greater than external area)	4.4000	-0.0530	-0.2332
P1 Party wall - Ground floor	17.3400	0.0720	1.2485
P2 Party wall - Intermediate floor within a dwelling	17.3400	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	11.5200	0.4800	5.5296
R1 Head of roof window	2.0400	0.2400	0.4896
R2 Sill of roof window	2.0400	0.2400	0.4896
R3 Jamb of roof window	3.6800	0.2400	0.8832

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 55.6000 (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	46.0536	45.7302	45.5753	45.2788	45.1373	44.7398	45.0003	44.6163	44.4973	44.7398	44.8678	45.2788 (38)
Average = Sum(39)m / 12 =	101.6536	101.3302	101.1752	100.8788	100.7373	100.3398	100.6003	100.2163	100.0972	100.3398	100.4678	100.8788 (39)
												100.7262

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9999	0.9968	0.9952	0.9923	0.9909	0.9870	0.9896	0.9858	0.9846	0.9870	0.9883	0.9923 (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												2.7544 (42)
Hot water usage for mixer showers												
Hot water usage for baths	105.6023	104.0153	101.7027	97.2781	94.0128	90.3713	88.3015	90.5966	93.1124	97.0222	101.5419	105.1977 (42a)
Hot water usage for other uses	30.3982	29.9467	29.3110	28.1388	27.2611	26.2878	25.7621	26.3934	27.0808	28.1222	29.3185	30.2954 (42b)
Average daily hot water use (litres/day)	42.8375	41.2798	39.7221	38.1643	36.6066	35.0489	35.0489	36.6066	38.1643	39.7221	41.2798	42.8375 (42c)
Daily hot water use												164.4889 (43)
Energy conte	178.8380	175.2418	170.7358	163.5812	157.8804	151.7080	149.1125	153.5966	158.3575	164.8664	172.1402	178.3306 (44)
Energy content (annual)	283.2357	249.5420	262.4145	223.9344	212.5374	186.5427	180.3386	190.1846	195.2706	223.7222	245.2453	279.2226 (45)
Distribution loss (46)m = 0.15 x (45)m	42.4853	37.4313	39.3622	33.5902	31.8806	27.9814	27.0508	28.5277	29.2906	33.5583	36.7868	41.8834 (46)
Water storage loss:												200.0000 (47)
Store volume												2.0000 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												1.0800 (55)
Enter (49) or (54) in (55)												
Total storage loss	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (56)
If cylinder contains dedicated solar storage	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (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	339.9781	300.7932	319.1569	278.8464	269.2798	241.4547	237.0810	246.9270	250.1826	280.4646	300.1573	335.9650 (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)
FV 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	339.9781	300.7932	319.1569	278.8464	269.2798	241.4547	237.0810	246.9270	250.1826	280.4646	300.1573	335.9650 (64)
Total per year (kWh/year) = Sum(64)m =												3400.2867 (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) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	139.5698	123.9737	132.6467	118.3878	116.0626	105.9550	105.3565	108.6303	108.8571	119.7815	125.4737	138.2354 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.6301	28.9818	23.5696	17.8437	13.3384	11.2608	12.1677	15.8160	21.2283	26.9541	31.4595	33.5370 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	386.5430	390.5541	380.4462	358.9278	331.7646	306.2351	289.1798	285.1687	295.2765	316.7950	343.9581	369.4877 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806 (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)	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748 (71)
Water heating gains (Table 5)												

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Total internal gains	187.5938	184.4846	178.2886	164.4275	155.9981	147.1598	141.6082	146.0085	151.1904	160.9967	174.2690	185.8003 (72)
	716.1349	713.3885	691.6724	650.5670	610.4691	574.0237	552.3237	556.3612	577.0632	614.1138	659.0546	698.1930 (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
East	2.8500	22.2970	0.6300	0.7000	0.7700	19.4206 (76)
West	6.1100	22.2970	0.6300	0.7000	0.7700	41.6351 (80)
East	6.0800	22.2970	0.6300	0.7000	0.7700	41.4307 (76)
East	2.0900	30.4656	0.7600	0.7000	1.0000	30.4866 (82)

Solar gains	132.9731	231.6205	387.4633	591.6727	713.9719	787.2728	744.7445	641.7582	494.2690	308.1290	170.2343	108.0564 (83)
Total gains	849.1080	945.0090	1079.1358	1242.2397	1324.4410	1361.2964	1297.0683	1198.1194	1071.3322	922.2428	829.2889	806.2494 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	67.1476	67.3619	67.4651	67.6633	67.7584	68.0268	67.8506	68.1107	68.1916	68.0268	67.9401	67.6633
alpha	5.4765	5.4908	5.4977	5.5109	5.5172	5.5351	5.5234	5.5407	5.5461	5.5351	5.5293	5.5109
util living area	0.9845	0.9716	0.9227	0.7859	0.5726	0.3458	0.2171	0.2425	0.5076	0.8379	0.9645	0.9872 (86)
Living	20.3169	20.4319	20.6510	20.8490	20.9293	20.9432	20.9438	20.9440	20.9384	20.8348	20.5536	20.3013
Non living	19.3024	19.4481	19.7143	19.9346	20.0094	20.0220	20.0200	20.0233	20.0218	19.9309	19.6073	19.2884
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	20.6505	20.4319	20.6510	20.8490	20.9293	20.9432	20.9438	20.9440	20.9384	20.8348	20.5536	20.3991 (87)
Th 2	20.0834	20.0860	20.0873	20.0897	20.0909	20.0942	20.0920	20.0952	20.0962	20.0942	20.0931	20.0897 (88)
util rest of house	0.9798	0.9634	0.9018	0.7410	0.5099	0.2795	0.1467	0.1669	0.4272	0.7885	0.9522	0.9833 (89)
MIT 2	19.7720	19.4481	19.7143	19.9346	20.0094	20.0220	20.0200	20.0233	20.0218	19.9309	19.6073	19.4328 (90)
Living area fraction	FLA = Living area / (4) =											
MIT	19.9327	19.6280	19.8856	20.1018	20.1776	20.1905	20.1889	20.1917	20.1894	20.0962	19.7803	19.6095 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.9327	19.6280	19.8856	20.1018	20.1776	20.1905	20.1889	20.1917	20.1894	20.0962	19.7803	19.6095 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9789	0.9582	0.8965	0.7416	0.5160	0.2866	0.1543	0.1749	0.4356	0.7886	0.9470	0.9806 (94)
Useful gains	831.2162	905.5317	967.4073	921.2701	683.4348	390.0922	200.0792	209.6105	466.6713	727.2644	785.3089	790.6158 (95)
Ext temp.	5.4000	5.9000	7.7000	10.2000	13.3000	16.3000	18.2000	18.1000	15.5000	12.0000	8.4000	5.5000 (96)
Heat loss rate W	1477.2989	1391.0582	1232.8800	998.8862	692.8293	390.3690	200.0848	209.6215	469.3971	812.3696	1143.3568	1423.3484 (97)
Space heating kWh	480.6855	326.2738	197.5117	55.8836	6.9895	0.0000	0.0000	0.0000	0.0000	63.3183	257.7945	470.7531 (98a)
Space heating requirement - total per year (kWh/year)	1859.2099											
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	480.6855	326.2738	197.5117	55.8836	6.9895	0.0000	0.0000	0.0000	0.0000	63.3183	257.7945	470.7531 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	1859.2099											
Space heating per m2	(98c) / (4) = 18.2885 (99)											

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

Fraction of space heat from secondary/supplementary system (Table 11)												
Fraction of space heat from main system(s)												
Efficiency of main space heating system 1 (in %)												
Efficiency of main space heating system 2 (in %)												
Efficiency of secondary/supplementary heating system, %												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	480.6855	326.2738	197.5117	55.8836	6.9895	0.0000	0.0000	0.0000	0.0000	63.3183	257.7945	470.7531 (98)
Space heating efficiency (main heating system 1)	323.6049	323.6049	323.6049	323.6049	323.6049	0.0000	0.0000	0.0000	0.0000	323.6049	323.6049	323.6049 (210)
Space heating fuel (main heating system)	148.5409	100.8247	61.0348	17.2691	2.1599	0.0000	0.0000	0.0000	0.0000	19.5665	79.6634	145.4716 (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	339.9781	300.7932	319.1569	278.8464	269.2798	241.4547	237.0810	246.9270	250.1826	280.4646	300.1573	335.9650 (64)
Efficiency of water heater (217)m	171.3249	171.3249	171.3249	171.3249	171.3249	171.3249	171.3249	171.3249	171.3249	171.3249	171.3249	171.3249 (216)
Fuel for water heating, kWh/month	198.4405	175.5688	186.2875	162.7588	157.1749	140.9338	138.3809	144.1279	146.0281	163.7033	175.1977	196.0982 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	28.5610	22.9127	20.6303	15.1147	11.6750	9.5386	10.6503	13.8437	17.9816	23.5928	26.6480	29.3548 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)

Electricity generated by wind turbines (Appendix M) (negative quantity)															
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)															
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)															
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	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	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)															
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)															
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year															
Space heating fuel - main system 1															574.5309 (211)
Space heating fuel - main system 2															0.0000 (213)
Space heating fuel - secondary															0.0000 (215)
Efficiency of water heater															171.3249
Water heating fuel used															1984.7005 (219)
Space cooling fuel															0.0000 (221)
Electricity for pumps and fans:															
Total electricity for the above, kWh/year															0.0000 (231)
Electricity for lighting (calculated in Appendix L)															230.5033 (232)
Energy saving/generation technologies (Appendices M ,N and Q)															
PV generation															0.0000 (233)
Wind generation															0.0000 (234)
Hydro-electric generation (Appendix N)															0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)															0.0000 (235)
Appendix Q - special features															
Energy saved or generated															-0.0000 (236)
Energy used															0.0000 (237)
Total delivered energy for all uses															2789.7347 (238)

10a. Fuel costs - using BEDF prices (531)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	574.5309	21.5100	123.5816	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1984.7005	21.5100	426.9091	(247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	230.5033	21.5100	49.5813	(250)
Additional standing charges			0.0000	(251)
Total energy cost			600.0719	(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	574.5309	0.1581	90.8391	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1984.7005	0.1410	279.8730	(264)
Space and water heating			370.7121	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	230.5033	0.1443	33.2688	(268)
Total CO2, kg/year			403.9809	(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	574.5309	1.5853	910.7923	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1984.7005	1.5214	3019.5811	(278)
Space and water heating			3930.3734	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	230.5033	1.5338	353.5537	(282)
Total Primary energy kWh/year			4283.9271	(286)

SAP 10 EPC IMPROVEMENTS

304434 - House 2

Current energy efficiency rating: C 80

Current environmental impact rating: A 96

N Solar water heating Recommended

U Solar photovoltaic panels Recommended

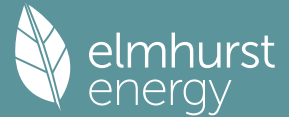
V2 Wind turbine Not applicable

Recommended measures:

	SAP change	Cost change	CO2 change
N Solar water heating	+ 2.2	-£ 82	-47 kg (11.7%)
U Solar photovoltaic panels	+ 5.9	-£ 198	-123 kg (34.6%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£82	0.46 kg/m ²	B 83 A 96
Solar photovoltaic panels	£198	1.21 kg/m ²	B 88 A 98
Total Savings	£280	1.68 kg/m²	

Full SAP Calculation Printout



Potential energy efficiency rating: B 88
 Potential environmental impact rating: A 98

Fuel prices for cost data on this page from database revision number 531 TEST (31 Oct 2023)
 Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current £600	Potential £518	Saving £82
Electricity			
Space heating	£124	£141	-£17
Water heating	£427	£328	£99
Lighting	£50	£50	£0
Generated (PV)	-£0	-£198	£198
Total cost of fuels	£600	£320	£280
Total cost of uses	£601	£321	£280
Delivered energy	27 kWh/m ²	15 kWh/m ²	13 kWh/m ²
Carbon dioxide emissions	0.4 tonnes	0.2 tonnes	0.2 tonnes
CO2 emissions per m ²	4 kg/m ²	2 kg/m ²	2 kg/m ²
Primary energy	42 kWh/m ²	23 kWh/m ²	19 kWh/m ²

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 ²)	Storey height (m)	Volume (m ³)
Ground floor	37.6200 (1b)	x 2.6000 (2b)	= 97.8120 (1b) - (3b)
First floor	37.6200 (1c)	x 2.8000 (2c)	= 105.3360 (1c) - (3c)
Second floor	26.4200 (1d)	x 2.1700 (2d)	= 57.3314 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	260.4794 (5)

2. Ventilation rate

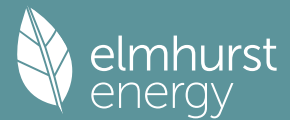
		m ³ per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	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) =	0.1152 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50		4.5000 (17)
Infiltration rate		0.3402 (18)
Number of sides sheltered		2 (19)
Shelter factor (20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) =		0.2891 (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 infiltr rate	0.3687	0.3614	0.3542	0.3181	0.3108	0.2747	0.2747	0.2675	0.2891	0.3108	0.3253	0.3397 (22b)
Effective ac	0.5680	0.5653	0.5627	0.5506	0.5483	0.5377	0.5377	0.5358	0.5418	0.5483	0.5529	0.5577 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			8.9600	1.1450	10.2595		(27)
Half glazed door			1.7800	1.0000	1.7800		(26a)
Bi-fold (Uw = 1.20)			6.0800	1.1450	6.9618		(27)
E			2.0900	1.2357	2.5827		(27a)
Ground floor			37.6200	0.1300	4.8906	110.0000	4138.2000 (28a)
External wall	69.2900	15.4100	53.8800	0.1600	8.6208	150.0000	8082.0000 (29a)
Dormer wall	8.7200	1.4100	7.3100	0.1800	1.3158	9.0000	65.7900 (29a)
Secondary wall	10.2300		10.2300	0.1800	1.8414	9.0000	92.0700 (29a)
Sloped roof	28.6700	2.0900	26.5800	0.1500	3.9870	9.0000	239.2200 (30)
Dormer sloped roof	1.8400		1.8400	0.1500	0.2760	9.0000	16.5600 (30)
Secondary plane roof	11.2000		11.2000	0.1500	1.6800	9.0000	100.8000 (30)
Total net area of external elements Aum (A, m ²)			167.5700				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	44.1957	(33)
Party wall			118.6300	0.0000	0.0000	70.0000	8304.1000 (32)
Internal stud wall			200.5600			9.0000	1805.0400 (32c)
First floor			37.6200			18.0000	677.1600 (32d)
Second floor			26.4200			18.0000	475.5600 (32d)
Ground floor ceiling			37.6200			9.0000	338.5800 (32e)

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First floor ceiling 26.4200 9.0000 237.7800 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 24572.8600 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 241.7161 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	10.3100	0.0120	0.1237
E3 Sill	6.6500	0.0150	0.0998
E4 Jamb	24.9800	0.0260	0.6495
E5 Ground floor (normal)	10.2600	0.0720	0.7387
E6 Intermediate floor within a dwelling	22.7600	0.0200	0.4552
E11 Eaves (insulation at rafter level)	8.5800	0.0200	0.1716
E13 Gable (insulation at rafter level)	4.5300	0.0410	0.1857
E16 Corner (normal)	17.9000	0.0320	0.5728
E17 Corner (inverted - internal area greater than external area)	4.4000	-0.0530	-0.2332
P1 Party wall - Ground floor	17.3400	0.0720	1.2485
P2 Party wall - Intermediate floor within a dwelling	17.3400	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	11.5200	0.4800	5.5296
R1 Head of roof window	2.0400	0.2400	0.4896
R2 Sill of roof window	2.0400	0.2400	0.4896
R3 Jamb of roof window	3.6800	0.2400	0.8832

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.4043 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 55.6000 (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
 48.8205 48.5936 48.3713 47.3270 47.1316 46.2221 46.2221 46.0536 46.5724 47.1316 47.5269 47.9401 (38)
 Heat transfer coeff 104.4204 104.1936 103.9712 102.9269 102.7316 101.8220 101.8220 101.6536 102.1724 102.7316 103.1268 103.5400 (39)
 Average = Sum(39)m / 12 = 102.9260

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0272	1.0249	1.0227	1.0125	1.0105	1.0016	1.0016	0.9999	1.0050	1.0105	1.0144	1.0185 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

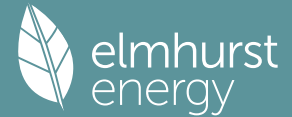
4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.7544 (42)
Hot water usage for mixer showers												
105.6023 104.0153	101.7027	97.2781	94.0128	90.3713	88.3015	90.5966	93.1124	97.0222	101.5419	105.1977 (42a)		
Hot water usage for baths												
30.3982 29.9467	29.3110	28.1388	27.2611	26.2878	25.7621	26.3934	27.0808	28.1222	29.3185	30.2954 (42b)		
Hot water usage for other uses												
42.8375 41.2798	39.7221	38.1643	36.6066	35.0489	35.0489	36.6066	38.1643	39.7221	41.2798	42.8375 (42c)		
Average daily hot water use (litres/day)												164.4889 (43)
Daily hot water use	178.8380	175.2418	170.7358	163.5812	157.8804	151.7080	149.1125	153.5966	158.3575	164.8664	172.1402	178.3306 (44)
Energy conte	283.2357	249.5420	262.4145	223.9344	212.5374	186.5427	180.3386	190.1846	195.2706	223.7222	245.2453	279.2226 (45)
Energy content (annual)												Total = Sum(45)m = 2732.1907
Distribution loss (46)m = 0.15 x (45)m	42.4853	37.4313	39.3622	33.5902	31.8806	27.9814	27.0508	28.5277	29.2906	33.5583	36.7868	41.8834 (46)
Water storage loss:												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0800 (55)
Total storage loss	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (56)
If cylinder contains dedicated solar storage	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	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	339.9781	300.7932	317.7612	272.0928	256.4855	228.8479	224.0541	234.8306	244.7797	279.0688	300.1573	335.9650 (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)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												651.5644 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												651.5644
Solar input	-0.0000	-16.1665	-59.8272	-83.5177	-110.9010	-102.5255	-101.9136	-88.1180	-59.7030	-28.8920	-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	339.9781	284.6267	257.9340	188.5752	145.5845	126.3224	122.1405	146.7126	185.0767	250.1769	300.1573	335.9650 (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	139.5698	123.9737	131.5302	112.9849	105.8271	95.8697	94.9350	98.9532	104.5348	118.6650	125.4737	138.2354 (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	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.6301	28.9818	23.5696	17.8437	13.3384	11.2608	12.1677	15.8160	21.2283	26.9541	31.4595	33.5370 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												

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Cooking gains	386.5430	390.5541	380.4462	358.9278	331.7646	306.2351	289.1798	285.1687	295.2765	316.7950	343.9581	369.4877	(68)
(calculated in Appendix L, equation L15 or L15a), also see Table 5													
Pumps, fans	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	(69)
Losses e.g. evaporation	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)
(negative values) (Table 5)													
Water heating gains	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	(71)
(Table 5)													
Total internal gains	187.5938	184.4846	176.7878	156.9235	142.2408	133.1523	127.6008	133.0016	145.1872	159.4959	174.2690	185.8003	(72)
(Table 5)													
Total internal gains	716.1349	713.3885	690.1716	643.0630	596.7118	560.0162	538.3162	543.3543	571.0600	612.6130	659.0546	698.1930	(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
East	2.8500	19.6403	0.6300	0.7000	0.7700	17.1066 (76)
West	6.1100	19.6403	0.6300	0.7000	0.7700	36.6742 (80)
East	6.0800	19.6403	0.6300	0.7000	0.7700	36.4941 (76)
East	2.0900	26.6072	0.7600	0.7000	1.0000	26.6256 (82)

Solar gains	116.9005	230.4262	383.8404	566.6973	700.6605	719.9826	684.3298	583.7038	448.6596	274.5643	146.0736	95.9340	(83)
Total gains	833.0354	943.8147	1074.0120	1209.7602	1297.3722	1279.9988	1222.6460	1127.0581	1019.7196	887.1773	805.1282	794.1270	(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	65.3684	65.5107	65.6508	66.3169	66.4430	67.0365	67.0365	67.1476	66.8067	66.4430	66.1884	65.9242
alpha	5.3579	5.3674	5.3767	5.4211	5.4295	5.4691	5.4691	5.4765	5.4538	5.4295	5.4126	5.3949
util living area	0.9899	0.9795	0.9475	0.8563	0.6936	0.5028	0.3655	0.4129	0.6599	0.9113	0.9802	0.9920 (86)
Living	20.1781	20.3160	20.5347	20.7681	20.8965	20.9366	20.9423	20.9415	20.9164	20.7262	20.4059	20.1502
Non living	19.1081	19.2833	19.5547	19.8333	19.9654	20.0056	20.0089	20.0101	19.9895	19.7959	19.4056	19.0786
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	20.5795	20.3160	20.5347	20.7681	20.8965	20.9366	20.9423	20.9415	20.9164	20.7262	20.4059	20.2690 (87)
Th 2	20.0608	20.0626	20.0644	20.0730	20.0746	20.0820	20.0820	20.0834	20.0791	20.0746	20.0713	20.0680 (88)
util rest of house	0.9870	0.9737	0.9331	0.8221	0.6373	0.4334	0.2897	0.3317	0.5838	0.8808	0.9735	0.9897 (89)
MIT 2	19.6810	19.2833	19.5547	19.8333	19.9654	20.0056	20.0089	20.0101	19.9895	19.7959	19.4056	19.2568 (90)
Living area fraction										FLA = Living area / (4) =		0.1829 (91)
MIT	19.8453	19.4721	19.7339	20.0042	20.1357	20.1759	20.1796	20.1804	20.1590	19.9660	19.5885	19.4419 (92)
Temperature adjustment												0.0000
adjusted MIT	19.8453	19.4721	19.7339	20.0042	20.1357	20.1759	20.1796	20.1804	20.1590	19.9660	19.5885	19.4419 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9862	0.9690	0.9271	0.8193	0.6412	0.4406	0.2978	0.3403	0.5908	0.8766	0.9690	0.9876 (94)	
Useful gains	821.5003	914.5634	995.6665	991.1656	831.8361	564.0217	364.1425	383.5924	602.4051	777.6960	780.1608	784.3007 (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	1623.2451	1518.3221	1375.9495	1142.9259	866.6081	567.7451	364.4840	384.2920	619.0637	962.1872	1287.8969	1578.1510 (97)	
Space heating kWh	596.4981	405.7258	282.9306	109.2675	25.8704	0.0000	0.0000	0.0000	0.0000	137.2615	365.5700	590.6246 (98a)	
Space heating requirement - total per year (kWh/year)												2513.7485	
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	596.4981	405.7258	282.9306	109.2675	25.8704	0.0000	0.0000	0.0000	0.0000	137.2615	365.5700	590.6246 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												2513.7485	
Space heating per m2												(98c) / (4) =	24.7270 (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 %)	323.7828 (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	596.4981	405.7258	282.9306	109.2675	25.8704	0.0000	0.0000	0.0000	0.0000	137.2615	365.5700	590.6246 (98)
Space heating efficiency (main heating system 1)	323.7828	323.7828	323.7828	323.7828	323.7828	0.0000	0.0000	0.0000	0.0000	323.7828	323.7828	323.7828 (210)
Space heating fuel (main heating system)	184.2279	125.3080	87.3828	33.7471	7.9900	0.0000	0.0000	0.0000	0.0000	42.3931	112.9059	182.4138 (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	339.9781	284.6267	257.9340	188.5752	145.5845	126.3224	122.1405	146.7126	185.0767	250.1769	300.1573	335.9650 (64)
Efficiency of water heater	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013 (216)
(217)m	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013 (217)
Fuel for water heating, kWh/month												

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	198.3520	166.0586	150.4854	110.0197	84.9378	73.6998	71.2599	85.5960	107.9786	145.9597	175.1196	196.0108	(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	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	28.5610	22.9127	20.6303	15.1147	11.6750	9.5386	10.6503	13.8437	17.9816	23.5928	26.6480	29.3548	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-38.5272	-57.4233	-85.7281	-97.7215	-105.0005	-98.0448	-96.5483	-90.9639	-80.1970	-66.0862	-43.1936	-32.8942	(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												776.3688	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												171.4013	
Water heating fuel used												1565.4778	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												230.5033	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-892.3287	(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												1760.0212	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	776.3688	16.4900	128.0232	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1565.4778	16.4900	258.1473	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	230.5033	16.4900	38.0100	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-892.3287	16.4900	-147.1450	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-147.1450	(252)
Total energy cost			290.2275	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.7124	(257)
SAP value		88.4519	
SAP rating (Section 12)		88	(258)
SAP band		B	

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	776.3688	0.1570	121.8762	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1565.4778	0.1448	226.6269	(264)
Space and water heating			348.5032	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	230.5033	0.1443	33.2688	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-892.3287	0.1342	-119.7443	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-119.7443	(269)
Total CO2, kg/year			273.1246	(272)
CO2 emissions per m2			2.6900	(273)
EI value			97.5045	
EI rating			98	(274)
EI band			A	

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1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	37.6200 (1b)	x 2.6000 (2b)	= 97.8120 (1b) - (3b)
First floor	37.6200 (1c)	x 2.8000 (2c)	= 105.3360 (1c) - (3c)
Second floor	26.4200 (1d)	x 2.1700 (2d)	= 57.3314 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.4794 (5)

2. Ventilation rate

		m ³ per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	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) = 0.1152 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50		4.5000 (17)
Infiltration rate		0.3402 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2891 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.7000	3.5000	3.4000	3.2000	3.1000	2.8000	3.0000	2.7000	2.6000	2.8000	2.9000	3.2000 (22)
Wind factor	0.9250	0.8750	0.8500	0.8000	0.7750	0.7000	0.7500	0.6750	0.6500	0.7000	0.7250	0.8000 (22a)
Adj infiltr rate												
Effective ac	0.2675	0.2530	0.2458	0.2313	0.2241	0.2024	0.2169	0.1952	0.1879	0.2024	0.2096	0.2313 (22b)
	0.5358	0.5320	0.5302	0.5268	0.5251	0.5205	0.5235	0.5190	0.5177	0.5205	0.5220	0.5268 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			8.9600	1.1450	10.2595		(27)
Half glazed door			1.7800	1.0000	1.7800		(26a)
Bi-fold (Uw = 1.20)			6.0800	1.1450	6.9618		(27)
E			2.0900	1.2357	2.5827		(27a)
Ground floor			37.6200	0.1300	4.8906	110.0000	4138.2000 (28a)
External wall	69.2900	15.4100	53.8800	0.1600	8.6208	150.0000	8082.0000 (29a)
Dormer wall	8.7200	1.4100	7.3100	0.1800	1.3158	9.0000	65.7900 (29a)
Secondary wall	10.2300		10.2300	0.1800	1.8414	9.0000	92.0700 (29a)
Sloped roof	28.6700	2.0900	26.5800	0.1500	3.9870	9.0000	239.2200 (30)
Dormer sloped roof	1.8400		1.8400	0.1500	0.2760	9.0000	16.5600 (30)
Secondary plane roof	11.2000		11.2000	0.1500	1.6800	9.0000	100.8000 (30)
Total net area of external elements Aum(A, m ²)			167.5700				(31)
Fabric heat loss, W/K = Sum (A x k)					(26)...(30) + (32) =	44.1957	(33)
Party wall			118.6300	0.0000	0.0000	70.0000	8304.1000 (32)
Internal stud wall			200.5600			9.0000	1805.0400 (32c)
First floor			37.6200			18.0000	677.1600 (32d)
Second floor			26.4200			18.0000	475.5600 (32d)
Ground floor ceiling			37.6200			9.0000	338.5800 (32e)
First floor ceiling			26.4200			9.0000	237.7800 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =	24572.8600 (34)	
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							241.7161 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	10.3100	0.0120	0.1237
E3 Sill	6.6500	0.0150	0.0998
E4 Jamb	24.9800	0.0260	0.6495
E5 Ground floor (normal)	10.2600	0.0720	0.7387
E6 Intermediate floor within a dwelling	22.7600	0.0200	0.4552
E11 Eaves (insulation at rafter level)	8.5800	0.0200	0.1716
E13 Gable (insulation at rafter level)	4.5300	0.0410	0.1857
E16 Corner (normal)	17.9000	0.0320	0.5728
E17 Corner (inverted - internal area greater than external area)	4.4000	-0.0530	-0.2332
P1 Party wall - Ground floor	17.3400	0.0720	1.2485
P2 Party wall - Intermediate floor within a dwelling	17.3400	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	11.5200	0.4800	5.5296
R1 Head of roof window	2.0400	0.2400	0.4896
R2 Sill of roof window	2.0400	0.2400	0.4896
R3 Jamb of roof window	3.6800	0.2400	0.8832

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

Point Thermal bridges	(36a) =	11.4043 (36)
Total fabric heat loss	(33) + (36) + (36a) =	55.6000 (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
	46.0536	45.7302	45.5753	45.2788	45.1373	44.7398	45.0003	44.6163	44.4973	44.7398	44.8678	45.2788 (38)
Heat transfer coeff	101.6536	101.3302	101.1752	100.8788	100.7373	100.3398	100.6003	100.2163	100.0972	100.3398	100.4678	100.8788 (39)
Average = Sum(39)m / 12 =												100.7262

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9999	0.9968	0.9952	0.9923	0.9909	0.9870	0.9896	0.9858	0.9846	0.9870	0.9883	0.9923 (40)

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HLP (average)	31	28	31	30	31	30	31	31	30	31	30	0.9908
Days in mont												31

4. Water heating energy requirements (kWh/year)												

Assumed occupancy												2.7544 (42)
Hot water usage for mixer showers												105.1977 (42a)
Hot water usage for baths												30.2954 (42b)
Hot water usage for other uses												42.8375 (42c)
Average daily hot water use (litres/day)												164.4889 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	178.8380	175.2418	170.7358	163.5812	157.8804	151.7080	149.1125	153.5966	158.3575	164.8664	172.1402	178.3306 (44)
Energy content (annual)	283.2357	249.5420	262.4145	223.9344	212.5374	186.5427	180.3386	190.1846	195.2706	223.7222	245.2453	279.2226 (45)
Distribution loss (46)m = 0.15 x (45)m	42.4853	37.4313	39.3622	33.5902	31.8806	27.9814	27.0508	28.5277	29.2906	33.5583	36.7868	41.8834 (46)
Water storage loss:												200.0000 (47)
Store volume												2.0000 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												1.0800 (55)
Enter (49) or (54) in (55)												
Total storage loss	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (56)
If cylinder contains dedicated solar storage	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	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	339.9781	300.7932	317.7612	272.0928	256.4855	228.8479	224.0541	234.8306	244.7797	279.0688	300.1573	335.9650 (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)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												724.4475 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												724.4475
Solar input	-0.0000	-16.7813	-61.0863	-89.1631	-114.6825	-115.2667	-113.8725	-100.6600	-69.9976	-38.6371	-4.3004	-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	339.9781	284.0119	256.6749	182.9298	141.8030	113.5812	110.1816	134.1706	174.7821	240.4317	295.8569	335.9650 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	139.5698	123.9737	131.5302	112.9849	105.8271	95.8697	94.9350	98.9532	104.5348	118.6650	125.4737	138.2354 (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	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.6301	28.9818	23.5696	17.8437	13.3384	11.2608	12.1677	15.8160	21.2283	26.9541	31.4595	33.5370 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	386.5430	390.5541	380.4462	358.9278	331.7646	306.2351	289.1798	285.1687	295.2765	316.7950	343.9581	369.4877 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806 (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)	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748 (71)
Water heating gains (Table 5)	187.5938	184.4846	176.7878	156.9235	142.2408	133.1523	127.6008	133.0016	145.1872	159.4959	174.2690	185.8003 (72)
Total internal gains	716.1349	713.3885	690.1716	643.0630	596.7118	560.0162	538.3162	543.3543	571.0600	612.6130	659.0546	698.1930 (73)

6. Solar gains												
[Jan]												
			Area	Solar flux	g	FF	Access	Gains				
			m2	Table 6a	Specific data	Specific data	factor	W				
				W/m2	or Table 6b	or Table 6c	Table 6d					
East			2.8500	22.2970	0.6300	0.7000	0.7700	19.4206 (76)				
West			6.1100	22.2970	0.6300	0.7000	0.7700	41.6351 (80)				
East			6.0800	22.2970	0.6300	0.7000	0.7700	41.4307 (76)				
East			2.0900	30.4656	0.7600	0.7000	1.0000	30.4866 (82)				
Solar gains	132.9731	231.6205	387.4633	591.6727	713.9719	787.2728	744.7445	641.7582	494.2690	308.1290	170.2343	108.0564 (83)
Total gains	849.1080	945.0090	1077.6350	1234.7357	1310.6837	1347.2890	1283.0608	1185.1125	1065.3290	920.7420	829.2889	806.2494 (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	67.1476	67.3619	67.4651	67.6633	67.7584	68.0268	67.8506	68.1107	68.1916	68.0268	67.9401	67.6633	
alpha	5.4765	5.4908	5.4977	5.5109	5.5172	5.5351	5.5234	5.5407	5.5461	5.5351	5.5293	5.5109	
util living area	0.9845	0.9716	0.9231	0.7889	0.5780	0.3494	0.2195	0.2452	0.5103	0.8386	0.9645	0.9872	(86)
Living	20.3169	20.4319	20.6501	20.8472	20.9286	20.9432	20.9438	20.9439	20.9383	20.8343	20.5536	20.3013	
Non living	19.3024	19.4481	19.7134	19.9329	20.0089	20.0220	20.0200	20.0233	20.0217	19.9304	19.6073	19.2884	
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	20.6505	20.4319	20.6501	20.8472	20.9286	20.9432	20.9438	20.9439	20.9383	20.8343	20.5536	20.3991	(87)
Th 2	20.0834	20.0860	20.0873	20.0897	20.0909	20.0942	20.0920	20.0952	20.0962	20.0942	20.0931	20.0897	(88)
util rest of house	0.9798	0.9634	0.9023	0.7442	0.5149	0.2824	0.1483	0.1687	0.4295	0.7893	0.9522	0.9833	(89)
MIT 2	19.7720	19.4481	19.7134	19.9329	20.0089	20.0220	20.0200	20.0233	20.0217	19.9304	19.6073	19.4328	(90)
Living area fraction													
MIT	19.9327	19.6280	19.8847	20.1001	20.1771	20.1905	20.1889	20.1917	20.1893	20.0957	19.7803	19.6095	(91)
Temperature adjustment												0.0000	(92)
adjusted MIT	19.9327	19.6280	19.8847	20.1001	20.1771	20.1905	20.1889	20.1917	20.1893	20.0957	19.7803	19.6095	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9789	0.9582	0.8969	0.7447	0.5211	0.2895	0.1559	0.1769	0.4380	0.7894	0.9470	0.9806	(94)
Useful gains	831.2162	905.5317	966.5313	919.5034	682.9361	390.0753	200.0788	209.6097	466.5886	726.7925	785.3089	790.6158	(95)
Ext temp.	5.4000	5.9000	7.7000	10.2000	13.3000	16.3000	18.2000	18.1000	15.5000	12.0000	8.4000	5.5000	(96)
Heat loss rate W	1477.2989	1391.0582	1232.7872	998.7066	692.7795	390.3672	200.0847	209.6214	469.3885	812.3211	1143.3568	1423.3484	(97)
Space heating kWh	480.6855	326.2738	198.0943	57.0263	7.3235	0.0000	0.0000	0.0000	0.0000	63.6333	257.7945	470.7531	(98a)
Space heating requirement - total per year (kWh/year)												1861.5844	
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	480.6855	326.2738	198.0943	57.0263	7.3235	0.0000	0.0000	0.0000	0.0000	63.6333	257.7945	470.7531	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1861.5844	
Space heating per m ²												18.3119	(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 %) 323.6049 (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	480.6855	326.2738	198.0943	57.0263	7.3235	0.0000	0.0000	0.0000	0.0000	63.6333	257.7945	470.7531	(98)
Space heating efficiency (main heating system 1)	323.6049	323.6049	323.6049	323.6049	323.6049	0.0000	0.0000	0.0000	0.0000	323.6049	323.6049	323.6049	(210)
Space heating fuel (main heating system)	148.5409	100.8247	61.2149	17.6222	2.2631	0.0000	0.0000	0.0000	0.0000	19.6639	79.6634	145.4716	(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	339.9781	284.0119	256.6749	182.9298	141.8030	113.5812	110.1816	134.1706	174.7821	240.4317	295.8569	335.9650	(64)
Efficiency of water heater	171.3249	171.3249	171.3249	171.3249	171.3249	171.3249	171.3249	171.3249	171.3249	171.3249	171.3249	171.3249	(216)
Fuel for water heating, kWh/month	198.4405	165.7738	149.8176	106.7736	82.7685	66.2958	64.3115	78.3135	102.0179	140.3367	172.6876	196.0982	(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	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	28.5610	22.9127	20.6303	15.1147	11.6750	9.5386	10.6503	13.8437	17.9816	23.5928	26.6480	29.3548	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-42.0968	-56.4458	-84.4035	-98.3610	-104.8634	-101.6535	-99.8537	-94.8737	-84.2684	-70.0721	-47.8176	-35.6778	(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												575.2646	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												171.3249	
Water heating fuel used												1523.6351	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:												80.0000	(230g)
pump for solar water heating												80.0000	(231)
Total electricity for the above, kWh/year												230.5033	(232)
Electricity for lighting (calculated in Appendix L)													

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Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-920.3872	(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	1489.0159	(238)

10a. Fuel costs - using BEDF prices (531)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	575.2646	21.5100	123.7394 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1523.6351	21.5100	327.7339 (247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	21.5100	17.2080 (249)
Energy for lighting	230.5033	21.5100	49.5813 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-920.3872	21.5100	-197.9753
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-197.9753 (252)
Total energy cost			320.2873 (255)

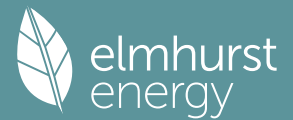
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	575.2646	0.1581	90.9440 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1523.6351	0.1453	221.4227 (264)
Space and water heating			312.3668 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	230.5033	0.1443	33.2688 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-920.3872	0.1341	-123.4689
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-123.4689 (269)
Total CO2, kg/year			233.2636 (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	575.2646	1.5852	911.9148 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1523.6351	1.5376	2342.6811 (278)
Space and water heating			3254.5960 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	230.5033	1.5338	353.5537 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-920.3872	1.4958	-1376.6792
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1376.6792 (283)
Total Primary energy kWh/year			2352.4944 (286)

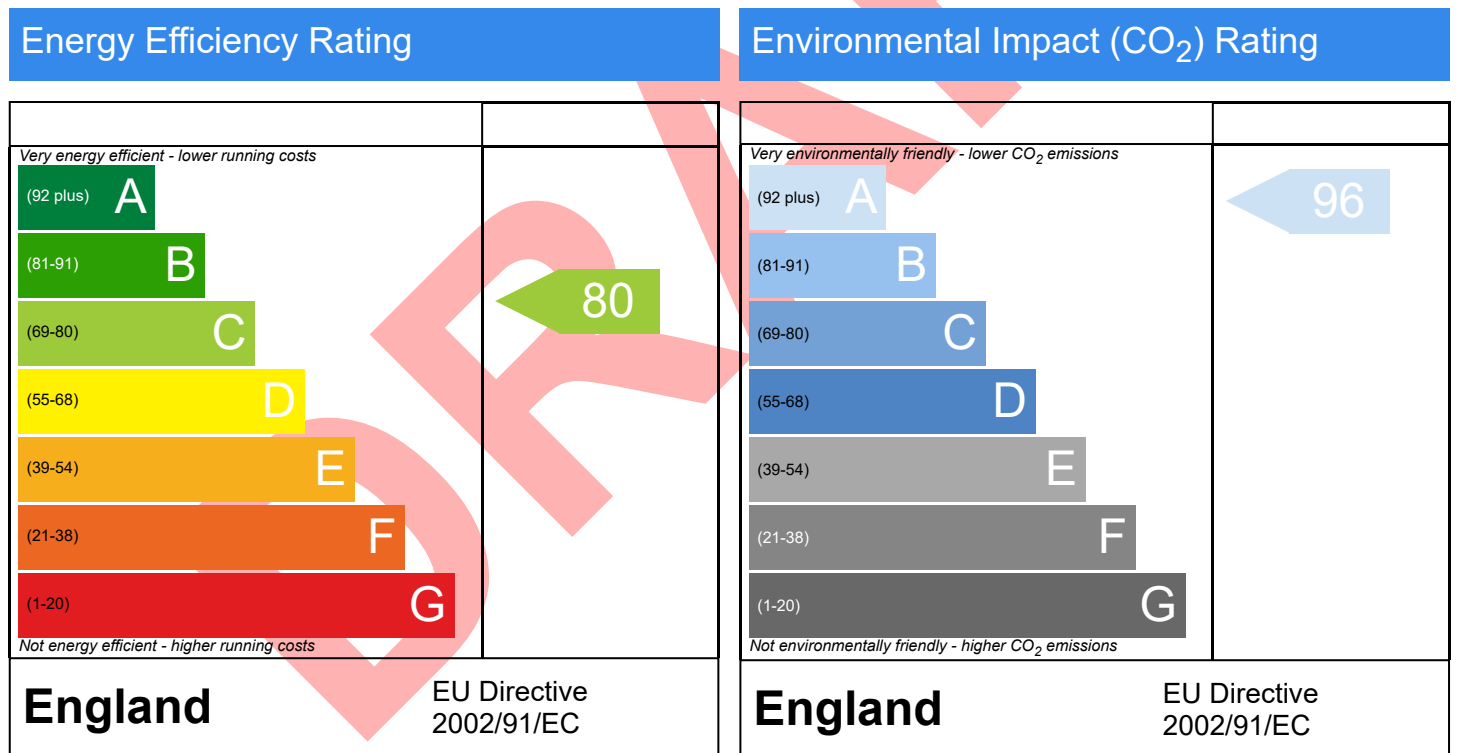
Predicted Energy Assessment



House 1, 10 Palmerston Road, Sutton, Surrey, SM1 4QL Dwelling type: House, Mid-Terrace
 Date of assessment: 01/12/2023
 Produced by: Kyle Jones
 Total floor area: 101.66 m²
 DRRN:

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

The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) 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 (CO₂) 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: Fri 01 Dec 2023 16:17:06

Project Information			
Assessed By	Kyle Jones	Building Type	House, Mid-terrace
OCDEA Registration	EES/027281	Assessment Date	2023-12-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	102 m ²
Site Reference	304434 - House 3	Plot Reference	304434 - House 3
Address	House 1 10 Palmerston Road, Sutton, SM1 4QL		

Client Details	
Name	Canopy Planning
Company	Canopy Planning
Address	5 Palmerston Court, Palmerston Road, Sutton, SM1 4QL

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	10.44 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	4.37 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	54.5 kWh _{PE} /m ²		
Dwelling primary energy	46.2 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	33.8 kWh/m ²		
Dwelling fabric energy efficiency	33.8 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.16	Walls (2) (0.18)	OK
Party walls	0.2	0	Party Wall (1) (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	0.13	Ground floor (0.13)	OK
Roofs	0.16	0.15	Roof (1) (0.15)	OK
Windows, doors, and roof windows	1.6	1.18	W (1.2)	OK
Rooflights	2.2	1.3	E, East (1.3)	OK

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	Net area [m ²]	U-Value [W/m ² K]
Exposed wall: Walls (1)	53.88	0.16
Exposed wall: Walls (2)	7.31	0.18
Exposed wall: Walls (3)	10.23	0.18
Party wall: Party Wall (1)	118.63	0 (!)
Ground floor: Ground floor, Ground floor	37.62	0.13
Exposed roof: Roof (1)	26.58	0.15
Exposed roof: Roof (2)	1.84	0.15
Exposed roof: Roof (3)	11.2	0.15

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
W, Window	4.7	West	0.7	1.2
W, Half glazed door	1.78	West	N/A	1 (!)
W, Window	1.41	West	0.7	1.2
E, Roof-light	2.09	East	0.7	1.3
E, Bi-fold	6.08	East	0.7	1.2
E, Window	2.85	East	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)	Government-approved scheme	0.012 (!)	
External wall	E3: Sill	Government-approved scheme	0.015 (!)	
External wall	E4: Jamb	Government-approved scheme	0.026 (!)	
External wall	E5: Ground floor (normal)	Government-approved scheme	0.072	
External wall	E6: Intermediate floor within a dwelling	Government-approved scheme	0.02 (!)	
External wall	E11: Eaves (insulation at rafter level)	Government-approved scheme	0.02 (!)	
External wall	E13: Gable (insulation at rafter level)	Government-approved scheme	0.041	
External wall	E16: Corner (normal)	Government-approved scheme	0.032 (!)	
External wall	E17: Corner (inverted - internal area greater than external area)	Government-approved scheme	-0.053	
Party wall	P1: Ground floor	Government-approved scheme	0.072	
Party wall	P2: Intermediate floor within a dwelling	SAP table default	0 (!)	
Party wall	P4: Roof (insulation at ceiling level)	SAP table default	0.48	
Roof	R1: Head of roof window	SAP table default	0.24	
Roof	R2: Sill of roof window	SAP table default	0.24	
Roof	R3: Jamb of roof window	SAP table default	0.24	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))			
Maximum permitted air permeability at 50Pa	8 m ³ /hm ²		
Dwelling air permeability at 50Pa	4.5 m ³ /hm ² , Design value		OK
Air permeability test certificate reference			

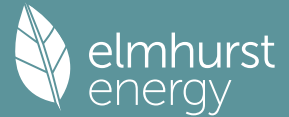
4 Space heating	
Main heating system 1: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	323.8%
Emitter type	Both radiators and underfloor
Flow temperature	35°C
System type	Heat Pump
Manufacturer	Grant Engineering (UK) Ltd
Model	AERONA3
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	200 litres
Declared heat loss	2 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		
System type: N/A		
Maximum permitted specific fan power	N/A	
Specific fan power	N/A	N/A
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model		
Commissioning		
9 Local generation		
N/A		
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		

Full SAP Calculation Printout



Property Reference	304434 - House 3		Issued on Date	01/12/2023	
Assessment Reference	304434 - House 3	Prop Type Ref	304434		
Property	House 1, 10 Palmerston Road, Sutton, Surrey, SM1 4QL				
SAP Rating	80 C	DER	4.37	TER	10.44
Environmental	96 A	% DER < TER			58.14
CO ₂ Emissions (t/year)	0.4	DFEE	33.78	TFEE	33.83
Compliance Check	See BREL	% DFEE < TFEE			0.17
% DPER < TPER	15.23	DPER	46.20	TPER	54.50
Assessor Details	Mr. Kyle Jones			Assessor ID	AV53-0001
Client	304434, Canopy Planning				

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	37.6200 (1b)	x 2.6000 (2b)	= 97.8120 (1b) - (3b)
First floor	37.6200 (1c)	x 2.8000 (2c)	= 105.3360 (1c) - (3c)
Second floor	26.4200 (1d)	x 2.1700 (2d)	= 57.3314 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.4794 (5)

2. Ventilation rate

		m ³ per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	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) =	0.1152 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50		4.5000 (17)
Infiltration rate		0.3402 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2891 (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	0.3687	0.3614	0.3542	0.3181	0.3108	0.2747	0.2747	0.2675	0.2891	0.3108	0.3253	0.3397 (22b)
Effective ac	0.5680	0.5653	0.5627	0.5506	0.5483	0.5377	0.5377	0.5358	0.5418	0.5483	0.5529	0.5577 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			8.9600	1.1450	10.2595		(27)
Half glazed door			1.7800	1.0000	1.7800		(26a)
Bi-fold (Uw = 1.20)			6.0800	1.1450	6.9618		(27)
E			2.0900	1.2357	2.5827		(27a)
Ground floor			37.6200	0.1300	4.8906	110.0000	4138.2000 (28a)
External wall	69.2900	15.4100	53.8800	0.1600	8.6208	150.0000	8082.0000 (29a)
Dormer wall	8.7200	1.4100	7.3100	0.1800	1.3158	9.0000	65.7900 (29a)
Secondary wall	10.2300		10.2300	0.1800	1.8414	9.0000	92.0700 (29a)
Sloped roof	28.6700	2.0900	26.5800	0.1500	3.9870	9.0000	239.2200 (30)
Dormer sloped roof	1.8400		1.8400	0.1500	0.2760	9.0000	16.5600 (30)
Secondary plane roof	11.2000		11.2000	0.1500	1.6800	9.0000	100.8000 (30)
Total net area of external elements Aum(A, m ²)			167.5700				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	44.1957	(33)
Party wall			118.6300	0.0000	0.0000	70.0000	8304.1000 (32)
Internal stud wall			200.5600			9.0000	1805.0400 (32c)
First floor			37.6200			18.0000	677.1600 (32d)
Second floor			26.4200			18.0000	475.5600 (32d)
Ground floor ceiling			37.6200			9.0000	338.5800 (32e)

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First floor ceiling 26.4200 9.0000 237.7800 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 24572.8600 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 241.7161 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	10.3100	0.0120	0.1237
E3 Sill	6.6500	0.0150	0.0998
E4 Jamb	24.9800	0.0260	0.6495
E5 Ground floor (normal)	10.2600	0.0720	0.7387
E6 Intermediate floor within a dwelling	22.7600	0.0200	0.4552
E11 Eaves (insulation at rafter level)	8.5800	0.0200	0.1716
E13 Gable (insulation at rafter level)	4.5300	0.0410	0.1857
E16 Corner (normal)	17.9000	0.0320	0.5728
E17 Corner (inverted - internal area greater than external area)	4.4000	-0.0530	-0.2332
P1 Party wall - Ground floor	17.3400	0.0720	1.2485
P2 Party wall - Intermediate floor within a dwelling	17.3400	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	11.5200	0.4800	5.5296
R1 Head of roof window	2.0400	0.2400	0.4896
R2 Sill of roof window	2.0400	0.2400	0.4896
R3 Jamb of roof window	3.6800	0.2400	0.8832

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.4043 (36)
 Point Thermal bridges 0.0000 (36a) =
 Total fabric heat loss (33) + (36) + (36a) = 55.6000 (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	48.8205	48.5936	48.3713	47.3270	47.1316	46.2221	46.2221	46.0536	46.5724	47.1316	47.5269	47.9401 (38)
Average = Sum(39)m / 12 =	104.4204	104.1936	103.9712	102.9269	102.7316	101.8220	101.8220	101.6536	102.1724	102.7316	103.1268	103.5400 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0272	1.0249	1.0227	1.0125	1.0105	1.0016	1.0016	0.9999	1.0050	1.0105	1.0144	1.0185 (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 2.7544 (42)

Hot water usage for mixer showers 105.6023 104.0153 101.7027 97.2781 94.0128 90.3713 88.3015 90.5966 93.1124 97.0222 101.5419 105.1977 (42a)

Hot water usage for baths 30.3982 29.9467 29.3110 28.1388 27.2611 26.2878 25.7621 26.3934 27.0808 28.1222 29.3185 30.2954 (42b)

Hot water usage for other uses 42.8375 41.2798 39.7221 38.1643 36.6066 35.0489 35.0489 36.6066 38.1643 39.7221 41.2798 42.8375 (42c)

Average daily hot water use (litres/day) 164.4889 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	178.8380	175.2418	170.7358	163.5812	157.8804	151.7080	149.1125	153.5966	158.3575	164.8664	172.1402	178.3306 (44)
Energy content (annual)	283.2357	249.5420	262.4145	223.9344	212.5374	186.5427	180.3386	190.1846	195.2706	223.7222	245.2453	279.2226 (45)
Distribution loss (46)m = 0.15 x (45)m	42.4853	37.4313	39.3622	33.5902	31.8806	27.9814	27.0508	28.5277	29.2906	33.5583	36.7868	41.8834 (46)
Water storage loss:												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0800 (55)
Total storage loss	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (56)
If cylinder contains dedicated solar storage	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (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	339.9781	300.7932	319.1569	278.8464	269.2798	241.4547	237.0810	246.9270	250.1826	280.4646	300.1573	335.9650 (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	339.9781	300.7932	319.1569	278.8464	269.2798	241.4547	237.0810	246.9270	250.1826	280.4646	300.1573	335.9650 (64)
12Total per year (kWh/year)												3400.2867 (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	139.5698	123.9737	132.6467	118.3878	116.0626	105.9550	105.3565	108.6303	108.8571	119.7815	125.4737	138.2354 (65)

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

Metabolic gains (Table 5), Watts

(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	134.3455	148.7396	134.3455	138.8236	134.3455	138.8236	134.3455	134.3455	138.8236	134.3455	138.8236	134.3455 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	258.9838	261.6712	254.8990	240.4816	222.2823	205.1775	193.7505	191.0630	197.8353	212.2526	230.4519	247.5567 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719 (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)	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748 (71)
Water heating gains (Table 5)	187.5938	184.4846	178.2886	164.4275	155.9981	147.1598	141.6082	146.0085	151.1904	160.9967	174.2690	185.8003 (72)
Total internal gains	645.2386	659.2110	631.8486	608.0483	576.9414	555.4765	534.0197	535.7325	552.1649	571.9104	607.8601	632.0181 (73)

6. Solar gains

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[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East					2.8500	19.6403	0.6300	0.7000	0.7700	17.1066 (76)
West					6.1100	19.6403	0.6300	0.7000	0.7700	36.6742 (80)
East					6.0800	19.6403	0.6300	0.7000	0.7700	36.4941 (76)
East					2.0900	26.6072	0.7600	0.7000	1.0000	26.6256 (82)

Solar gains	116.9005	230.4262	383.8404	566.6973	700.6605	719.9826	684.3298	583.7038	448.6596	274.5643	146.0736	95.9340 (83)
Total gains	762.1391	889.6372	1015.6890	1174.7456	1277.6019	1275.4591	1218.3495	1119.4363	1000.8245	846.4747	753.9337	727.9521 (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	65.3684	65.5107	65.6508	66.3169	66.4430	67.0365	67.0365	67.1476	66.8067	66.4430	66.1884	65.9242
alpha	5.3579	5.3674	5.3767	5.4211	5.4295	5.4691	5.4691	5.4765	5.4538	5.4295	5.4126	5.3949
util living area	0.9933	0.9841	0.9576	0.8678	0.7018	0.5045	0.3667	0.4157	0.6700	0.9244	0.9851	0.9947 (86)
Living	20.1219	20.2753	20.4972	20.7545	20.8938	20.9364	20.9423	20.9415	20.9144	20.7045	20.3671	20.0971
Non living	19.0369	19.2325	19.5099	19.8189	19.9631	20.0056	20.0089	20.0101	19.9882	19.7722	19.3575	19.0112
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	20.5508	20.2753	20.4972	20.7545	20.8938	20.9364	20.9423	20.9415	20.9144	20.7045	20.3671	20.2234 (87)
Th 2	20.0608	20.0626	20.0644	20.0730	20.0746	20.0820	20.0820	20.0834	20.0791	20.0746	20.0713	20.0680 (88)
util rest of house	0.9913	0.9794	0.9454	0.8351	0.6455	0.4349	0.2908	0.3339	0.5936	0.8970	0.9799	0.9931 (89)
MIT 2	19.6526	19.2325	19.5099	19.8189	19.9631	20.0056	20.0089	20.0101	19.9882	19.7722	19.3575	19.2016 (90)
Living area fraction	$fLA = \text{Living area} / (4) =$										0.1829 (91)	
MIT	19.8168	19.4232	19.6905	19.9900	20.1333	20.1758	20.1796	20.1804	20.1575	19.9427	19.5421	19.3885 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.8168	19.4232	19.6905	19.9900	20.1333	20.1758	20.1796	20.1804	20.1575	19.9427	19.5421	19.3885 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9906	0.9754	0.9395	0.8319	0.6493	0.4422	0.2989	0.3426	0.6004	0.8923	0.9760	0.9915 (94)
Useful gains	754.9842	867.7083	954.2046	977.2436	829.4915	563.9520	364.1356	383.5655	600.9303	755.3039	735.8480	721.7775 (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	1620.2757	1513.2210	1371.4295	1141.4563	866.3700	567.7379	364.4832	384.2891	618.9132	959.7879	1283.1130	1572.6169 (97)
Space heating kWh	643.7769	433.7845	310.4153	118.2331	27.4376	0.0000	0.0000	0.0000	0.0000	152.1361	394.0308	633.0245 (98a)
Space heating requirement - total per year (kWh/year)												2712.8388
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	643.7769	433.7845	310.4153	118.2331	27.4376	0.0000	0.0000	0.0000	0.0000	152.1361	394.0308	633.0245 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2712.8388
Space heating per m2												(98c) / (4) = 26.6854 (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 %)													323.7828 (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	643.7769	433.7845	310.4153	118.2331	27.4376	0.0000	0.0000	0.0000	0.0000	152.1361	394.0308	633.0245 (98)
Space heating efficiency (main heating system 1)	323.7828	323.7828	323.7828	323.7828	323.7828	0.0000	0.0000	0.0000	0.0000	323.7828	323.7828	323.7828 (210)
Space heating fuel (main heating system)	198.8299	133.9739	95.8715	36.5162	8.4741	0.0000	0.0000	0.0000	0.0000	46.9871	121.6960	195.5090 (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	339.9781	300.7932	319.1569	278.8464	269.2798	241.4547	237.0810	246.9270	250.1826	280.4646	300.1573	335.9650 (64)
Efficiency of water heater												
(217)m	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013 (217)
Fuel for water heating, kWh/month	198.3520	175.4906	186.2045	162.6863	157.1048	140.8709	138.3192	144.0637	145.9631	163.6303	175.1196	196.0108 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	28.5610	22.9127	20.6303	15.1147	11.6750	9.5386	10.6503	13.8437	17.9816	23.5928	26.6480	29.3548 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)

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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													837.8576	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													171.4013	
Water heating fuel used													1983.8157	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
Total electricity for the above, kWh/year													0.0000	(231)
Electricity for lighting (calculated in Appendix L)													230.5033	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													0.0000	(233)
Wind generation													0.0000	(234)
Hydro-electric generation (Appendix N)													0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)													0.0000	(235)
Appendix Q - special features														
Energy saved or generated													-0.0000	(236)
Energy used													0.0000	(237)
Total delivered energy for all uses													3052.1767	(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	837.8576	0.1569	131.4881 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1983.8157	0.1410	279.7482 (264)
Space and water heating			411.2364 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	230.5033	0.1443	33.2688 (268)
Total CO2, kg/year			444.5051 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.3700 (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	837.8576	1.5809	1324.6105 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1983.8157	1.5214	3018.2351 (278)
Space and water heating			4342.8456 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	230.5033	1.5338	353.5537 (282)
Total Primary energy kWh/year			4696.3993 (286)
Dwelling Primary energy Rate (DPER)			46.2000 (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	37.6200 (1b)	x 2.6000 (2b)	= 97.8120 (1b) - (3b)
First floor	37.6200 (1c)	x 2.8000 (2c)	= 105.3360 (1c) - (3c)
Second floor	26.4200 (1d)	x 2.1700 (2d)	= 57.3314 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.6600		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 260.4794 (5)

 2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1536 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4036 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)

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Infiltration rate adjusted to include shelter factor

(21) = (18) x (20) = 0.3430 (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													
Effective ac	0.4374	0.4288	0.4202	0.3773	0.3688	0.3259	0.3259	0.3173	0.3430	0.3688	0.3859	0.4031	(22b)
	0.5956	0.5919	0.5883	0.5712	0.5680	0.5531	0.5531	0.5503	0.5588	0.5680	0.5745	0.5812	(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 Semi-glazed door			1.7800	1.0000	1.7800			(26a)
TER Opening Type (Uw = 1.20)			15.0400	1.1450	17.2214			(27)
E			2.0900	2.0221	4.2261			(27a)
Ground floor			37.6200	0.1300	4.8906			(28a)
External wall	69.2900	15.4100	53.8800	0.1800	9.6984			(29a)
Dormer wall	8.7200	1.4100	7.3100	0.1800	1.3158			(29a)
Secondary wall	10.2300		10.2300	0.1800	1.8414			(29a)
Sloped roof	28.6700	2.0900	26.5800	0.1100	2.9238			(30)
Dormer sloped roof	1.8400		1.8400	0.1100	0.2024			(30)
Secondary plane roof	11.2000		11.2000	0.1100	1.2320			(30)
Total net area of external elements Aum(A, m2)			167.5700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.3319			(33)
Party wall			118.6300	0.0000	0.0000			(32)

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

241.7161 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	10.3100	0.0500	0.5155
E3 Sill	6.6500	0.0500	0.3325
E4 Jamb	24.9800	0.0500	1.2490
E5 Ground floor (normal)	10.2600	0.1600	1.6416
E6 Intermediate floor within a dwelling	22.7600	0.0000	0.0000
E11 Eaves (insulation at rafter level)	8.5800	0.0400	0.3432
E13 Gable (insulation at rafter level)	4.5300	0.0800	0.3624
E16 Corner (normal)	17.9000	0.0900	1.6110
E17 Corner (inverted - internal area greater than external area)	4.4000	-0.0900	-0.3960
P1 Party wall - Ground floor	17.3400	0.0800	1.3872
P2 Party wall - Intermediate floor within a dwelling	17.3400	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	11.5200	0.1200	1.3824
R1 Head of roof window	2.0400	0.0800	0.1632
R2 Sill of roof window	2.0400	0.0600	0.1224
R3 Jamb of roof window	3.6800	0.0800	0.2944

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

9.0088 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 54.3407 (37)

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

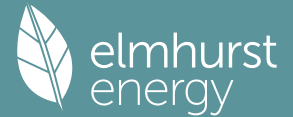
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	51.2004	50.8811	50.5682	49.0984	48.8234	47.5433	47.5433	47.3062	48.0364	48.8234	49.3797	49.9613	(38)
Average = Sum(39)m / 12 =	105.5410	105.2218	104.9089	103.4391	103.1641	101.8840	101.8840	101.6469	102.3771	103.1641	103.7204	104.3020	(39)
												103.4378	(39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0382	1.0350	1.0320	1.0175	1.0148	1.0022	1.0022	0.9999	1.0071	1.0148	1.0203	1.0260	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	(40)

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.7544	(42)
Hot water usage for mixer showers														
Hot water usage for baths														
Hot water usage for other uses														
Average daily hot water use (litres/day)														132.0349
Daily hot water use														
Energy conte	143.6372	140.5700	136.8349	131.1551	126.5428	121.5842	119.6786	123.3977	127.3200	132.5257	138.2929	143.2647	(44)	
Energy content (annual)	227.4862	200.1699	210.3101	179.5448	170.3510	149.5020	144.7409	152.7921	156.9983	179.8361	197.0236	224.3179	(45)	
Distribution loss (46)m = 0.15 x (45)m														
Water storage loss:	34.1229	30.0255	31.5465	26.9317	25.5526	22.4253	21.7111	22.9188	23.5497	26.9754	29.5535	33.6477	(46)	
Store volume													200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6525	(48)
Temperature factor from Table 2b													0.5400	(49)
Enter (49) or (54) in (55)													0.8924	(55)
Total storage loss														
If cylinder contains dedicated solar storage	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)	
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														
WWHRS	278.4123	246.1676	261.2362	228.8281	221.2770	198.7853	195.6670	203.7182	206.2816	230.7622	246.3069	275.2440	(62)	
PV diverter	-32.1846	-28.4644	-29.8062	-24.6807	-23.0016	-19.6826	-18.4493	-19.6190	-20.3644	-24.0074	-27.1974	-31.5886	(63a)	
Solar input	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)	
Output from w/h	246.2277	217.7032	231.4299	204.1474	198.2755	179.1027	177.2177	184.0992	185.9172	206.7548	219.1095	243.6554	(64)	
12Total per year (kWh/year)													2493.6402	(64)
Electric shower(s)													2494	(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)

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Heat gains from water heating, kWh/month	116.3800	103.3547	110.6690	99.1253	97.3826	89.1360	88.8672	91.5442	91.6286	100.5364	104.9370	115.3266 (65)
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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	137.7185	137.7185	137.7185	137.7185	137.7185	137.7185	137.7185	137.7185	137.7185	137.7185	137.7185	137.7185 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	134.3455	148.7396	134.3455	138.8236	134.3455	138.8236	134.3455	134.3455	138.8236	134.3455	138.8236	134.3455 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	258.9838	261.6712	254.8990	240.4816	222.2823	205.1775	193.7505	191.0630	197.8353	212.2526	230.4519	247.5567 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719 (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)	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748 (71)
Water heating gains (Table 5)	156.4248	153.8016	148.7486	137.6740	130.8905	123.8001	119.4452	123.0433	127.2619	135.1295	145.7458	155.0088 (72)
Total internal gains	617.0696	631.5280	605.3086	584.2948	554.8338	532.1168	511.8567	512.7674	528.2364	549.0432	582.3370	604.2266 (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						
East	8.9300	19.6403	0.6300	0.7000	0.7700	53.6007 (76)						
West	6.1100	19.6403	0.6300	0.7000	0.7700	36.6742 (80)						
East	2.0900	26.6072	0.6300	0.7000	1.0000	22.0713 (82)						
Solar gains	112.3461	221.2185	367.9307	542.3155	669.7275	687.8499	653.9302	558.2967	429.7733	263.4429	140.3414	92.2228 (83)
Total gains	729.4157	852.7465	973.2393	1126.6104	1224.5613	1219.9667	1165.7869	1071.0641	958.0096	812.4861	722.6783	696.4494 (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)	64.6743	64.8705	65.0640	65.9885	66.1644	66.9958	66.9958	67.1520	66.6731	66.1644	65.8096	65.4426
tau	5.3116	5.3247	5.3376	5.3992	5.4110	5.4664	5.4664	5.4768	5.4449	5.4110	5.3873	5.3628
util living area	0.9946	0.9870	0.9647	0.8845	0.7262	0.5262	0.3833	0.4339	0.6945	0.9352	0.9878	0.9957 (86)
MIT	19.8530	20.0567	20.3552	20.7167	20.9221	20.9888	20.9983	20.9969	20.9543	20.6522	20.1922	19.8263 (87)
Th 2	20.0516	20.0542	20.0568	20.0688	20.0710	20.0815	20.0815	20.0834	20.0775	20.0710	20.0665	20.0617 (88)
util rest of house	0.9929	0.9831	0.9542	0.8541	0.6701	0.4543	0.3039	0.3488	0.6175	0.9105	0.9834	0.9944 (89)
MIT 2	18.7202	18.9804	19.3555	19.7938	20.0096	20.0754	20.0810	20.0823	20.0483	19.7327	19.1633	18.6935 (90)
Living area fraction	18.9273	19.1772	19.5383	19.9626	20.1765	20.2424	20.2487	20.2496	20.2140	19.9009	19.3515	18.9006 (92)
MIT	18.9273	19.1772	19.5383	19.9626	20.1765	20.2424	20.2487	20.2496	20.2140	19.9009	19.3515	18.9006 (93)
Temperature adjustment												0.0000
adjusted MIT	18.9273	19.1772	19.5383	19.9626	20.1765	20.2424	20.2487	20.2496	20.2140	19.9009	19.3515	18.9006 (93)

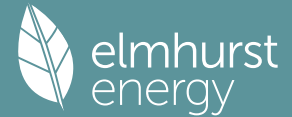
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9901	0.9782	0.9470	0.8502	0.6768	0.4671	0.3185	0.3644	0.6295	0.9050	0.9788	0.9920 (94)
Useful gains	722.1793	834.1500	921.6272	957.8761	828.7652	569.8633	371.2564	390.2955	603.0859	735.2932	707.3599	690.8938 (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	1543.7843	1502.2709	1367.8343	1144.3008	874.4698	574.8743	371.7466	391.2970	625.9344	959.5142	1270.7294	1533.3064 (97)
Space heating kWh	611.2742	448.9773	331.9781	134.2258	34.0042	0.0000	0.0000	0.0000	0.0000	166.8204	405.6260	626.7550 (98a)
Space heating requirement - total per year (kWh/year)												2759.6610
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	611.2742	448.9773	331.9781	134.2258	34.0042	0.0000	0.0000	0.0000	0.0000	166.8204	405.6260	626.7550 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2759.6610
Space heating per m2												(98c) / (4) = 27.1460 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fraction of space heat from main system(s)												0.0000 (201)
Efficiency of main space heating system 1 (in %)												1.0000 (202)
Efficiency of main space heating system 2 (in %)												92.3000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	611.2742	448.9773	331.9781	134.2258	34.0042	0.0000	0.0000	0.0000	0.0000	166.8204	405.6260	626.7550 (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)	662.2689	486.4326	359.6729	145.4234	36.8410	0.0000	0.0000	0.0000	0.0000	180.7372	439.4648	679.0411 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating														
Water heating requirement	246.2277	217.7032	231.4299	204.1474	198.2755	179.1027	177.2177	184.0992	185.9172	206.7548	219.1095	243.6554		(64)
Efficiency of water heater														(216)
(217)m	86.0144	85.6458	84.8683	83.1427	81.0018	79.8000	79.8000	79.8000	79.8000	83.5828	85.4211	86.0823		(217)
Fuel for water heating, kWh/month	286.2632	254.1903	272.6930	245.5387	244.7790	224.4394	222.0773	230.7008	232.9790	247.3652	256.5050	283.0494		(219)
Space cooling fuel requirement														
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685		(231)
Lighting	27.9143	22.3939	20.1632	14.7725	11.4107	9.3226	10.4092	13.5303	17.5745	23.0587	26.0447	28.6902		(232)
Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)m	-36.7540	-52.6414	-76.8469	-87.7745	-95.7845	-89.7742	-88.6305	-83.0964	-73.5432	-60.7774	-40.6849	-31.6771		(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(235c)
Electricity generated by PVs (Appendix M) (negative quantity)														
(233b)m	-18.3291	-38.8145	-77.6355	-117.3309	-155.8686	-156.9127	-155.1053	-131.0284	-95.6183	-55.7948	-24.5616	-14.4781		(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													2989.8819	(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													3000.5803	(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)													225.2847	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-1859.4628	(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													4442.2841	(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	2989.8819	0.2100	627.8752	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3000.5803	0.2100	630.1219	(264)
Space and water heating			1257.9971	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	225.2847	0.1443	32.5155	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-817.9851	0.1343	-109.8289	
PV Unit electricity exported	-1041.4777	0.1257	-130.9210	
Total			-240.7499	(269)
Total CO2, kg/year			1061.6920	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.4400	(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	2989.8819	1.1300	3378.5665	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3000.5803	1.1300	3390.6557	(278)
Space and water heating			6769.2223	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	225.2847	1.5338	345.5491	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-817.9851	1.4962	-1223.8795	
PV Unit electricity exported	-1041.4777	0.4614	-480.5603	
Total			-1704.4398	(283)
Total Primary energy kWh/year			5540.4324	(286)
Target Primary Energy Rate (TPER)			54.5000	(287)

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

1. Overall dwelling characteristics

Area (m ²)	Storey height (m)	Volume (m ³)
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Ground floor					37.6200 (1b)	x	2.6000 (2b)	=	97.8120 (1b)	-	(3b)
First floor					37.6200 (1c)	x	2.8000 (2c)	=	105.3360 (1c)	-	(3c)
Second floor					26.4200 (1d)	x	2.1700 (2d)	=	57.3314 (1d)	-	(3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)				101.6600							(4)
Dwelling volume									(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	260.4794 (5)

2. Ventilation rate

												m3 per hour
Number of open chimneys												0 * 80 = 0.0000 (6a)
Number of open flues												0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire												0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler												0 * 20 = 0.0000 (6d)
Number of flues attached to other heater												0 * 35 = 0.0000 (6e)
Number of blocked chimneys												0 * 20 = 0.0000 (6f)
Number of intermittent extract fans												4 * 10 = 40.0000 (7a)
Number of passive vents												0 * 10 = 0.0000 (7b)
Number of flueless gas fires												0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1536 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			4.5000 (17)
Infiltration rate			0.3786 (18)
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3218 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(22)
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	
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 infiltr rate	0.4103	0.4022	0.3942	0.3540	0.3459	0.3057	0.3057	0.2976	0.3218	0.3459	0.3620	0.3781	(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	0.5842	0.5809	0.5777	0.5626	0.5598	0.5467	0.5467	0.5443	0.5518	0.5598	0.5655	0.5715	(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)			8.9600	1.1450	10.2595		(27)
Half glazed door			1.7800	1.0000	1.7800		(26a)
Bi-fold (Uw = 1.20)			6.0800	1.1450	6.9618		(27)
E			2.0900	1.2357	2.5827		(27a)
Ground floor			37.6200	0.1300	4.8906	110.0000	4138.2000 (28a)
External wall	69.2900	15.4100	53.8800	0.1600	8.6208	150.0000	8082.0000 (29a)
Dormer wall	8.7200	1.4100	7.3100	0.1800	1.3158	9.0000	65.7900 (29a)
Secondary wall	10.2300		10.2300	0.1800	1.8414	9.0000	92.0700 (29a)
Sloped roof	28.6700	2.0900	26.5800	0.1500	3.9870	9.0000	239.2200 (30)
Dormer sloped roof	1.8400		1.8400	0.1500	0.2760	9.0000	16.5600 (30)
Secondary plane roof	11.2000		11.2000	0.1500	1.6800	9.0000	100.8000 (30)
Total net area of external elements Aum(A, m2)			167.5700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.1957		(33)
Party wall			118.6300	0.0000	0.0000	70.0000	8304.1000 (32)
Internal stud wall			200.5600			9.0000	1805.0400 (32c)
First floor			37.6200			18.0000	677.1600 (32d)
Second floor			26.4200			18.0000	475.5600 (32d)
Ground floor ceiling			37.6200			9.0000	338.5800 (32e)
First floor ceiling			26.4200			9.0000	237.7800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	24572.8600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							241.7161 (35)

List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				10.3100	0.0120	0.1237	
E3 Sill				6.6500	0.0150	0.0998	
E4 Jamb				24.9800	0.0260	0.6495	
E5 Ground floor (normal)				10.2600	0.0720	0.7387	
E6 Intermediate floor within a dwelling				22.7600	0.0200	0.4552	
E11 Eaves (insulation at rafter level)				8.5800	0.0200	0.1716	
E13 Gable (insulation at rafter level)				4.5300	0.0410	0.1857	
E16 Corner (normal)				17.9000	0.0320	0.5728	
E17 Corner (inverted - internal area greater than external area)				4.4000	-0.0530	-0.2332	
P1 Party wall - Ground floor				17.3400	0.0720	1.2485	
P2 Party wall - Intermediate floor within a dwelling				17.3400	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)				11.5200	0.4800	5.5296	
R1 Head of roof window				2.0400	0.2400	0.4896	
R2 Sill of roof window				2.0400	0.2400	0.4896	
R3 Jamb of roof window				3.6800	0.2400	0.8832	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.4043 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	55.6000 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(38)
	50.2133	49.9324	49.6571	48.3637	48.1218	46.9953	46.9953	46.7867	47.4292	48.1218	48.6113	49.1230	
Heat transfer coeff	105.8133	105.5324	105.2570	103.9637	103.7217	102.5953	102.5953	102.3867	103.0292	103.7217	104.2112	104.7230	(39)
Average = Sum(39)m / 12 =													103.9625
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(40)
HLP (average)	1.0409	1.0381	1.0354	1.0227	1.0203	1.0092	1.0092	1.0071	1.0135	1.0203	1.0251	1.0301	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7544 (42)
Hot water usage for mixer showers												0.0000 (42a)
Hot water usage for baths	30.3982	29.9467	29.3110	28.1388	27.2611	26.2878	25.7621	26.3934	27.0808	28.1222	29.3185	30.2954 (42b)
Hot water usage for other uses	42.8375	41.2798	39.7221	38.1643	36.6066	35.0489	35.0489	36.6066	38.1643	39.7221	41.2798	42.8375 (42c)
Average daily hot water use (litres/day)												67.1271 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	73.2357	71.2265	69.0330	66.3031	63.8677	61.3367	60.8110	63.0000	65.2451	67.8442	70.5983	73.1329 (44)
Distribution loss (46)m = 0.15 x (45)m	115.9874	101.4256	106.1012	90.7656	85.9781	75.4206	73.5456	78.0071	80.4537	92.0640	100.5802	114.5085 (45)
Water storage loss:												Total = Sum(45)m = 1114.8377
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
If cylinder contains dedicated solar storage												0.0000 (56)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month	98.5893	86.2118	90.1860	77.1508	73.0814	64.1075	62.5137	66.3061	68.3857	78.2544	85.4932	97.3322 (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	98.5893	86.2118	90.1860	77.1508	73.0814	64.1075	62.5137	66.3061	68.3857	78.2544	85.4932	97.3322 (64)
12Total per year (kWh/year)												947.6121 (64)
Electric shower(s)	56.3799	50.2349	54.8546	52.3471	53.3294	50.8711	52.5668	53.3294	52.3471	54.8546	53.8232	56.3799 (64a)
Heat gains from water heating, kWh/month	38.7423	34.1117	36.2602	32.3745	31.6027	28.7446	28.7701	29.9089	30.1832	33.2773	34.8291	38.4280 (65)
Total Energy used by instantaneous electric shower(s) = Sum(64a)m = 641.3180 (64a)												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	137.7185	137.7185	137.7185	137.7185	137.7185	137.7185	137.7185	137.7185	137.7185	137.7185	137.7185	137.7185 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	134.3455	148.7396	134.3455	138.8236	134.3455	138.8236	134.3455	134.3455	138.8236	134.3455	138.8236	134.3455 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	258.9838	261.6712	254.8990	240.4816	222.2823	205.1775	193.7505	191.0630	197.8353	212.2526	230.4519	247.5567 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719 (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)	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748 (71)
Water heating gains (Table 5)	52.0730	50.7614	48.7368	44.9646	42.4767	39.9231	38.6695	40.2001	41.9211	44.7275	48.3737	51.6506 (72)
Total internal gains	509.7178	525.4878	502.2968	488.5854	463.4201	448.2398	431.0810	429.9241	442.8956	455.6411	481.9649	497.8683 (73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m2	Table 6a	Specific data	Specific data	factor	W						
		W/m2	or Table 6b	or Table 6c	Table 6d							
East	2.8500	19.6403	0.6300	0.7000	0.7700	17.1066 (76)						
West	6.1100	19.6403	0.6300	0.7000	0.7700	36.6742 (80)						
East	6.0800	19.6403	0.6300	0.7000	0.7700	36.4941 (76)						
East	2.0900	26.6072	0.7600	0.7000	1.0000	26.6256 (82)						
Solar gains	116.9005	230.4262	383.8404	566.6973	700.6605	719.9826	684.3298	583.7038	448.6596	274.5643	146.0736	95.9340 (83)
Total gains	626.6183	755.9140	886.1371	1055.2826	1164.0805	1168.2225	1115.4108	1013.6279	891.5552	730.2054	628.0385	593.8023 (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	64.5079	64.6796	64.8488	65.6556	65.8087	66.5313	66.5313	66.6668	66.2511	65.8087	65.4996	65.1795
alpha	5.3005	5.3120	5.3233	5.3770	5.3872	5.4354	5.4354	5.4445	5.4167	5.3872	5.3666	5.3453
util living area	0.9973	0.9924	0.9760	0.9070	0.7549	0.5510	0.4029	0.4608	0.7355	0.9570	0.9936	0.9980 (86)
MIT	19.7375	19.9506	20.2682	20.6664	20.9047	20.9857	20.9978	20.9956	20.9387	20.5784	20.0858	19.7077 (87)
Th 2	20.0494	20.0517	20.0540	20.0645	20.0665	20.0757	20.0757	20.0774	20.0721	20.0665	20.0625	20.0583 (88)
util rest of house	0.9965	0.9901	0.9684	0.8804	0.6994	0.4762	0.3192	0.3704	0.6585	0.9388	0.9912	0.9974 (89)
MIT 2	18.8975	19.1110	19.4249	19.8076	20.0070	20.0696	20.0751	20.0762	20.0408	19.7376	19.2549	18.8748 (90)
Living area fraction	19.0511	19.2645	19.5791	19.9646	20.1711	20.2371	20.2439	20.2443	20.2050	19.8913	19.4069	19.0271 (92)
MIT	19.0511	19.2645	19.5791	19.9646	20.1711	20.2371	20.2439	20.2443	20.2050	19.8913	19.4069	19.0271 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0511	19.2645	19.5791	19.9646	20.1711	20.2371	20.2439	20.2443	20.2050	19.8913	19.4069	19.0271 (93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Utilisation	0.9952	0.9874	0.9636	0.8771	0.7060	0.4895	0.3346	0.3869	0.6704	0.9345	0.9888	0.9964 (94)
Useful gains	623.6360	746.3921	853.8891	925.6409	821.8977	571.8744	373.1882	392.2077	597.6570	682.3954	621.0177	591.6452 (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	1560.8645	1515.9196	1376.6658	1150.3170	878.6418	578.3382	373.8419	393.6070	628.9933	963.7110	1282.5136	1552.7357 (97)
Space heating kWh	697.2980	517.1224	388.9459	161.7668	42.2176	0.0000	0.0000	0.0000	0.0000	209.2988	476.2771	715.0513 (98a)
Space heating requirement - total per year (kWh/year)												3207.9779
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	697.2980	517.1224	388.9459	161.7668	42.2176	0.0000	0.0000	0.0000	0.0000	209.2988	476.2771	715.0513 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3207.9779
Space heating per m2												31.5560 (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	964.3957	759.2051	778.1388	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9364	0.9699	0.9516	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	903.0134	736.3415	740.5054	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1277.1036	1219.7799	1108.4205	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	269.3449	359.6782	273.7288	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	67.3362	89.9195	68.4322	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												225.6880 (107)
Energy for space heating												31.5560 (99)
Energy for space cooling												2.2200 (108)
Total												33.7760 (109)
Fabric Energy Efficiency (DFEE)												33.8 (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	37.6200 (1b)	x 2.6000 (2b)	= 97.8120 (1b) - (3b)
First floor	37.6200 (1c)	x 2.8000 (2c)	= 105.3360 (1c) - (3c)
Second floor	26.4200 (1d)	x 2.1700 (2d)	= 57.3314 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	260.4794 (5)

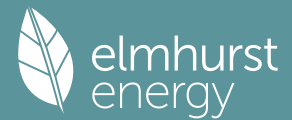
2. Ventilation rate

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1536 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.4036	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3430 (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	0.4374	0.4288	0.4202	0.3773	0.3688	0.3259	0.3259	0.3173	0.3430	0.3688	0.3859	0.4031 (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	0.5956	0.5919	0.5883	0.5712	0.5680	0.5531	0.5531	0.5503	0.5588	0.5680	0.5745	0.5812 (25)

3. Heat losses and heat loss parameter

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Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Semi-glazed door			1.7800	1.0000	1.7800		(26a)
TER Opening Type (Uw = 1.20)			15.0400	1.1450	17.2214		(27)
E			2.0900	2.0221	4.2261		(27a)
Ground floor			37.6200	0.1300	4.8906		(28a)
External wall	69.2900	15.4100	53.8800	0.1800	9.6984		(29a)
Dormer wall	8.7200	1.4100	7.3100	0.1800	1.3158		(29a)
Secondary wall	10.2300		10.2300	0.1800	1.8414		(29a)
Sloped roof	28.6700	2.0900	26.5800	0.1100	2.9238		(30)
Dormer sloped roof	1.8400		1.8400	0.1100	0.2024		(30)
Secondary plane roof	11.2000		11.2000	0.1100	1.2320		(30)
Total net area of external elements Aum(A, m ²)			167.5700				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	45.3319	(33)
Party wall			118.6300	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 241.7161 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	10.3100	0.0500	0.5155
E3 Sill	6.6500	0.0500	0.3325
E4 Jamb	24.9800	0.0500	1.2490
E5 Ground floor (normal)	10.2600	0.1600	1.6416
E6 Intermediate floor within a dwelling	22.7600	0.0000	0.0000
E11 Eaves (insulation at rafter level)	8.5800	0.0400	0.3432
E13 Gable (insulation at rafter level)	4.5300	0.0800	0.3624
E16 Corner (normal)	17.9000	0.0900	1.6110
E17 Corner (inverted - internal area greater than external area)	4.4000	-0.0900	-0.3960
P1 Party wall - Ground floor	17.3400	0.0800	1.3872
P2 Party wall - Intermediate floor within a dwelling	17.3400	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	11.5200	0.1200	1.3824
R1 Head of roof window	2.0400	0.0800	0.1632
R2 Sill of roof window	2.0400	0.0600	0.1224
R3 Jamb of roof window	3.6800	0.0800	0.2944

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.0088 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 54.3407 (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	51.2004	50.8811	50.5682	49.0984	48.8234	47.5433	47.5433	47.3062	48.0364	48.8234	49.3797	49.9613 (38)
Heat transfer coeff	105.5410	105.2218	104.9089	103.4391	103.1641	101.8840	101.8840	101.6469	102.3771	103.1641	103.7204	104.3020 (39)
Average = Sum(39)m / 12 =												103.4378
HLP	1.0382	1.0350	1.0320	1.0175	1.0148	1.0022	1.0022	0.9999	1.0071	1.0148	1.0203	1.0260 (40)
HLP (average)												1.0175
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.7544 (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	30.3982	29.9467	29.3110	28.1388	27.2611	26.2878	25.7621	26.3934	27.0808	28.1222	29.3185	30.2954	30.2954 (42b)
Hot water usage for other uses	42.8375	41.2798	39.7221	38.1643	36.6066	35.0489	35.0489	36.6066	38.1643	39.7221	41.2798	42.8375	42.8375 (42c)
Average daily hot water use (litres/day)													67.1271 (43)
Daily hot water use	73.2357	71.2265	69.0330	66.3031	63.8677	61.3367	60.8110	63.0000	65.2451	67.8442	70.5983	73.1329	73.1329 (44)
Energy conte	115.9874	101.4256	106.1012	90.7656	85.9781	75.4206	73.5456	78.0071	80.4537	92.0640	100.5802	114.5085	114.5085 (45)
Energy content (annual)													Total = Sum(45)m = 1114.8377
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													
WWHRs	98.5893	86.2118	90.1860	77.1508	73.0814	64.1075	62.5137	66.3061	68.3857	78.2544	85.4932	97.3322	97.3322 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	0.0000 (63d)
Output from w/h	98.5893	86.2118	90.1860	77.1508	73.0814	64.1075	62.5137	66.3061	68.3857	78.2544	85.4932	97.3322	97.3322 (64)
12Total per year (kWh/year)													Total per year (kWh/year) = Sum(64)m = 947.6121 (64)
Electric shower(s)	56.3799	50.2349	54.8546	52.3471	53.3294	50.8711	52.5668	53.3294	52.3471	54.8546	53.8232	56.3799	56.3799 (64a)
Heat gains from water heating, kWh/month	38.7423	34.1117	36.2602	32.3745	31.6027	28.7446	28.7701	29.9089	30.1832	33.2773	34.8291	38.4280	38.4280 (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	137.7185	137.7185	137.7185	137.7185	137.7185	137.7185	137.7185	137.7185	137.7185	137.7185	137.7185	137.7185
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	134.3455	148.7396	134.3455	138.8236	134.3455	138.8236	134.3455	134.3455	138.8236	134.3455	138.8236	134.3455 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	258.9838	261.6712	254.8990	240.4816	222.2823	205.1775	193.7505	191.0630	197.8353	212.2526	230.4519	247.5567 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719	36.7719 (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)	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748 (71)

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Water heating gains (Table 5)	52.0730	50.7614	48.7368	44.9646	42.4767	39.9231	38.6695	40.2001	41.9211	44.7275	48.3737	51.6506 (72)
Total internal gains	509.7178	525.4878	502.2968	488.5854	463.4201	448.2398	431.0810	429.9241	442.8956	455.6411	481.9649	497.8683 (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
East	8.9300	19.6403	0.6300	0.7000	0.7700	0.7700	53.6007 (76)	
West	6.1100	19.6403	0.6300	0.7000	0.7700	0.7700	36.6742 (80)	
East	2.0900	26.6072	0.6300	0.7000	1.0000	1.0000	22.0713 (82)	

Solar gains	112.3461	221.2185	367.9307	542.3155	669.7275	687.8499	653.9302	558.2967	429.7733	263.4429	140.3414	92.2228 (83)
Total gains	622.0639	746.7063	870.2274	1030.9009	1133.1475	1136.0897	1085.0112	988.2208	872.6688	719.0841	622.3063	590.0911 (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	64.6743	64.8705	65.0640	65.9885	66.1644	66.9958	66.9958	67.1520	66.6731	66.1644	65.8096	65.4426
alpha	5.3116	5.3247	5.3376	5.3992	5.4110	5.4664	5.4664	5.4768	5.4449	5.4110	5.3873	5.3628
util living area	0.9974	0.9928	0.9776	0.9130	0.7663	0.5619	0.4112	0.4690	0.7439	0.9590	0.9938	0.9981 (86)
MIT	19.7369	19.9457	20.2577	20.6553	20.8988	20.9847	20.9977	20.9954	20.9363	20.5742	20.0864	19.7104 (87)
Th 2	20.0516	20.0542	20.0568	20.0688	20.0710	20.0815	20.0815	20.0834	20.0775	20.0710	20.0665	20.0617 (88)
util rest of house	0.9966	0.9906	0.9705	0.8875	0.7116	0.4864	0.3264	0.3777	0.6675	0.9416	0.9915	0.9974 (89)
MIT 2	18.8987	19.1082	19.4171	19.8019	20.0074	20.0749	20.0809	20.0822	20.0447	19.7377	19.2587	18.8802 (90)
Living area fraction	19.0520	19.2613	19.5708	19.9580	20.1704	20.2413	20.2485	20.2492	20.2077	19.8907	19.4101	19.0320 (92)
Temperature adjustment	19.0520	19.2613	19.5708	19.9580	20.1704	20.2413	20.2485	20.2492	20.2077	19.8907	19.4101	19.0320 (93)
adjusted MIT	19.0520	19.2613	19.5708	19.9580	20.1704	20.2413	20.2485	20.2492	20.2077	19.8907	19.4101	19.0320 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9954	0.9880	0.9658	0.8841	0.7178	0.4998	0.3420	0.3944	0.6791	0.9373	0.9892	0.9965 (94)
Useful gains	619.1978	737.7511	840.4882	911.3826	813.4045	567.8226	371.0281	389.7739	592.6146	674.0075	615.5961	588.0090 (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	1556.9383	1511.1257	1371.2466	1143.8292	873.8406	574.7563	371.7287	391.2557	625.2912	958.4654	1276.8041	1547.0100 (97)
Space heating kWh	697.6790	519.7077	394.8842	167.3616	44.9645	0.0000	0.0000	0.0000	0.0000	211.6367	476.0698	713.4967 (98a)
Space heating requirement - total per year (kWh/year)												3225.8002
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	697.6790	519.7077	394.8842	167.3616	44.9645	0.0000	0.0000	0.0000	0.0000	211.6367	476.0698	713.4967 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3225.8002
Space heating per m2												(98c) / (4) = 31.7313 (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	957.7094	753.9415	772.5166	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9327	0.9680	0.9492	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	893.2089	729.8373	733.3074	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1244.9709	1189.3803	1083.0134	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	253.2687	341.9000	260.1813	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	63.3172	85.4750	65.0453	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												213.8375 (107)
Energy for space heating												31.7313 (99)
Energy for space cooling												2.1035 (108)
Total												33.8347 (109)
Fabric Energy Efficiency (TFEE)												33.8 (109)

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

1. Overall dwelling characteristics

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	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	37.6200 (1b)	x 2.6000 (2b)	= 97.8120 (1b) - (3b)
First floor	37.6200 (1c)	x 2.8000 (2c)	= 105.3360 (1c) - (3c)
Second floor	26.4200 (1d)	x 2.1700 (2d)	= 57.3314 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.6600		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 260.4794 (5)
Dwelling volume			

2. Ventilation rate

		m ³ per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	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) =	0.1152 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	4.5000	(17)
Infiltration rate	0.3402	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2891 (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												
Effective ac	0.3687	0.3614	0.3542	0.3181	0.3108	0.2747	0.2747	0.2675	0.2891	0.3108	0.3253	0.3397 (22b)
	0.5680	0.5653	0.5627	0.5506	0.5483	0.5377	0.5377	0.5358	0.5418	0.5483	0.5529	0.5577 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			8.9600	1.1450	10.2595		(27)
Half glazed door			1.7800	1.0000	1.7800		(26a)
Bi-fold (Uw = 1.20)			6.0800	1.1450	6.9618		(27)
E			2.0900	1.2357	2.5827		(27a)
Ground floor			37.6200	0.1300	4.8906	110.0000	4138.2000 (28a)
External wall	69.2900	15.4100	53.8800	0.1600	8.6208	150.0000	8082.0000 (29a)
Dormer wall	8.7200	1.4100	7.3100	0.1800	1.3158	9.0000	65.7900 (29a)
Secondary wall	10.2300		10.2300	0.1800	1.8414	9.0000	92.0700 (29a)
Sloped roof	28.6700	2.0900	26.5800	0.1500	3.9870	9.0000	239.2200 (30)
Dormer sloped roof	1.8400		1.8400	0.1500	0.2760	9.0000	16.5600 (30)
Secondary plane roof	11.2000		11.2000	0.1500	1.6800	9.0000	100.8000 (30)
Total net area of external elements Aum(A, m ²)			167.5700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.1957		(33)
Party wall			118.6300	0.0000	0.0000	70.0000	8304.1000 (32)
Internal stud wall			200.5600			9.0000	1805.0400 (32c)
First floor			37.6200			18.0000	677.1600 (32d)
Second floor			26.4200			18.0000	475.5600 (32d)
Ground floor ceiling			37.6200			9.0000	338.5800 (32e)
First floor ceiling			26.4200			9.0000	237.7800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	24572.8600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							241.7161 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element	10.3100	0.0120	0.1237
E2 Other lintels (including other steel lintels)	6.6500	0.0150	0.0998
E3 Sill	24.9800	0.0260	0.6495
E4 Jamb	10.2600	0.0720	0.7387
E5 Ground floor (normal)	22.7600	0.0200	0.4552
E6 Intermediate floor within a dwelling	8.5800	0.0200	0.1716
E11 Eaves (insulation at rafter level)	4.5300	0.0410	0.1857
E13 Gable (insulation at rafter level)	17.9000	0.0320	0.5728
E16 Corner (normal)	4.4000	-0.0530	-0.2332
E17 Corner (inverted - internal area greater than external area)	17.3400	0.0720	1.2485
P1 Party wall - Ground floor	17.3400	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	11.5200	0.4800	5.5296
P4 Party wall - Roof (insulation at ceiling level)	2.0400	0.2400	0.4896
R1 Head of roof window	2.0400	0.2400	0.4896
R2 Sill of roof window	3.6800	0.2400	0.8832
R3 Jamb of roof window			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			11.4043 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 55.6000 (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	48.8205	48.5936	48.3713	47.3270	47.1316	46.2221	46.2221	46.0536	46.5724	47.1316	47.5269	47.9401 (38)
Heat transfer coeff	104.4204	104.1936	103.9712	102.9269	102.7316	101.8220	101.8220	101.6536	102.1724	102.7316	103.1268	103.5400 (39)
Average = Sum(39)m / 12 =												102.9260
HLP	1.0272	1.0249	1.0227	1.0125	1.0105	1.0016	1.0016	0.9999	1.0050	1.0105	1.0144	1.0185 (40)
HLP (average)												1.0125
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7544 (42)
Hot water usage for mixer showers												105.1977 (42a)
Hot water usage for baths												30.2954 (42b)
Hot water usage for other uses												42.8375 (42c)
Average daily hot water use (litres/day)												164.4889 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	178.8380	175.2418	170.7358	163.5812	157.8804	151.7080	149.1125	153.5966	158.3575	164.8664	172.1402	178.3306 (44)
Distribution loss (46)m = 0.15 x (45)m	283.2357	249.5420	262.4145	223.9344	212.5374	186.5427	180.3386	190.1846	195.2706	223.7222	245.2453	279.2226 (45)
Water storage loss:												2732.1907
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0800 (55)
Total storage loss												33.4800 (56)
If cylinder contains dedicated solar storage												33.4800 (57)
Primary loss												23.2624 (59)
Combi loss												0.0000 (61)
Total heat required for water heating calculated for each month												339.9781 (62)
WWHRS												0.0000 (63a)
PV diverter												0.0000 (63b)
Solar input												0.0000 (63c)
FGHRS												0.0000 (63d)
Output from w/h												339.9781 (64)
Electric shower(s)												0.0000 (64a)
Heat gains from water heating, kWh/month												139.5698 (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	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.6301	28.9818	23.5696	17.8437	13.3384	11.2608	12.1677	15.8160	21.2283	26.9541	31.4595	33.5370 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	386.5430	390.5541	380.4462	358.9278	331.7646	306.2351	289.1798	285.1687	295.2765	316.7950	343.9581	369.4877 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806 (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)	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748 (71)
Water heating gains (Table 5)	187.5938	184.4846	178.2886	164.4275	155.9981	147.1598	141.6082	146.0085	151.1904	160.9967	174.2690	185.8003 (72)
Total internal gains	716.1349	713.3885	691.6724	650.5670	610.4691	574.0237	552.3237	556.3612	577.0632	614.1138	659.0546	698.1930 (73)

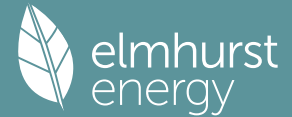
6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
East	2.8500	19.6403	0.6300	0.7000	0.7700	17.1066 (76)						
West	6.1100	19.6403	0.6300	0.7000	0.7700	36.6742 (80)						
East	6.0800	19.6403	0.6300	0.7000	0.7700	36.4941 (76)						
East	2.0900	26.6072	0.7600	0.7000	1.0000	26.6256 (82)						
Solar gains	116.9005	230.4262	383.8404	566.6973	700.6605	719.9826	684.3298	583.7038	448.6596	274.5643	146.0736	95.9340 (83)
Total gains	833.0354	943.8147	1075.5128	1217.2642	1311.1296	1294.0063	1236.6535	1140.0650	1025.7228	888.6781	805.1282	794.1270 (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	65.3684	65.5107	65.6508	66.3169	66.4430	67.0365	67.0365	67.1476	66.8067	66.4430	66.1884	65.9242
alpha	5.3579	5.3674	5.3767	5.4211	5.4295	5.4691	5.4691	5.4765	5.4538	5.4295	5.4126	5.3949
util living area	0.9899	0.9795	0.9472	0.8538	0.6879	0.4977	0.3614	0.4083	0.6568	0.9108	0.9802	0.9920 (86)
Living	20.1781	20.3160	20.5357	20.7709	20.8983	20.9369	20.9424	20.9416	20.9170	20.7269	20.4059	20.1502
Non living	19.1081	19.2833	19.5558	19.8362	19.9669	20.0058	20.0090	20.0101	19.9899	19.7968	19.4056	19.0786
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	20.5795	20.3160	20.5357	20.7709	20.8983	20.9369	20.9424	20.9416	20.9170	20.7269	20.4059	20.2690 (87)
Th 2	20.0608	20.0626	20.0644	20.0730	20.0746	20.0820	20.0820	20.0834	20.0791	20.0746	20.0713	20.0680 (88)
util rest of house	0.9870	0.9737	0.9328	0.8193	0.6316	0.4289	0.2865	0.3279	0.5808	0.8802	0.9735	0.9897 (89)
MIT 2	19.6810	19.2833	19.5558	19.8362	19.9669	20.0058	20.0090	20.0101	19.9899	19.7968	19.4056	19.2568 (90)
Living area fraction												0.1829 (91)
MIT	19.8453	19.4721	19.7350	20.0072	20.1372	20.1761	20.1796	20.1805	20.1595	19.9669	19.5885	19.4419 (92)
Temperature adjustment												0.0000
adjusted MIT	19.8453	19.4721	19.7350	20.0072	20.1372	20.1761	20.1796	20.1805	20.1595	19.9669	19.5885	19.4419 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9862	0.9690	0.9267	0.8166	0.6356	0.4360	0.2945	0.3365	0.5877	0.8760	0.9690	0.9876	(94)
Useful gains	821.5003	914.5634	996.6988	994.0197	833.3818	564.2282	364.1640	383.6359	602.8482	778.4860	780.1608	784.3007	(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	1623.2451	1518.3221	1376.0619	1143.2265	866.7649	567.7662	364.4864	384.2968	619.1089	962.2717	1287.8969	1578.1510	(97)
Space heating kWh	596.4981	405.7258	282.2462	107.4289	24.8370	0.0000	0.0000	0.0000	0.0000	136.7366	365.5700	590.6246	(98a)
Space heating requirement - total per year (kWh/year)												2509.6673	
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	596.4981	405.7258	282.2462	107.4289	24.8370	0.0000	0.0000	0.0000	0.0000	136.7366	365.5700	590.6246	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2509.6673	
Space heating per m2										(98c) / (4) =		24.6869	(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 %)													323.7828	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement	596.4981	405.7258	282.2462	107.4289	24.8370	0.0000	0.0000	0.0000	0.0000	136.7366	365.5700	590.6246	(98)	
Space heating efficiency (main heating system 1)	323.7828	323.7828	323.7828	323.7828	323.7828	0.0000	0.0000	0.0000	0.0000	323.7828	323.7828	323.7828	(210)	
Space heating fuel (main heating system)	184.2279	125.3080	87.1715	33.1793	7.6709	0.0000	0.0000	0.0000	0.0000	42.2310	112.9059	182.4138	(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	339.9781	300.7932	319.1569	278.8464	269.2798	241.4547	237.0810	246.9270	250.1826	280.4646	300.1573	335.9650	(64)	
Efficiency of water heater (217)m	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	(216)	
Fuel for water heating, kWh/month	198.3520	175.4906	186.2045	162.6863	157.1048	140.8709	138.3192	144.0637	145.9631	163.6303	175.1196	196.0108	(219)	
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)	
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)	
Lighting	28.5610	22.9127	20.6303	15.1147	11.6750	9.5386	10.6503	13.8437	17.9816	23.5928	26.6480	29.3548	(232)	
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)	
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)	
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													775.1083	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													171.4013	
Water heating fuel used													1983.8157	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
Total electricity for the above, kWh/year													0.0000	(231)
Electricity for lighting (calculated in Appendix L)													230.5033	(232)
Energy saving/generation technologies (Appendices M, N and Q)														
PV generation													0.0000	(233)
Wind generation													0.0000	(234)
Hydro-electric generation (Appendix N)													0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)													0.0000	(235)
Appendix Q - special features														
Energy saved or generated													-0.0000	(236)
Energy used													0.0000	(237)
Total delivered energy for all uses													2989.4274	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	775.1083	16.4900	127.8154	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1983.8157	16.4900	327.1312	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	230.5033	16.4900	38.0100	(250)
Additional standing charges			0.0000	(251)

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Total energy cost 492.9566 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12): 0.3600 (256)
 Energy cost factor (ECF) $[(255) \times (256)] / [(4) + 45.0] = 1.2100 (257)$
 SAP value 80.3853
 SAP rating (Section 12) 80 (258)
 SAP band C

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	775.1083	0.1570	121.6985 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1983.8157	0.1410	279.7482 (264)
Space and water heating			401.4468 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	230.5033	0.1443	33.2688 (268)
Total CO2, kg/year			434.7155 (272)
CO2 emissions per m2			4.2800 (273)
EI value			96.0281
EI rating			96 (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	37.6200 (1b)	x 2.6000 (2b)	= 97.8120 (1b) - (3b)
First floor	37.6200 (1c)	x 2.8000 (2c)	= 105.3360 (1c) - (3c)
Second floor	26.4200 (1d)	x 2.1700 (2d)	= 57.3314 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	260.4794 (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) =	0.1152 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	4.5000	(17)
Infiltration rate	0.3402	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2891 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.7000	3.5000	3.4000	3.2000	3.1000	2.8000	3.0000	2.7000	2.6000	2.8000	2.9000	3.2000 (22)
Wind factor	0.9250	0.8750	0.8500	0.8000	0.7750	0.7000	0.7500	0.6750	0.6500	0.7000	0.7250	0.8000 (22a)
Adj infilt rate	0.2675	0.2530	0.2458	0.2313	0.2241	0.2024	0.2169	0.1952	0.1879	0.2024	0.2096	0.2313 (22b)
Effective ac	0.5358	0.5320	0.5302	0.5268	0.5251	0.5205	0.5235	0.5190	0.5177	0.5205	0.5220	0.5268 (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)			8.9600	1.1450	10.2595		(27)
Half glazed door			1.7800	1.0000	1.7800		(26a)
Bi-fold (Uw = 1.20)			6.0800	1.1450	6.9618		(27)
E			2.0900	1.2357	2.5827		(27a)
Ground floor			37.6200	0.1300	4.8906	110.0000	4138.2000 (28a)
External wall	69.2900	15.4100	53.8800	0.1600	8.6208	150.0000	8082.0000 (29a)
Dormer wall	8.7200	1.4100	7.3100	0.1800	1.3158	9.0000	65.7900 (29a)
Secondary wall	10.2300		10.2300	0.1800	1.8414	9.0000	92.0700 (29a)
Sloped roof	28.6700	2.0900	26.5800	0.1500	3.9870	9.0000	239.2200 (30)

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Dormer sloped roof	1.8400	1.8400	0.1500	0.2760	9.0000	16.5600	(30)
Secondary plane roof	11.2000	11.2000	0.1500	1.6800	9.0000	100.8000	(30)
Total net area of external elements Aum(A, m2)		167.5700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =	44.1957			(33)
Party wall		118.6300	0.0000	0.0000	70.0000	8304.1000	(32)
Internal stud wall		200.5600			9.0000	1805.0400	(32c)
First floor		37.6200			18.0000	677.1600	(32d)
Second floor		26.4200			18.0000	475.5600	(32d)
Ground floor ceiling		37.6200			9.0000	338.5800	(32e)
First floor ceiling		26.4200			9.0000	237.7800	(32e)

Heat capacity Cm = Sum(A x k)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
 (28) ... (30) + (32) + (32a) ... (32e) = 24572.8600 (34)
 241.7161 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	10.3100	0.0120	0.1237
E3 Sill	6.6500	0.0150	0.0998
E4 Jamb	24.9800	0.0260	0.6495
E5 Ground floor (normal)	10.2600	0.0720	0.7387
E6 Intermediate floor within a dwelling	22.7600	0.0200	0.4552
E11 Eaves (insulation at rafter level)	8.5800	0.0200	0.1716
E13 Gable (insulation at rafter level)	4.5300	0.0410	0.1857
E16 Corner (normal)	17.9000	0.0320	0.5728
E17 Corner (inverted - internal area greater than external area)	4.4000	-0.0530	-0.2332
P1 Party wall - Ground floor	17.3400	0.0720	1.2485
P2 Party wall - Intermediate floor within a dwelling	17.3400	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	11.5200	0.4800	5.5296
R1 Head of roof window	2.0400	0.2400	0.4896
R2 Sill of roof window	2.0400	0.2400	0.4896
R3 Jamb of roof window	3.6800	0.2400	0.8832

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 55.6000 (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	46.0536	45.7302	45.5753	45.2788	45.1373	44.7398	45.0003	44.6163	44.4973	44.7398	44.8678	45.2788	(38)
Heat transfer coeff													
Average = Sum(39)m / 12 =	101.6536	101.3302	101.1752	100.8788	100.7373	100.3398	100.6003	100.2163	100.0972	100.3398	100.4678	100.8788	(39)
												100.7262	
HLP	0.9999	0.9968	0.9952	0.9923	0.9909	0.9870	0.9896	0.9858	0.9846	0.9870	0.9883	0.9923	(40)
HLP (average)												0.9908	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7544 (42)												
Hot water usage for mixer showers	105.6023	104.0153	101.7027	97.2781	94.0128	90.3713	88.3015	90.5966	93.1124	97.0222	101.5419	105.1977	(42a)
Hot water usage for baths	30.3982	29.9467	29.3110	28.1388	27.2611	26.2878	25.7621	26.3934	27.0808	28.1222	29.3185	30.2954	(42b)
Hot water usage for other uses	42.8375	41.2798	39.7221	38.1643	36.6066	35.0489	35.0489	36.6066	38.1643	39.7221	41.2798	42.8375	(42c)
Average daily hot water use (litres/day)													164.4889 (43)
Daily hot water use	178.8380	175.2418	170.7358	163.5812	157.8804	151.7080	149.1125	153.5966	158.3575	164.8664	172.1402	178.3306	(44)
Energy conte	283.2357	249.5420	262.4145	223.9344	212.5374	186.5427	180.3386	190.1846	195.2706	223.7222	245.2453	279.2226	(45)
Energy content (annual)	Total = Sum(45)m = 2732.1907												
Distribution loss (46)m = 0.15 x (45)m	42.4853	37.4313	39.3622	33.5902	31.8806	27.9814	27.0508	28.5277	29.2906	33.5583	36.7868	41.8834	(46)
Water storage loss:													
Store volume	200.0000 (47)												
a) If manufacturer declared loss factor is known (kWh/day):	2.0000 (48)												
Temperature factor from Table 2b	0.5400 (49)												
Enter (49) or (54) in (55)	1.0800 (55)												
Total storage loss	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(56)
If cylinder contains dedicated solar storage	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(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	339.9781	300.7932	319.1569	278.8464	269.2798	241.4547	237.0810	246.9270	250.1826	280.4646	300.1573	335.9650	(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	339.9781	300.7932	319.1569	278.8464	269.2798	241.4547	237.0810	246.9270	250.1826	280.4646	300.1573	335.9650	(64)
	Total per year (kWh/year) = Sum(64)m = 3400.2867 (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) = Sum(64a)m = 0.0000 (64a)												
Heat gains from water heating, kWh/month	139.5698	123.9737	132.6467	118.3878	116.0626	105.9550	105.3565	108.6303	108.8571	119.7815	125.4737	138.2354	(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	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.6301	28.9818	23.5696	17.8437	13.3384	11.2608	12.1677	15.8160	21.2283	26.9541	31.4595	33.5370	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	386.5430	390.5541	380.4462	358.9278	331.7646	306.2351	289.1798	285.1687	295.2765	316.7950	343.9581	369.4877	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	(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)	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	(71)
Water heating gains (Table 5)													

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Total internal gains	187.5938	184.4846	178.2886	164.4275	155.9981	147.1598	141.6082	146.0085	151.1904	160.9967	174.2690	185.8003 (72)
	716.1349	713.3885	691.6724	650.5670	610.4691	574.0237	552.3237	556.3612	577.0632	614.1138	659.0546	698.1930 (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
East		2.8500	22.2970	0.6300	0.7000	0.7700	19.4206 (76)
West		6.1100	22.2970	0.6300	0.7000	0.7700	41.6351 (80)
East		6.0800	22.2970	0.6300	0.7000	0.7700	41.4307 (76)
East		2.0900	30.4656	0.7600	0.7000	1.0000	30.4866 (82)

Solar gains	132.9731	231.6205	387.4633	591.6727	713.9719	787.2728	744.7445	641.7582	494.2690	308.1290	170.2343	108.0564 (83)
Total gains	849.1080	945.0090	1079.1358	1242.2397	1324.4410	1361.2964	1297.0683	1198.1194	1071.3322	922.2428	829.2889	806.2494 (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	67.1476	67.3619	67.4651	67.6633	67.7584	68.0268	67.8506	68.1107	68.1916	68.0268	67.9401	67.6633
alpha	5.4765	5.4908	5.4977	5.5109	5.5172	5.5351	5.5234	5.5407	5.5461	5.5351	5.5293	5.5109
util living area	0.9845	0.9716	0.9227	0.7859	0.5726	0.3458	0.2171	0.2425	0.5076	0.8379	0.9645	0.9872 (86)
Living	20.3169	20.4319	20.6510	20.8490	20.9293	20.9432	20.9438	20.9440	20.9384	20.8348	20.5536	20.3013
Non living	19.3024	19.4481	19.7143	19.9346	20.0094	20.0220	20.0200	20.0233	20.0218	19.9309	19.6073	19.2884
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	20.6505	20.4319	20.6510	20.8490	20.9293	20.9432	20.9438	20.9440	20.9384	20.8348	20.5536	20.3991 (87)
Th 2	20.0834	20.0860	20.0873	20.0897	20.0909	20.0942	20.0920	20.0952	20.0962	20.0942	20.0931	20.0897 (88)
util rest of house												
MIT 2	0.9798	0.9634	0.9018	0.7410	0.5099	0.2795	0.1467	0.1669	0.4272	0.7885	0.9522	0.9833 (89)
Living area fraction	19.7720	19.4481	19.7143	19.9346	20.0094	20.0220	20.0200	20.0233	20.0218	19.9309	19.6073	19.4328 (90)
MIT	19.9327	19.6280	19.8856	20.1018	20.1776	20.1905	20.1889	20.1917	20.1894	20.0962	19.7803	19.6095 (92)
Temperature adjustment												0.0000
adjusted MIT	19.9327	19.6280	19.8856	20.1018	20.1776	20.1905	20.1889	20.1917	20.1894	20.0962	19.7803	19.6095 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9789	0.9582	0.8965	0.7416	0.5160	0.2866	0.1543	0.1749	0.4356	0.7886	0.9470	0.9806 (94)
Useful gains	831.2162	905.5317	967.4073	921.2701	683.4348	390.0922	200.0792	209.6105	466.6713	727.2644	785.3089	790.6158 (95)
Ext temp.	5.4000	5.9000	7.7000	10.2000	13.3000	16.3000	18.2000	18.1000	15.5000	12.0000	8.4000	5.5000 (96)
Heat loss rate W	1477.2989	1391.0582	1232.8800	998.8862	692.8293	390.3690	200.0848	209.6215	469.3971	812.3696	1143.3568	1423.3484 (97)
Space heating kWh	480.6855	326.2738	197.5117	55.8836	6.9895	0.0000	0.0000	0.0000	0.0000	63.3183	257.7945	470.7531 (98a)
Space heating requirement - total per year (kWh/year)												1859.2099
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	480.6855	326.2738	197.5117	55.8836	6.9895	0.0000	0.0000	0.0000	0.0000	63.3183	257.7945	470.7531 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1859.2099
Space heating per m2										(98c) / (4) =		18.2885 (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 %)												323.6049 (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	480.6855	326.2738	197.5117	55.8836	6.9895	0.0000	0.0000	0.0000	0.0000	63.3183	257.7945	470.7531 (98)
Space heating efficiency (main heating system 1)	323.6049	323.6049	323.6049	323.6049	323.6049	0.0000	0.0000	0.0000	0.0000	323.6049	323.6049	323.6049 (210)
Space heating fuel (main heating system)	148.5409	100.8247	61.0348	17.2691	2.1599	0.0000	0.0000	0.0000	0.0000	19.5665	79.6634	145.4716 (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	339.9781	300.7932	319.1569	278.8464	269.2798	241.4547	237.0810	246.9270	250.1826	280.4646	300.1573	335.9650 (64)
Efficiency of water heater (217)m	171.3249	171.3249	171.3249	171.3249	171.3249	171.3249	171.3249	171.3249	171.3249	171.3249	171.3249	171.3249 (216)
Fuel for water heating, kWh/month	198.4405	175.5688	186.2875	162.7588	157.1749	140.9338	138.3809	144.1279	146.0281	163.7033	175.1977	196.0982 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	28.5610	22.9127	20.6303	15.1147	11.6750	9.5386	10.6503	13.8437	17.9816	23.5928	26.6480	29.3548 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)

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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													574.5309 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													171.3249
Water heating fuel used													1984.7005 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year													0.0000 (231)
Electricity for lighting (calculated in Appendix L)													230.5033 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													0.0000 (233)
Wind generation													0.0000 (234)
Hydro-electric generation (Appendix N)													0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)													0.0000 (235)
Appendix Q - special features													
Energy saved or generated													-0.0000 (236)
Energy used													0.0000 (237)
Total delivered energy for all uses													2789.7347 (238)

10a. Fuel costs - using BEDF prices (531)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	574.5309	21.5100	123.5816 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1984.7005	21.5100	426.9091 (247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	230.5033	21.5100	49.5813 (250)
Additional standing charges			0.0000 (251)
Total energy cost			600.0719 (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	574.5309	0.1581	90.8391 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1984.7005	0.1410	279.8730 (264)
Space and water heating			370.7121 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	230.5033	0.1443	33.2688 (268)
Total CO2, kg/year			403.9809 (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	574.5309	1.5853	910.7923 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1984.7005	1.5214	3019.5811 (278)
Space and water heating			3930.3734 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	230.5033	1.5338	353.5537 (282)
Total Primary energy kWh/year			4283.9271 (286)

SAP 10 EPC IMPROVEMENTS

304434 - House 3

Current energy efficiency rating: C 80
Current environmental impact rating: A 96

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 2.2	-£ 82	-47 kg (11.7%)
U Solar photovoltaic panels	+ 5.9	-£ 198	-123 kg (34.6%)

Recommended measures	Typical annual savings		Energy Environmental efficiency impact	
Solar water heating	£82	0.46 kg/m ²	B 83	A 96
Solar photovoltaic panels	£198	1.21 kg/m ²	B 88	A 98
Total Savings	£280	1.68 kg/m²		

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Potential energy efficiency rating: B 88
 Potential environmental impact rating: A 98

Fuel prices for cost data on this page from database revision number 531 TEST (31 Oct 2023)
 Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current £600	Potential £518	Saving £82
Electricity			
Space heating	£124	£141	-£17
Water heating	£427	£328	£99
Lighting	£50	£50	£0
Generated (PV)	-£0	-£198	£198
Total cost of fuels	£600	£320	£280
Total cost of uses	£601	£321	£280
Delivered energy	27 kWh/m ²	15 kWh/m ²	13 kWh/m ²
Carbon dioxide emissions	0.4 tonnes	0.2 tonnes	0.2 tonnes
CO2 emissions per m ²	4 kg/m ²	2 kg/m ²	2 kg/m ²
Primary energy	42 kWh/m ²	23 kWh/m ²	19 kWh/m ²

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 ²)	Storey height (m)	Volume (m ³)
Ground floor	37.6200 (1b)	x 2.6000 (2b)	= 97.8120 (1b) - (3b)
First floor	37.6200 (1c)	x 2.8000 (2c)	= 105.3360 (1c) - (3c)
Second floor	26.4200 (1d)	x 2.1700 (2d)	= 57.3314 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	260.4794 (5)

2. Ventilation rate

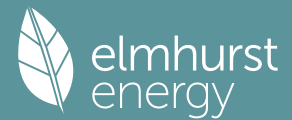
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	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) = 0.1152 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.5000 (17)
Infiltration rate	0.3402 (18)
Number of sides sheltered	2 (19)
Shelter factor (20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) =	0.2891 (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 infiltr rate	0.3687	0.3614	0.3542	0.3181	0.3108	0.2747	0.2747	0.2675	0.2891	0.3108	0.3253	0.3397 (22b)
Effective ac	0.5680	0.5653	0.5627	0.5506	0.5483	0.5377	0.5377	0.5358	0.5418	0.5483	0.5529	0.5577 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			8.9600	1.1450	10.2595		(27)
Half glazed door			1.7800	1.0000	1.7800		(26a)
Bi-fold (Uw = 1.20)			6.0800	1.1450	6.9618		(27)
E			2.0900	1.2357	2.5827		(27a)
Ground floor			37.6200	0.1300	4.8906	110.0000	4138.2000 (28a)
External wall	69.2900	15.4100	53.8800	0.1600	8.6208	150.0000	8082.0000 (29a)
Dormer wall	8.7200	1.4100	7.3100	0.1800	1.3158	9.0000	65.7900 (29a)
Secondary wall	10.2300		10.2300	0.1800	1.8414	9.0000	92.0700 (29a)
Sloped roof	28.6700	2.0900	26.5800	0.1500	3.9870	9.0000	239.2200 (30)
Dormer sloped roof	1.8400		1.8400	0.1500	0.2760	9.0000	16.5600 (30)
Secondary plane roof	11.2000		11.2000	0.1500	1.6800	9.0000	100.8000 (30)
Total net area of external elements Aum (A, m ²)			167.5700				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	44.1957	(33)
Party wall			118.6300	0.0000	0.0000	70.0000	8304.1000 (32)
Internal stud wall			200.5600			9.0000	1805.0400 (32c)
First floor			37.6200			18.0000	677.1600 (32a)
Second floor			26.4200			18.0000	475.5600 (32a)
Ground floor ceiling			37.6200			9.0000	338.5800 (32e)

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First floor ceiling 26.4200 9.0000 237.7800 (32e)

Heat capacity $C_m = \text{Sum}(A \times k)$ (28)...(30) + (32) + (32a)...(32e) = 24572.8600 (34)
 Thermal mass parameter (TMP = C_m / TFA) in $\text{kJ/m}^2\text{K}$ 241.7161 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	10.3100	0.0120	0.1237
E3 Sill	6.6500	0.0150	0.0998
E4 Jamb	24.9800	0.0260	0.6495
E5 Ground floor (normal)	10.2600	0.0720	0.7387
E6 Intermediate floor within a dwelling	22.7600	0.0200	0.4552
E11 Eaves (insulation at rafter level)	8.5800	0.0200	0.1716
E13 Gable (insulation at rafter level)	4.5300	0.0410	0.1857
E16 Corner (normal)	17.9000	0.0320	0.5728
E17 Corner (inverted - internal area greater than external area)	4.4000	-0.0530	-0.2332
P1 Party wall - Ground floor	17.3400	0.0720	1.2485
P2 Party wall - Intermediate floor within a dwelling	17.3400	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	11.5200	0.4800	5.5296
R1 Head of roof window	2.0400	0.2400	0.4896
R2 Sill of roof window	2.0400	0.2400	0.4896
R3 Jamb of roof window	3.6800	0.2400	0.8832

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.4043 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 55.6000 (37)

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	48.8205	48.5936	48.3713	47.3270	47.1316	46.2221	46.2221	46.0536	46.5724	47.1316	47.5269	47.9401 (38)
Average = $\text{Sum}(39)\text{m} / 12 =$	104.4204	104.1936	103.9712	102.9269	102.7316	101.8220	101.8220	101.6536	102.1724	102.7316	103.1268	103.5400 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0272	1.0249	1.0227	1.0125	1.0105	1.0016	1.0016	0.9999	1.0050	1.0105	1.0144	1.0185 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

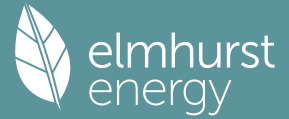
4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7544 (42)	
Hot water usage for mixer showers													
Hot water usage for baths													
Hot water usage for other uses													
Average daily hot water use (litres/day)													
Daily hot water use													
Energy conte													
Energy content (annual)													
Distribution loss (46)m = $0.15 \times (45)\text{m}$													
Water storage loss:													
Store volume													
a) If manufacturer declared loss factor is known (kWh/day):													
Temperature factor from Table 2b													
Enter (49) or (54) in (55)													
Total storage loss													
If cylinder contains dedicated solar storage													
Primary loss													
Combi loss													
Total heat required for water heating calculated for each month													
WVHRS													
PV diverter													
Aperture area of solar collector													
Zero-loss collector efficiency													
Collector linear heat loss coefficient													
Collector 2nd order heat loss coefficient													
Collector loop efficiency													
Incidence angle modifier													
Overshading factor													
Overall heat loss coefficient of system													
Heat loss coefficient of collector loop													
Dedicated solar storage volume													
Effective solar volume													
Reference volume													
Storage tank correction coefficient													
Heat delivered to hot water													
Heat delivered to space heating													
Solar input													
FGHRS													
Output from w/h													
Electric shower(s)													
Heat gains from water heating, kWh/month													

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	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.6301	28.9818	23.5696	17.8437	13.3384	11.2608	12.1677	15.8160	21.2283	26.9541	31.4595	33.5370 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												

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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	386.5430	390.5541	380.4462	358.9278	331.7646	306.2351	289.1798	285.1687	295.2765	316.7950	343.9581	369.4877 (68)
Pumps, fans	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806 (69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748 (71)
Total internal gains	187.5938	184.4846	176.7878	156.9235	142.2408	133.1523	127.6008	133.0016	145.1872	159.4959	174.2690	185.8003 (72)
	716.1349	713.3885	690.1716	643.0630	596.7118	560.0162	538.3162	543.3543	571.0600	612.6130	659.0546	698.1930 (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
East	2.8500	19.6403	0.6300	0.7000	0.7700	17.1066 (76)
West	6.1100	19.6403	0.6300	0.7000	0.7700	36.6742 (80)
East	6.0800	19.6403	0.6300	0.7000	0.7700	36.4941 (76)
East	2.0900	26.6072	0.7600	0.7000	1.0000	26.6256 (82)

Solar gains	116.9005	230.4262	383.8404	566.6973	700.6605	719.9826	684.3298	583.7038	448.6596	274.5643	146.0736	95.9340 (83)
Total gains	833.0354	943.8147	1074.0120	1209.7602	1297.3722	1279.9988	1222.6460	1127.0581	1019.7196	887.1773	805.1282	794.1270 (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	65.3684	65.5107	65.6508	66.3169	66.4430	67.0365	67.0365	67.1476	66.8067	66.4430	66.1884	65.9242
alpha	5.3579	5.3674	5.3767	5.4211	5.4295	5.4691	5.4691	5.4765	5.4538	5.4295	5.4126	5.3949
util living area	0.9899	0.9795	0.9475	0.8563	0.6936	0.5028	0.3655	0.4129	0.6599	0.9113	0.9802	0.9920 (86)
Living	20.1781	20.3160	20.5347	20.7681	20.8965	20.9366	20.9423	20.9415	20.9164	20.7262	20.4059	20.1502
Non living	19.1081	19.2833	19.5547	19.8333	19.9654	20.0056	20.0089	20.0101	19.9895	19.7959	19.4056	19.0786
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	20.5795	20.3160	20.5347	20.7681	20.8965	20.9366	20.9423	20.9415	20.9164	20.7262	20.4059	20.2690 (87)
Th 2	20.0608	20.0626	20.0644	20.0730	20.0746	20.0820	20.0820	20.0834	20.0791	20.0746	20.0713	20.0680 (88)
util rest of house	0.9870	0.9737	0.9331	0.8221	0.6373	0.4334	0.2897	0.3317	0.5838	0.8808	0.9735	0.9897 (89)
MIT 2	19.6810	19.2833	19.5547	19.8333	19.9654	20.0056	20.0089	20.0101	19.9895	19.7959	19.4056	19.2568 (90)
Living area fraction									FLA = Living area / (4) =			0.1829 (91)
MIT	19.8453	19.4721	19.7339	20.0042	20.1357	20.1759	20.1796	20.1804	20.1590	19.9660	19.5885	19.4419 (92)
Temperature adjustment												0.0000
adjusted MIT	19.8453	19.4721	19.7339	20.0042	20.1357	20.1759	20.1796	20.1804	20.1590	19.9660	19.5885	19.4419 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9862	0.9690	0.9271	0.8193	0.6412	0.4406	0.2978	0.3403	0.5908	0.8766	0.9690	0.9876 (94)
Useful gains	821.5003	914.5634	995.6665	991.1656	831.8361	564.0217	364.1425	383.5924	602.4051	777.6960	780.1608	784.3007 (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	1623.2451	1518.3221	1375.9495	1142.9259	866.6081	567.7451	364.4840	384.2920	619.0637	962.1872	1287.8969	1578.1510 (97)
Space heating kWh	596.4981	405.7258	282.9306	109.2675	25.8704	0.0000	0.0000	0.0000	0.0000	137.2615	365.5700	590.6246 (98a)
Space heating requirement - total per year (kWh/year)												2513.7485
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	596.4981	405.7258	282.9306	109.2675	25.8704	0.0000	0.0000	0.0000	0.0000	137.2615	365.5700	590.6246 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2513.7485
Space heating per m2										(98c) / (4) =		24.7270 (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 %) 323.7828 (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	596.4981	405.7258	282.9306	109.2675	25.8704	0.0000	0.0000	0.0000	0.0000	137.2615	365.5700	590.6246 (98)
Space heating efficiency (main heating system 1)	323.7828	323.7828	323.7828	323.7828	323.7828	0.0000	0.0000	0.0000	0.0000	323.7828	323.7828	323.7828 (210)
Space heating fuel (main heating system)	184.2279	125.3080	87.3828	33.7471	7.9900	0.0000	0.0000	0.0000	0.0000	42.3931	112.9059	182.4138 (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	339.9781	284.6267	257.9340	188.5752	145.5845	126.3224	122.1405	146.7126	185.0767	250.1769	300.1573	335.9650 (64)
Efficiency of water heater (217)m	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013	171.4013 (216)
Fuel for water heating, kWh/month												171.4013 (217)

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	198.3520	166.0586	150.4854	110.0197	84.9378	73.6998	71.2599	85.5960	107.9786	145.9597	175.1196	196.0108	(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	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	28.5610	22.9127	20.6303	15.1147	11.6750	9.5386	10.6503	13.8437	17.9816	23.5928	26.6480	29.3548	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-38.5272	-57.4233	-85.7281	-97.7215	-105.0005	-98.0448	-96.5483	-90.9639	-80.1970	-66.0862	-43.1936	-32.8942	(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												776.3688	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												171.4013	
Water heating fuel used												1565.4778	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												230.5033	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-892.3287	(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												1760.0212	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	776.3688	16.4900	128.0232	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1565.4778	16.4900	258.1473	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	230.5033	16.4900	38.0100	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-892.3287	16.4900	-147.1450	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-147.1450	(252)
Total energy cost			290.2275	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.7124	(257)
SAP value		88.4519	
SAP rating (Section 12)		88	(258)
SAP band		B	

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	776.3688	0.1570	121.8762	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1565.4778	0.1448	226.6269	(264)
Space and water heating			348.5032	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	230.5033	0.1443	33.2688	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-892.3287	0.1342	-119.7443	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-119.7443	(269)
Total CO2, kg/year			273.1246	(272)
CO2 emissions per m2			2.6900	(273)
EI value			97.5045	
EI rating			98	(274)
EI band			A	

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1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	37.6200 (1b)	x 2.6000 (2b)	= 97.8120 (1b) - (3b)
First floor	37.6200 (1c)	x 2.8000 (2c)	= 105.3360 (1c) - (3c)
Second floor	26.4200 (1d)	x 2.1700 (2d)	= 57.3314 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.4794 (5)

2. Ventilation rate

		m ³ per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	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) = 0.1152 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50		4.5000 (17)
Infiltration rate		0.3402 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2891 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.7000	3.5000	3.4000	3.2000	3.1000	2.8000	3.0000	2.7000	2.6000	2.8000	2.9000	3.2000 (22)
Wind factor	0.9250	0.8750	0.8500	0.8000	0.7750	0.7000	0.7500	0.6750	0.6500	0.7000	0.7250	0.8000 (22a)
Adj infiltr rate												
Effective ac	0.2675	0.2530	0.2458	0.2313	0.2241	0.2024	0.2169	0.1952	0.1879	0.2024	0.2096	0.2313 (22b)
	0.5358	0.5320	0.5302	0.5268	0.5251	0.5205	0.5235	0.5190	0.5177	0.5205	0.5220	0.5268 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			8.9600	1.1450	10.2595		(27)
Half glazed door			1.7800	1.0000	1.7800		(26a)
Bi-fold (Uw = 1.20)			6.0800	1.1450	6.9618		(27)
E			2.0900	1.2357	2.5827		(27a)
Ground floor			37.6200	0.1300	4.8906	110.0000	4138.2000 (28a)
External wall	69.2900	15.4100	53.8800	0.1600	8.6208	150.0000	8082.0000 (29a)
Dormer wall	8.7200	1.4100	7.3100	0.1800	1.3158	9.0000	65.7900 (29a)
Secondary wall	10.2300		10.2300	0.1800	1.8414	9.0000	92.0700 (29a)
Sloped roof	28.6700	2.0900	26.5800	0.1500	3.9870	9.0000	239.2200 (30)
Dormer sloped roof	1.8400		1.8400	0.1500	0.2760	9.0000	16.5600 (30)
Secondary plane roof	11.2000		11.2000	0.1500	1.6800	9.0000	100.8000 (30)
Total net area of external elements Aum(A, m ²)			167.5700				(31)
Fabric heat loss, W/K = Sum (A x k)					(26)...(30) + (32) =	44.1957	(33)
Party wall			118.6300	0.0000	0.0000	70.0000	8304.1000 (32)
Internal stud wall			200.5600			9.0000	1805.0400 (32c)
First floor			37.6200			18.0000	677.1600 (32d)
Second floor			26.4200			18.0000	475.5600 (32d)
Ground floor ceiling			37.6200			9.0000	338.5800 (32e)
First floor ceiling			26.4200			9.0000	237.7800 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 24572.8600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							241.7161 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	10.3100	0.0120	0.1237
E3 Sill	6.6500	0.0150	0.0998
E4 Jamb	24.9800	0.0260	0.6495
E5 Ground floor (normal)	10.2600	0.0720	0.7387
E6 Intermediate floor within a dwelling	22.7600	0.0200	0.4552
E11 Eaves (insulation at rafter level)	8.5800	0.0200	0.1716
E13 Gable (insulation at rafter level)	4.5300	0.0410	0.1857
E16 Corner (normal)	17.9000	0.0320	0.5728
E17 Corner (inverted - internal area greater than external area)	4.4000	-0.0530	-0.2332
P1 Party wall - Ground floor	17.3400	0.0720	1.2485
P2 Party wall - Intermediate floor within a dwelling	17.3400	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	11.5200	0.4800	5.5296
R1 Head of roof window	2.0400	0.2400	0.4896
R2 Sill of roof window	2.0400	0.2400	0.4896
R3 Jamb of roof window	3.6800	0.2400	0.8832

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

Point Thermal bridges	(36a) =	11.4043 (36)
Total fabric heat loss	(33) + (36) + (36a) =	55.6000 (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
	46.0536	45.7302	45.5753	45.2788	45.1373	44.7398	45.0003	44.6163	44.4973	44.7398	44.8678	45.2788 (38)
Heat transfer coeff	101.6536	101.3302	101.1752	100.8788	100.7373	100.3398	100.6003	100.2163	100.0972	100.3398	100.4678	100.8788 (39)
Average = Sum(39)m / 12 =												100.7262

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9999	0.9968	0.9952	0.9923	0.9909	0.9870	0.9896	0.9858	0.9846	0.9870	0.9883	0.9923 (40)

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HLP (average)	31	28	31	30	31	30	31	31	30	31	30	0.9908
Days in mont												31

4. Water heating energy requirements (kWh/year)												

Assumed occupancy												2.7544 (42)
Hot water usage for mixer showers												105.1977 (42a)
Hot water usage for baths												30.2954 (42b)
Hot water usage for other uses												42.8375 (42c)
Average daily hot water use (litres/day)												164.4889 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	178.8380	175.2418	170.7358	163.5812	157.8804	151.7080	149.1125	153.5966	158.3575	164.8664	172.1402	178.3306 (44)
Energy content (annual)	283.2357	249.5420	262.4145	223.9344	212.5374	186.5427	180.3386	190.1846	195.2706	223.7222	245.2453	279.2226 (45)
Distribution loss (46)m = 0.15 x (45)m	42.4853	37.4313	39.3622	33.5902	31.8806	27.9814	27.0508	28.5277	29.2906	33.5583	36.7868	41.8834 (46)
Water storage loss:												200.0000 (47)
Store volume												2.0000 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												1.0800 (55)
Enter (49) or (54) in (55)												
Total storage loss	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (56)
If cylinder contains dedicated solar storage	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	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	339.9781	300.7932	317.7612	272.0928	256.4855	228.8479	224.0541	234.8306	244.7797	279.0688	300.1573	335.9650 (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)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												724.4475 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												724.4475
Solar input	-0.0000	-16.7813	-61.0863	-89.1631	-114.6825	-115.2667	-113.8725	-100.6600	-69.9976	-38.6371	-4.3004	-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	339.9781	284.0119	256.6749	182.9298	141.8030	113.5812	110.1816	134.1706	174.7821	240.4317	295.8569	335.9650 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	139.5698	123.9737	131.5302	112.9849	105.8271	95.8697	94.9350	98.9532	104.5348	118.6650	125.4737	138.2354 (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	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622	165.2622 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.6301	28.9818	23.5696	17.8437	13.3384	11.2608	12.1677	15.8160	21.2283	26.9541	31.4595	33.5370 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	386.5430	390.5541	380.4462	358.9278	331.7646	306.2351	289.1798	285.1687	295.2765	316.7950	343.9581	369.4877 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806	54.2806 (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)	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748	-110.1748 (71)
Water heating gains (Table 5)	187.5938	184.4846	176.7878	156.9235	142.2408	133.1523	127.6008	133.0016	145.1872	159.4959	174.2690	185.8003 (72)
Total internal gains	716.1349	713.3885	690.1716	643.0630	596.7118	560.0162	538.3162	543.3543	571.0600	612.6130	659.0546	698.1930 (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				
East			2.8500	22.2970	0.6300	0.7000	0.7700	19.4206 (76)				
West			6.1100	22.2970	0.6300	0.7000	0.7700	41.6351 (80)				
East			6.0800	22.2970	0.6300	0.7000	0.7700	41.4307 (76)				
East			2.0900	30.4656	0.7600	0.7000	1.0000	30.4866 (82)				

Solar gains	132.9731	231.6205	387.4633	591.6727	713.9719	787.2728	744.7445	641.7582	494.2690	308.1290	170.2343	108.0564 (83)
Total gains	849.1080	945.0090	1077.6350	1234.7357	1310.6837	1347.2890	1283.0608	1185.1125	1065.3290	920.7420	829.2889	806.2494 (84)

7. Mean internal temperature (heating season)												

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	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	67.1476	67.3619	67.4651	67.6633	67.7584	68.0268	67.8506	68.1107	68.1916	68.0268	67.9401	67.6633
alpha	5.4765	5.4908	5.4977	5.5109	5.5172	5.5351	5.5234	5.5407	5.5461	5.5351	5.5293	5.5109
util living area	0.9845	0.9716	0.9231	0.7889	0.5780	0.3494	0.2195	0.2452	0.5103	0.8386	0.9645	0.9872 (86)
Living	20.3169	20.4319	20.6501	20.8472	20.9286	20.9432	20.9438	20.9439	20.9383	20.8343	20.5536	20.3013
Non living	19.3024	19.4481	19.7134	19.9329	20.0089	20.0220	20.0200	20.0233	20.0217	19.9304	19.6073	19.2884
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	20.6505	20.4319	20.6501	20.8472	20.9286	20.9432	20.9438	20.9439	20.9383	20.8343	20.5536	20.3991 (87)
Th 2	20.0834	20.0860	20.0873	20.0897	20.0909	20.0942	20.0920	20.0952	20.0962	20.0942	20.0931	20.0897 (88)
util rest of house	0.9798	0.9634	0.9023	0.7442	0.5149	0.2824	0.1483	0.1687	0.4295	0.7893	0.9522	0.9833 (89)
MIT 2	19.7720	19.4481	19.7134	19.9329	20.0089	20.0220	20.0200	20.0233	20.0217	19.9304	19.6073	19.4328 (90)
Living area fraction									FLA = Living area / (4) = 0.1829 (91)			
MIT	19.9327	19.6280	19.8847	20.1001	20.1771	20.1905	20.1889	20.1917	20.1893	20.0957	19.7803	19.6095 (92)
Temperature adjustment												0.0000
adjusted MIT	19.9327	19.6280	19.8847	20.1001	20.1771	20.1905	20.1889	20.1917	20.1893	20.0957	19.7803	19.6095 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9789	0.9582	0.8969	0.7447	0.5211	0.2895	0.1559	0.1769	0.4380	0.7894	0.9470	0.9806 (94)
Useful gains	831.2162	905.5317	966.5313	919.5034	682.9361	390.0753	200.0788	209.6097	466.5886	726.7925	785.3089	790.6158 (95)
Ext temp.	5.4000	5.9000	7.7000	10.2000	13.3000	16.3000	18.2000	18.1000	15.5000	12.0000	8.4000	5.5000 (96)
Heat loss rate W	1477.2989	1391.0582	1232.7872	998.7066	692.7795	390.3672	200.0847	209.6214	469.3885	812.3211	1143.3568	1423.3484 (97)
Space heating kWh	480.6855	326.2738	198.0943	57.0263	7.3235	0.0000	0.0000	0.0000	0.0000	63.6333	257.7945	470.7531 (98a)
Space heating requirement - total per year (kWh/year)												1861.5844
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	480.6855	326.2738	198.0943	57.0263	7.3235	0.0000	0.0000	0.0000	0.0000	63.6333	257.7945	470.7531 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1861.5844
Space heating per m2										(98c) / (4) =		18.3119 (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 %)												323.6049 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	480.6855	326.2738	198.0943	57.0263	7.3235	0.0000	0.0000	0.0000	0.0000	63.6333	257.7945	470.7531 (98)
Space heating efficiency (main heating system 1)	323.6049	323.6049	323.6049	323.6049	323.6049	0.0000	0.0000	0.0000	0.0000	323.6049	323.6049	323.6049 (210)
Space heating fuel (main heating system)	148.5409	100.8247	61.2149	17.6222	2.2631	0.0000	0.0000	0.0000	0.0000	19.6639	79.6634	145.4716 (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	339.9781	284.0119	256.6749	182.9298	141.8030	113.5812	110.1816	134.1706	174.7821	240.4317	295.8569	335.9650 (64)
Efficiency of water heater	171.3249	171.3249	171.3249	171.3249	171.3249	171.3249	171.3249	171.3249	171.3249	171.3249	171.3249	171.3249 (216)
Fuel for water heating, kWh/month	198.4405	165.7738	149.8176	106.7736	82.7685	66.2958	64.3115	78.3135	102.0179	140.3367	172.6876	196.0982 (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	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	28.5610	22.9127	20.6303	15.1147	11.6750	9.5386	10.6503	13.8437	17.9816	23.5928	26.6480	29.3548 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-42.0968	-56.4458	-84.4035	-98.3610	-104.8634	-101.6535	-99.8537	-94.8737	-84.2684	-70.0721	-47.8176	-35.6778 (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												575.2646 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												171.3249
Water heating fuel used												1523.6351 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												80.0000 (230g)
pump for solar water heating												80.0000 (231)
Total electricity for the above, kWh/year												230.5033 (232)
Electricity for lighting (calculated in Appendix L)												

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Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-920.3872	(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	1489.0159	(238)

10a. Fuel costs - using BEDF prices (531)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	575.2646	21.5100	123.7394 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1523.6351	21.5100	327.7339 (247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	21.5100	17.2080 (249)
Energy for lighting	230.5033	21.5100	49.5813 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-920.3872	21.5100	-197.9753
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-197.9753 (252)
Total energy cost			320.2873 (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	575.2646	0.1581	90.9440 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1523.6351	0.1453	221.4227 (264)
Space and water heating			312.3668 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	230.5033	0.1443	33.2688 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-920.3872	0.1341	-123.4689
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-123.4689 (269)
Total CO2, kg/year			233.2636 (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	575.2646	1.5852	911.9148 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1523.6351	1.5376	2342.6811 (278)
Space and water heating			3254.5960 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	230.5033	1.5338	353.5537 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-920.3872	1.4958	-1376.6792
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1376.6792 (283)
Total Primary energy kWh/year			2352.4944 (286)

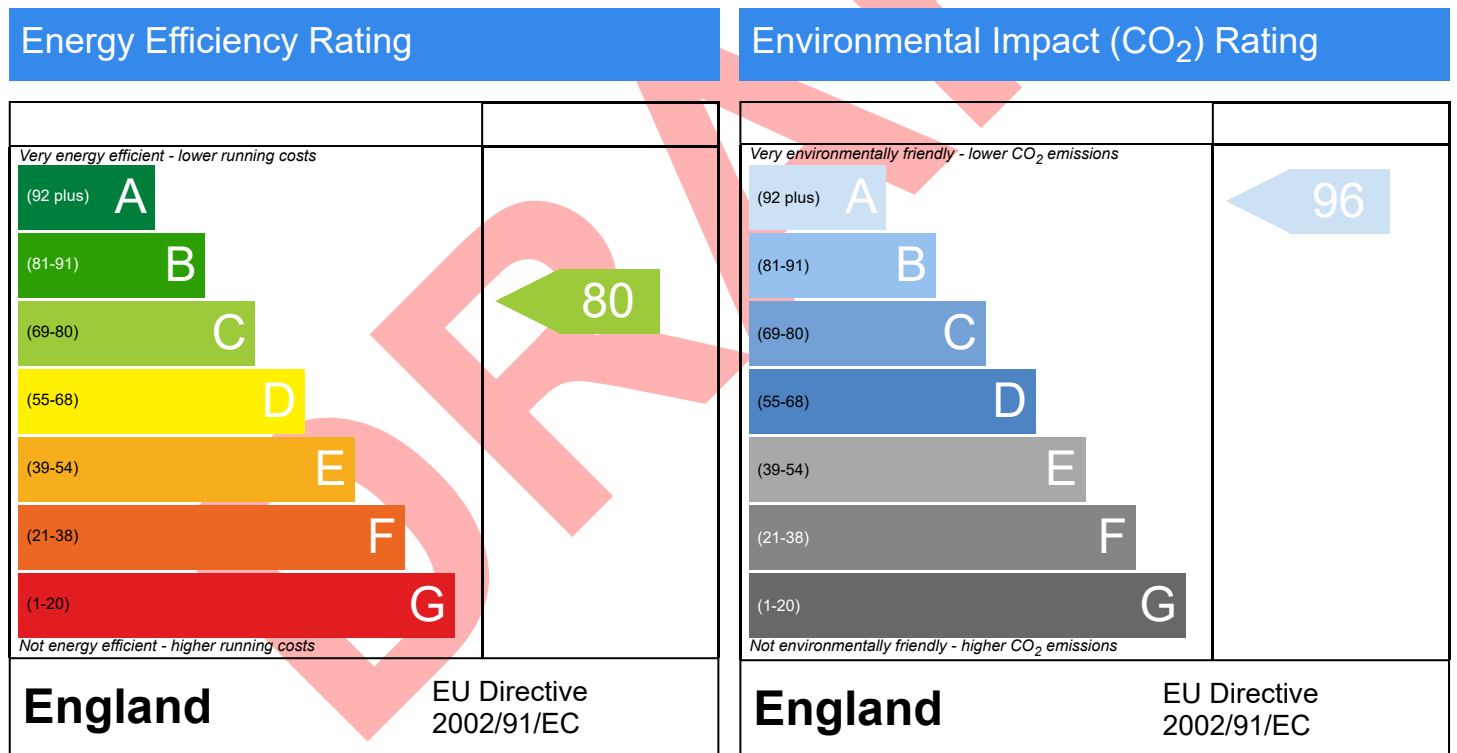
Predicted Energy Assessment



House 1, 10 Palmerston Road, Sutton, Surrey, SM1 4QL Dwelling type: House, Mid-Terrace
 Date of assessment: 01/12/2023
 Produced by: Kyle Jones
 Total floor area: 101.66 m²
 DRRN:

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

The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) 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 (CO₂) 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: Fri 01 Dec 2023 16:17:49

Project Information			
Assessed By	Kyle Jones	Building Type	House, End-terrace
OCDEA Registration	EES/027281	Assessment Date	2023-12-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	103 m ²
Site Reference	304434 - House 4	Plot Reference	304434 - House 4
Address	House 1 10 Palmerston Road, Sutton, SM1 4QL		

Client Details	
Name	Canopy Planning
Company	Canopy Planning
Address	5 Palmerston Court, Palmerston Road, Sutton, SM1 4QL

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	11.54 kgCO ₂ /m ²	
Dwelling carbon dioxide emission rate	4.83 kgCO ₂ /m ²	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	60.38 kWh _{PE} /m ²	
Dwelling primary energy	50.84 kWh _{PE} /m ²	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	39.0 kWh/m ²	
Dwelling fabric energy efficiency	37.1 kWh/m ²	OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.16	Walls (2) (0.18)	OK
Party walls	0.2	0	Party Wall (1) (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	0.13	Ground floor (0.13)	OK
Roofs	0.16	0.15	Roof (1) (0.15)	OK
Windows, doors, and roof windows	1.6	1.18	W (1.2)	OK
Rooflights	2.2	1.3	E, East (1.3)	OK

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	Net area [m ²]	U-Value [W/m ² K]
Exposed wall: Walls (1)	103.6	0.16
Exposed wall: Walls (2)	7.31	0.18
Exposed wall: Walls (3)	10.53	0.18
Party wall: Party Wall (1)	57.85	0 (!)
Ground floor: Ground floor, Ground floor	38.23	0.13
Exposed roof: Roof (1)	26.4	0.15
Exposed roof: Roof (2)	1.84	0.15
Exposed roof: Roof (3)	11.97	0.15

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
W, Window	4.7	West	0.7	1.2
W, Half glazed door	1.78	West	N/A	1 (!)
W, Window	1.41	West	0.7	1.2
E, Roof-light	2.09	East	0.7	1.3
E, Bi-fold	6.08	East	0.7	1.2
E, Window	2.85	East	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)	Government-approved scheme	0.012 (!)	
External wall	E3: Sill	Government-approved scheme	0.015 (!)	
External wall	E4: Jamb	Government-approved scheme	0.026 (!)	
External wall	E5: Ground floor (normal)	Government-approved scheme	0.072	
External wall	E6: Intermediate floor within a dwelling	Government-approved scheme	0.02 (!)	
External wall	E11: Eaves (insulation at rafter level)	Government-approved scheme	0.02 (!)	
External wall	E13: Gable (insulation at rafter level)	Government-approved scheme	0.041	
External wall	E16: Corner (normal)	Government-approved scheme	0.032 (!)	
External wall	E17: Corner (inverted - internal area greater than external area)	Government-approved scheme	-0.053	
Party wall	P1: Ground floor	Government-approved scheme	0.072	
Party wall	P2: Intermediate floor within a dwelling	SAP table default	0 (!)	
Party wall	P4: Roof (insulation at ceiling level)	SAP table default	0.48	
Roof	R1: Head of roof window	SAP table default	0.24	
Roof	R2: Sill of roof window	SAP table default	0.24	
Roof	R3: Jamb of roof window	SAP table default	0.24	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))				
Maximum permitted air permeability at 50Pa		8 m ³ /hm ²		
Dwelling air permeability at 50Pa		5 m ³ /hm ² , Design value		OK
Air permeability test certificate reference				

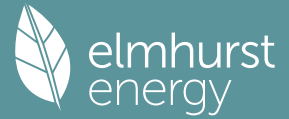
4 Space heating	
Main heating system 1: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	264.4%
Emitter type	Both radiators and underfloor
Flow temperature	45°C
System type	Heat Pump
Manufacturer	Grant Engineering (UK) Ltd
Model	AERONA3
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	200 litres
Declared heat loss	2 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		
System type: N/A		
Maximum permitted specific fan power	N/A	
Specific fan power	N/A	N/A
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model		
Commissioning		
9 Local generation		
N/A		
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	304434 - House 4		Issued on Date	01/12/2023	
Assessment Reference	304434 - House 4	Prop Type Ref	304434		
Property	House 1, 10 Palmerston Road, Sutton, Surrey, SM1 4QL				
SAP Rating	78 C	DER	4.83	TER	11.54
Environmental	96 A	% DER < TER			58.15
CO ₂ Emissions (t/year)	0.44	DFEE	37.12	TFEE	39.02
Compliance Check	See BREL	% DFEE < TFEE			4.86
% DPER < TPER	15.79	DPER	50.84	TPER	60.38
Assessor Details	Mr. Kyle Jones			Assessor ID	AV53-0001
Client	304434, Canopy Planning				

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	38.2300 (1b)	x 2.6000 (2b)	= 99.3980 (1b) - (3b)
First floor	38.2300 (1c)	x 2.8000 (2c)	= 107.0440 (1c) - (3c)
Second floor	26.2600 (1d)	x 2.1700 (2d)	= 56.9842 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.7200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 263.4262 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	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) = 0.1139 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3639 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3093 (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	0.3944	0.3866	0.3789	0.3402	0.3325	0.2938	0.2938	0.2861	0.3093	0.3325	0.3480	0.3634 (22b)
Effective ac	0.5778	0.5747	0.5718	0.5579	0.5553	0.5432	0.5432	0.5409	0.5478	0.5553	0.5605	0.5660 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			8.9600	1.1450	10.2595		(27)
Half glazed door			1.7800	1.0000	1.7800		(26a)
Bi-fold (Uw = 1.20)			6.0800	1.1450	6.9618		(27)
E			2.0900	1.2357	2.5827		(27a)
Ground floor			38.2300	0.1300	4.9699	110.0000	4205.3000 (28a)
External wall	119.0100	15.4100	103.6000	0.1600	16.5760	150.0000	15540.0000 (29a)
Dormer wall	8.7200	1.4100	7.3100	0.1800	1.3158	9.0000	65.7900 (29a)
Secondary wall	10.5300		10.5300	0.1800	1.8954	9.0000	94.7700 (29a)
Sloped roof	28.4900	2.0900	26.4000	0.1500	3.9600	9.0000	237.6000 (30)
Dormer sloped roof	1.8400		1.8400	0.1500	0.2760	9.0000	16.5600 (30)
Secondary plane roof	11.9700		11.9700	0.1500	1.7955	9.0000	107.7300 (30)
Total net area of external elements Aum (A, m ²)			218.7900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	52.3727	(33)
Party wall			57.8500	0.0000	0.0000	70.0000	4049.5000 (32)
Internal stud wall			200.5600			9.0000	1805.0400 (32c)
First floor			38.2300			18.0000	688.1400 (32d)
Second floor			26.2600			18.0000	472.6800 (32d)
Ground floor ceiling			38.2300			9.0000	344.0700 (32e)

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First floor ceiling 26.2600 9.0000 236.3400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 27863.5200 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 271.2570 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	10.3100	0.0120	0.1237
E3 Sill	6.6500	0.0150	0.0998
E4 Jamb	24.9800	0.0260	0.6495
E5 Ground floor (normal)	19.0600	0.0720	1.3723
E6 Intermediate floor within a dwelling	37.9700	0.0200	0.7594
E11 Eaves (insulation at rafter level)	8.7200	0.0200	0.1744
E13 Gable (insulation at rafter level)	11.9400	0.0410	0.4895
E16 Corner (normal)	24.5000	0.0320	0.7840
E17 Corner (inverted - internal area greater than external area)	4.4000	-0.0530	-0.2332
P1 Party wall - Ground floor	8.6600	0.0720	0.6235
P2 Party wall - Intermediate floor within a dwelling	8.6600	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	5.1100	0.4800	2.4528
R1 Head of roof window	2.0400	0.2400	0.4896
R2 Sill of roof window	2.0400	0.2400	0.4896
R3 Jamb of roof window	3.6800	0.2400	0.8832

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.1581 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 61.5308 (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	50.2250	49.9625	49.7052	48.4968	48.2707	47.2181	47.2181	47.0232	47.6235	48.2707	48.7281	49.2063 (38)
Average = Sum(39)m / 12 =	111.7558	111.4933	111.2360	110.0276	109.8015	108.7489	108.7489	108.5540	109.1543	109.8015	110.2589	110.7371 (39)
HLP	1.0880	1.0854	1.0829	1.0711	1.0689	1.0587	1.0587	1.0568	1.0626	1.0689	1.0734	1.0780 (40)
HLP (average)												1.0711
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7633 (42)

Hot water usage for mixer showers	105.8274	104.2370	101.9195	97.4854	94.2131	90.5639	88.4897	90.7897	93.3108	97.2290	101.7583	105.4219 (42a)
Hot water usage for baths	30.4627	30.0103	29.3732	28.1985	27.3189	26.3436	25.8168	26.4494	27.1382	28.1819	29.3807	30.3597 (42b)
Hot water usage for other uses	42.9291	41.3681	39.8070	38.2460	36.6849	35.1238	35.1238	36.6849	38.2460	39.8070	41.3681	42.9291 (42c)
Average daily hot water use (litres/day)												164.8395 (43)
Daily hot water use	179.2192	175.6154	171.0997	163.9299	158.2169	152.0314	149.4303	153.9240	158.6951	165.2179	172.5072	178.7108 (44)
Energy content (annual)	283.8394	250.0739	262.9739	224.4118	212.9904	186.9403	180.7230	190.5900	195.6869	224.1991	245.7681	279.8179 (45)
Distribution loss (46)m = 0.15 x (45)m	42.5759	37.5111	39.4461	33.6618	31.9486	28.0410	27.1085	28.5885	29.3530	33.6299	36.8652	41.9727 (46)
Water storage loss:												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0800 (55)
Total storage loss	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (56)
If cylinder contains dedicated solar storage	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (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	340.5818	301.3251	319.7163	279.3238	269.7328	241.8523	237.4654	247.3324	250.5989	280.9415	300.6801	336.5603 (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	340.5818	301.3251	319.7163	279.3238	269.7328	241.8523	237.4654	247.3324	250.5989	280.9415	300.6801	336.5603 (64)
12Total per year (kWh/year)												3406.1107 (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	139.7705	124.1505	132.8327	118.5465	116.2132	106.0872	105.4843	108.7651	108.9955	119.9401	125.6475	138.4334 (65)

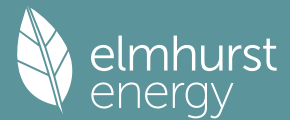
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	135.4593	149.9728	135.4593	139.9746	135.4593	139.9746	135.4593	135.4593	139.9746	135.4593	139.9746	135.4593 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	260.6515	263.3562	256.5404	242.0302	223.7137	206.4987	194.9981	192.2934	199.1092	213.6194	231.9359	249.1509 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.8166	36.8166	36.8166	36.8166	36.8166	36.8166	36.8166	36.8166	36.8166	36.8166	36.8166	36.8166 (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)	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328 (71)
Water heating gains (Table 5)	187.8636	184.7478	178.5386	164.6479	156.2006	147.3434	141.7800	146.1897	151.3826	161.2098	174.5104	186.0663 (72)
Total internal gains	648.4242	662.5267	634.9881	611.1025	579.8233	558.2665	536.6872	538.3921	554.9162	574.7383	610.8707	635.1263 (73)

6. Solar gains

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[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
East					2.8500	19.6403	0.6300	0.7000	0.7700	17.1066 (76)		
West					6.1100	19.6403	0.6300	0.7000	0.7700	36.6742 (80)		
East					6.0800	19.6403	0.6300	0.7000	0.7700	36.4941 (76)		
East					2.0900	26.6072	0.7600	0.7000	1.0000	26.6256 (82)		
Solar gains	116.9005	230.4262	383.8404	566.6973	700.6605	719.9826	684.3298	583.7038	448.6596	274.5643	146.0736	95.9340 (83)
Total gains	765.3247	892.9528	1018.8285	1177.7998	1280.4838	1278.2492	1221.0170	1122.0959	1003.5758	849.3026	756.9443	731.0603 (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	69.2569	69.4200	69.5806	70.3448	70.4897	71.1719	71.1719	71.2997	70.9076	70.4897	70.1972	69.8941
alpha	5.6171	5.6280	5.6387	5.6897	5.6993	5.7448	5.7448	5.7533	5.7272	5.6993	5.6798	5.6596
util living area	0.9960	0.9900	0.9710	0.8973	0.7405	0.5368	0.3908	0.4427	0.7082	0.9450	0.9907	0.9969 (86)
Living	20.1264	20.2693	20.4823	20.7415	20.8913	20.9387	20.9450	20.9441	20.9142	20.6932	20.3638	20.1050
Non living	18.9939	19.1770	19.4453	19.7603	19.9156	19.9618	19.9651	19.9665	19.9431	19.7150	19.3062	18.9731
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	20.5531	20.2693	20.4823	20.7415	20.8913	20.9387	20.9450	20.9441	20.9142	20.6932	20.3638	20.2302 (87)
Th 2	20.0107	20.0128	20.0148	20.0245	20.0263	20.0347	20.0347	20.0363	20.0315	20.0263	20.0226	20.0188 (88)
util rest of house	0.9947	0.9866	0.9611	0.8664	0.6805	0.4594	0.3057	0.3512	0.6255	0.9208	0.9869	0.9958 (89)
MIT 2	19.6053	19.1770	19.4453	19.7603	19.9156	19.9618	19.9651	19.9665	19.9431	19.7150	19.3062	19.1615 (90)
Living area fraction	fLA = Living area / (4) =											0.1839 (91)
MIT	19.7796	19.3779	19.6360	19.9407	20.0950	20.1414	20.1453	20.1463	20.1217	19.8949	19.5007	19.3581 (92)
Temperature adjustment												0.0000
adjusted MIT	19.7796	19.3779	19.6360	19.9407	20.0950	20.1414	20.1453	20.1463	20.1217	19.8949	19.5007	19.3581 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9943	0.9837	0.9564	0.8633	0.6850	0.4681	0.3155	0.3617	0.6337	0.9168	0.9842	0.9949 (94)
Useful gains	760.9329	878.4144	974.3981	1016.8422	877.1838	598.3597	385.1988	405.9150	635.9643	778.6399	744.9584	727.3081 (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	1729.9364	1614.1868	1461.1950	1214.7847	921.7838	602.6235	385.5499	406.6705	657.2949	1020.5950	1367.2867	1678.5584 (97)
Space heating kWh	720.9386	494.4390	362.1769	142.5186	33.1824	0.0000	0.0000	0.0000	0.0000	180.0146	448.0764	707.7302 (98a)
Space heating requirement - total per year (kWh/year)												3089.0766
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	720.9386	494.4390	362.1769	142.5186	33.1824	0.0000	0.0000	0.0000	0.0000	180.0146	448.0764	707.7302 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3089.0766
Space heating per m2												(98c) / (4) = 30.0728 (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 %)												264.4181 (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	720.9386	494.4390	362.1769	142.5186	33.1824	0.0000	0.0000	0.0000	0.0000	180.0146	448.0764	707.7302 (98)
Space heating efficiency (main heating system 1)	264.4181	264.4181	264.4181	264.4181	264.4181	0.0000	0.0000	0.0000	0.0000	264.4181	264.4181	264.4181 (210)
Space heating fuel (main heating system)	272.6510	186.9914	136.9713	53.8989	12.5492	0.0000	0.0000	0.0000	0.0000	68.0795	169.4575	267.6557 (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	340.5818	301.3251	319.7163	279.3238	269.7328	241.8523	237.4654	247.3324	250.5989	280.9415	300.6801	336.5603 (64)
Efficiency of water heater												171.5938 (216)
(217)m	171.5938	171.5938	171.5938	171.5938	171.5938	171.5938	171.5938	171.5938	171.5938	171.5938	171.5938	171.5938 (217)
Fuel for water heating, kWh/month	198.4815	175.6038	186.3216	162.7820	157.1927	140.9447	138.3882	144.1384	146.0419	163.7248	175.2279	196.1378 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	28.7978	23.1026	20.8014	15.2400	11.7718	9.6177	10.7386	13.9585	18.1307	23.7884	26.8690	29.5981 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)

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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												1168.2546	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												171.5938	
Water heating fuel used												1984.9851	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												232.4144	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												3385.6541	(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	1168.2546	0.1568	183.1562 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1984.9851	0.1410	279.9151 (264)
Space and water heating			463.0712 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	232.4144	0.1443	33.5446 (268)
Total CO2, kg/year			496.6158 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.8300 (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	1168.2546	1.5804	1846.2874 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1984.9851	1.5214	3020.0214 (278)
Space and water heating			4866.3088 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	232.4144	1.5338	356.4850 (282)
Total Primary energy kWh/year			5222.7938 (286)
Dwelling Primary energy Rate (DPER)			50.8400 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	38.2300 (1b)	x 2.6000 (2b)	= 99.3980 (1b) - (3b)
First floor	38.2300 (1c)	x 2.8000 (2c)	= 107.0440 (1c) - (3c)
Second floor	26.2600 (1d)	x 2.1700 (2d)	= 56.9842 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.7200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	263.4262 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1518 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4018 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)

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Infiltration rate adjusted to include shelter factor

$$(21) = (18) \times (20) = 0.3416 (21)$$

	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													
Effective ac	0.4355	0.4270	0.4184	0.3757	0.3672	0.3245	0.3245	0.3160	0.3416	0.3672	0.3843	0.4013	(22b)
	0.5948	0.5911	0.5875	0.5706	0.5674	0.5526	0.5526	0.5499	0.5583	0.5674	0.5738	0.5805	(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 Semi-glazed door			1.7800	1.0000	1.7800			(26a)
TER Opening Type (Uw = 1.20)			15.0400	1.1450	17.2214			(27)
E			2.0900	2.0221	4.2261			(27a)
Ground floor			38.2300	0.1300	4.9699			(28a)
External wall	119.0100	15.4100	103.6000	0.1800	18.6480			(29a)
Dormer wall	8.7200	1.4100	7.3100	0.1800	1.3158			(29a)
Secondary wall	10.5300		10.5300	0.1800	1.8954			(29a)
Sloped roof	28.4900	2.0900	26.4000	0.1100	2.9040			(30)
Dormer sloped roof	1.8400		1.8400	0.1100	0.2024			(30)
Secondary plane roof	11.9700		11.9700	0.1100	1.3167			(30)
Total net area of external elements Aum(A, m2)			218.7900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.4797			(33)
Party wall			57.8500	0.0000	0.0000			(32)

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

$$271.2570 (35)$$

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	10.3100	0.0500	0.5155	
E3 Sill	6.6500	0.0500	0.3325	
E4 Jamb	24.9800	0.0500	1.2490	
E5 Ground floor (normal)	19.0600	0.1600	3.0496	
E6 Intermediate floor within a dwelling	37.9700	0.0000	0.0000	
E11 Eaves (insulation at rafter level)	8.7200	0.0400	0.3488	
E13 Gable (insulation at rafter level)	11.9400	0.0800	0.9552	
E16 Corner (normal)	24.5000	0.0900	2.2050	
E17 Corner (inverted - internal area greater than external area)	4.4000	-0.0900	-0.3960	
P1 Party wall - Ground floor	8.6600	0.0800	0.6928	
P2 Party wall - Intermediate floor within a dwelling	8.6600	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)	5.1100	0.1200	0.6132	
R1 Head of roof window	2.0400	0.0800	0.1632	
R2 Sill of roof window	2.0400	0.0600	0.1224	
R3 Jamb of roof window	3.6800	0.0800	0.2944	

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

$$10.1456 (36)$$

Point Thermal bridges

$$(36a) = 0.0000$$

Total fabric heat loss

$$(33) + (36) + (36a) = 64.6253 (37)$$

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	51.7090	51.3888	51.0751	49.6013	49.3256	48.0419	48.0419	47.8042	48.5364	49.3256	49.8834	50.4665	(38)
Heat transfer coeff	116.3342	116.0141	115.7004	114.2266	113.9508	112.6672	112.6672	112.4295	113.1617	113.9508	114.5087	115.0918	(39)
Average = Sum(39)m / 12 =													114.2253

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1325	1.1294	1.1264	1.1120	1.1093	1.0968	1.0968	1.0945	1.1017	1.1093	1.1148	1.1204	(40)
HLP (average)												1.1120	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.7633	(42)
Hot water usage for mixer showers														
70.5516	69.4913	67.9463	64.9902	62.8087	60.3759	58.9931	60.5264	62.2072	64.8193	67.8389	70.2813	70.2813	(42a)	
Hot water usage for baths														
30.4627	30.0103	29.3732	28.1985	27.3189	26.3436	25.8168	26.4494	27.1382	28.1819	29.3807	30.3597	30.3597	(42b)	
Hot water usage for other uses														
42.9291	41.3681	39.8070	38.2460	36.6849	35.1238	35.1238	36.6849	38.2460	39.8070	41.3681	42.9291	42.9291	(42c)	
Average daily hot water use (litres/day)													132.3164	(43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	143.9434	140.8697	137.1265	131.4347	126.8126	121.8434	119.9338	123.6608	127.5914	132.8082	138.5877	143.5701	(44)	
Energy conte	227.9712	200.5966	210.7584	179.9276	170.7141	149.8207	145.0495	153.1179	157.3330	180.2195	197.4436	224.7961	(45)	
Energy content (annual)										Total = Sum(45)m =		2197.7481		
Distribution loss (46)m = 0.15 x (45)m	34.1957	30.0895	31.6138	26.9891	25.6071	22.4731	21.7574	22.9677	23.5999	27.0329	29.6165	33.7194	(46)	
Water storage loss:														
Store volume													200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6525	(48)
Temperature factor from Table 2b													0.5400	(49)
Enter (49) or (54) in (55)													0.8924	(55)
Total storage loss	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)	
If cylinder contains dedicated solar storage	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(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	278.8973	246.5943	261.6845	229.2109	221.6402	199.1040	195.9756	204.0439	206.6163	231.1456	246.7269	275.7222	(62)	
WWHRS	-32.2532	-28.5250	-29.8698	-24.7333	-23.0506	-19.6608	-18.4886	-19.6608	-20.4078	-24.0585	-27.2554	-31.6559	(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	246.6440	218.0693	231.8147	204.4775	198.5896	179.3794	177.4869	184.3831	186.2085	207.0870	219.4715	244.0662	(64)	
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2497.6780	(64)	
Electric shower(s)												2498	(64)	
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)	

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Heat gains from water heating, kWh/month
 116.5413 103.4966 110.8180 99.2526 97.5033 89.2420 88.9698 91.6525 91.7399 100.6638 105.0766 115.4856 (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	138.1659	138.1659	138.1659	138.1659	138.1659	138.1659	138.1659	138.1659	138.1659	138.1659	138.1659	138.1659 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	135.4593	149.9728	135.4593	139.9746	135.4593	139.9746	135.4593	135.4593	139.9746	135.4593	139.9746	135.4593 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	260.6515	263.3562	256.5404	242.0302	223.7137	206.4987	194.9981	192.2934	199.1092	213.6194	231.9359	249.1509 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.8166	36.8166	36.8166	36.8166	36.8166	36.8166	36.8166	36.8166	36.8166	36.8166	36.8166	36.8166 (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)	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328 (71)
Water heating gains (Table 5)	156.6415	154.0127	148.9490	137.8508	131.0528	123.9472	119.5831	123.1889	127.4165	135.3009	145.9398	155.2225 (72)
Total internal gains	620.2021	634.7916	608.3984	587.3054	557.6756	534.8704	514.4903	515.3913	530.9501	551.8294	585.3001	607.2825 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W					
East	8.9300	19.6403	0.6300	0.7000	0.7700	53.6007 (76)						
West	6.1100	19.6403	0.6300	0.7000	0.7700	36.6742 (80)						
East	2.0900	26.6072	0.6300	0.7000	1.0000	22.0713 (82)						
Solar gains	112.3461	221.2185	367.9307	542.3155	669.7275	687.8499	653.9302	558.2967	429.7733	263.4429	140.3414	92.2228 (83)
Total gains	732.5482	856.0101	976.3291	1129.6209	1227.4031	1222.7203	1168.4205	1073.6880	960.7234	815.2723	725.6415	699.5053 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	66.5313	66.7149	66.8958	67.7589	67.9229	68.6967	68.6967	68.8419	68.3965	67.9229	67.5920	67.2495
alpha	5.4354	5.4477	5.4597	5.5173	5.5282	5.5798	5.5798	5.5895	5.5598	5.5282	5.5061	5.4833
util living area	0.9969	0.9922	0.9776	0.9179	0.7785	0.5766	0.4222	0.4774	0.7481	0.9568	0.9928	0.9976 (86)
MIT	19.8108	20.0006	20.2899	20.6602	20.8974	20.9842	20.9976	20.9955	20.9388	20.6011	20.1429	19.7855 (87)
Th 2	19.9743	19.9769	19.9794	19.9910	19.9932	20.0034	20.0034	20.0053	19.9995	19.9932	19.9888	19.9842 (88)
util rest of house	0.9958	0.9895	0.9695	0.8907	0.7189	0.4927	0.3277	0.3765	0.6640	0.9363	0.9897	0.9967 (89)
MIT 2	18.5975	18.8409	19.2071	19.6617	19.9141	19.9954	20.0028	20.0039	19.9620	19.6053	19.0323	18.5724 (90)
Living area fraction	18.8206	19.0542	19.4062	19.8453	20.0949	20.1773	20.1857	20.1863	20.1416	19.7884	19.2365	18.7955 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8206	19.0542	19.4062	19.8453	20.0949	20.1773	20.1857	20.1863	20.1416	19.7884	19.2365	18.7955 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9939	0.9860	0.9636	0.8861	0.7254	0.5078	0.3452	0.3951	0.6769	0.9310	0.9865	0.9952 (94)
Useful gains	728.1055	844.0462	940.8304	1000.9095	890.3970	620.8366	403.2868	424.2268	650.3599	759.0299	715.8124	696.1469 (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	1689.2472	1642.0858	1493.2537	1250.2470	956.6108	628.3743	403.9931	425.6890	683.6787	1047.0293	1389.7366	1679.8242 (97)
Space heating kWh	715.0894	536.2826	411.0029	179.5229	49.2631	0.0000	0.0000	0.0000	0.0000	214.2715	485.2254	731.8559 (98a)
Space heating requirement - total per year (kWh/year)												3322.5138
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	715.0894	536.2826	411.0029	179.5229	49.2631	0.0000	0.0000	0.0000	0.0000	214.2715	485.2254	731.8559 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3322.5138
Space heating per m ²										(98c) / (4) =		32.3453 (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	715.0894	536.2826	411.0029	179.5229	49.2631	0.0000	0.0000	0.0000	0.0000	214.2715	485.2254	731.8559 (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)	774.7448	581.0212	445.2903	194.4994	53.3728	0.0000	0.0000	0.0000	0.0000	232.1468	525.7047	792.9100 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating														
Water heating requirement	246.6440	218.0693	231.8147	204.4775	198.5896	179.3794	177.4869	184.3831	186.2085	207.0870	219.4715	244.0662		(64)
Efficiency of water heater														(216)
(217)m	86.3038	85.9962	85.3295	83.7692	81.4406	79.8000	79.8000	79.8000	79.8000	84.1364	85.7867	86.3641		(217)
Fuel for water heating, kWh/month	285.7860	253.5800	271.6701	244.0963	243.8460	224.7862	222.4147	231.0566	233.3440	246.1326	255.8338	282.6016		(219)
Space cooling fuel requirement														
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041		(231)
Lighting	28.1458	22.5796	20.3304	14.8949	11.5053	9.3999	10.4955	13.6424	17.7202	23.2498	26.2606	28.9280		(232)
Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)m	-37.2731	-53.3446	-77.8145	-88.8093	-96.8527	-90.7520	-89.5947	-84.0298	-74.4149	-61.5568	-41.2450	-32.1291		(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(235c)
Electricity generated by PVs (Appendix M) (negative quantity)														
(233b)m	-18.7031	-39.5943	-79.1728	-119.6218	-158.8810	-159.9348	-158.0932	-133.5669	-97.4896	-56.9056	-25.0594	-14.7745		(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													3599.6900	(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													2995.1479	(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)													227.1525	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-1889.6135	(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													5018.3768	(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	3599.6900	0.2100	755.9349	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2995.1479	0.2100	628.9811	(264)
Space and water heating			1384.9160	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	227.1525	0.1443	32.7851	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-827.8165	0.1343	-111.1625	
PV Unit electricity exported	-1061.7971	0.1257	-133.4836	
Total			-244.6461	(269)
Total CO2, kg/year			1184.9842	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.5400	(273)

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

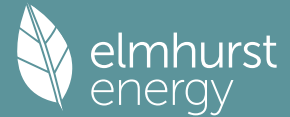
	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3599.6900	1.1300	4067.6497	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2995.1479	1.1300	3384.5171	(278)
Space and water heating			7452.1668	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	227.1525	1.5338	348.4140	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-827.8165	1.4963	-1238.6404	
PV Unit electricity exported	-1061.7971	0.4615	-489.9669	
Total			-1728.6074	(283)
Total Primary energy kWh/year			6202.0743	(286)
Target Primary Energy Rate (TPER)			60.3800	(287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
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Ground floor		38.2300 (1b)	x	2.6000 (2b)	=	99.3980 (1b)	-	(3b)
First floor		38.2300 (1c)	x	2.8000 (2c)	=	107.0440 (1c)	-	(3c)
Second floor		26.2600 (1d)	x	2.1700 (2d)	=	56.9842 (1d)	-	(3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.7200							(4)
Dwelling volume						(3a) + (3b) + (3c) + (3d) + (3e) ... (3n)	=	263.4262 (5)

2. Ventilation rate

						m3 per hour	
Number of open chimneys		0 * 80 =		0.0000	(6a)		
Number of open flues		0 * 20 =		0.0000	(6b)		
Number of chimneys / flues attached to closed fire		0 * 10 =		0.0000	(6c)		
Number of flues attached to solid fuel boiler		0 * 20 =		0.0000	(6d)		
Number of flues attached to other heater		0 * 35 =		0.0000	(6e)		
Number of blocked chimneys		0 * 20 =		0.0000	(6f)		
Number of intermittent extract fans		4 * 10 =		40.0000	(7a)		
Number of passive vents		0 * 10 =		0.0000	(7b)		
Number of flueless gas fires		0 * 40 =		0.0000	(7c)		

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1518	(8)
Pressure test				Yes
Pressure Test Method				Blower Door
Measured/design AP50				5.0000 (17)
Infiltration rate				0.4018 (18)
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3416	(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 infiltr rate	0.4355	0.4270	0.4184	0.3757	0.3672	0.3245	0.3245	0.3160	0.3416	0.3672	0.3843	0.4013	(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	0.5948	0.5911	0.5875	0.5706	0.5674	0.5526	0.5526	0.5499	0.5583	0.5674	0.5738	0.5805	(25)

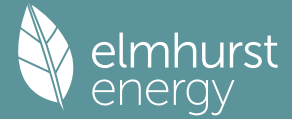
3. Heat losses and heat loss parameter

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)			8.9600	1.1450	10.2595		(27)
Half glazed door			1.7800	1.0000	1.7800		(26a)
Bi-fold (Uw = 1.20)			6.0800	1.1450	6.9618		(27)
E			2.0900	1.2357	2.5827		(27a)
Ground floor			38.2300	0.1300	4.9699	110.0000	4205.3000 (28a)
External wall	119.0100	15.4100	103.6000	0.1600	16.5760	150.0000	15540.0000 (29a)
Dormer wall	8.7200	1.4100	7.3100	0.1800	1.3158	9.0000	65.7900 (29a)
Secondary wall	10.5300		10.5300	0.1800	1.8954	9.0000	94.7700 (29a)
Sloped roof	28.4900	2.0900	26.4000	0.1500	3.9600	9.0000	237.6000 (30)
Dormer sloped roof	1.8400		1.8400	0.1500	0.2760	9.0000	16.5600 (30)
Secondary plane roof	11.9700		11.9700	0.1500	1.7955	9.0000	107.7300 (30)
Total net area of external elements Aum(A, m2)			218.7900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.3727		(33)
Party wall			57.8500	0.0000	0.0000	70.0000	4049.5000 (32)
Internal stud wall			200.5600			9.0000	1805.0400 (32c)
First floor			38.2300			18.0000	688.1400 (32d)
Second floor			26.2600			18.0000	472.6800 (32d)
Ground floor ceiling			38.2300			9.0000	344.0700 (32e)
First floor ceiling			26.2600			9.0000	236.3400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	27863.5200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							271.2570 (35)

List of Thermal Bridges				Length	Psi-value	Total
K1 Element				10.3100	0.0120	0.1237
E2 Other lintels (including other steel lintels)				6.6500	0.0150	0.0998
E3 Sill				24.9800	0.0260	0.6495
E4 Jamb				19.0600	0.0720	1.3723
E5 Ground floor (normal)				37.9700	0.0200	0.7594
E6 Intermediate floor within a dwelling				8.7200	0.0200	0.1744
E11 Eaves (insulation at rafter level)				11.9400	0.0410	0.4895
E13 Gable (insulation at rafter level)				24.5000	0.0320	0.7840
E16 Corner (normal)				4.4000	-0.0530	-0.2332
E17 Corner (inverted - internal area greater than external area)				8.6600	0.0720	0.6235
P1 Party wall - Ground floor				8.6600	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling				5.1100	0.4800	2.4528
P4 Party wall - Roof (insulation at ceiling level)				2.0400	0.2400	0.4896
R1 Head of roof window				2.0400	0.2400	0.4896
R2 Sill of roof window				3.6800	0.2400	0.8832
R3 Jamb of roof window						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)						9.1581 (36)
Point Thermal bridges						(36a) = 0.0000
Total fabric heat loss						(33) + (36) + (36a) = 61.5308 (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
	51.7090	51.3888	51.0751	49.6013	49.3256	48.0419	48.0419	47.8042	48.5364	49.3256	49.8834	50.4665 (38)
Heat transfer coeff	113.2398	112.9196	112.6059	111.1321	110.8564	109.5728	109.5728	109.3350	110.0672	110.8564	111.4142	111.9974 (39)
Average = Sum(39)m / 12 =												111.1308
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1.1024	1.0993	1.0962	1.0819	1.0792	1.0667	1.0667	1.0644	1.0715	1.0792	1.0846	1.0903 (40)
HLP (average)												1.0819
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7633 (42)	
Hot water usage for mixer showers												0.0000 (42a)	
Hot water usage for baths												30.3597 (42b)	
Hot water usage for other uses												42.9291 (42c)	
Average daily hot water use (litres/day)												67.2702 (43)	
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	73.3919	71.3784	69.1802	66.4445	64.0038	61.4674	60.9406	63.1343	65.3842	67.9889	70.7488	73.2889	(44)
Energy content (annual)	116.2348	101.6419	106.3274	90.9592	86.1615	75.5814	73.7024	78.1735	80.6253	92.2603	100.7947	114.7527	(45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1117.2148	
Water storage loss:												0.0000 (46)	
Total storage loss												0.0000 (56)	
If cylinder contains dedicated solar storage												0.0000 (57)	
Primary loss												0.0000 (59)	
Combi loss												0.0000 (61)	
Total heat required for water heating calculated for each month												98.7995 (62)	
WWHRs												0.0000 (63a)	
PV diverter												0.0000 (63b)	
Solar input												0.0000 (63c)	
FGHRs												0.0000 (63d)	
Output from w/h	98.7995	86.3956	90.3783	77.3153	73.2372	64.2442	62.6470	66.4475	68.5315	78.4212	85.6755	97.5398	(64)
12Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m = 949.6326 (64)	
Electric shower(s)												56.5000 (64a)	
Heat gains from water heating, kWh/month	38.8249	34.1844	36.3375	32.4435	31.6701	28.8059	28.8315	29.9726	30.2475	33.3482	34.9033	38.5100	(65)
												Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 642.6847 (64a)	

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	138.1659	138.1659	138.1659	138.1659	138.1659	138.1659	138.1659	138.1659	138.1659	138.1659	138.1659	138.1659	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	135.4593	149.9728	135.4593	139.9746	135.4593	139.9746	135.4593	139.9746	135.4593	139.9746	135.4593	139.9746	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	260.6515	263.3562	256.5404	242.0302	223.7137	206.4987	194.9981	192.2934	199.1092	213.6194	231.9359	249.1509	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.8166	36.8166	36.8166	36.8166	36.8166	36.8166	36.8166	36.8166	36.8166	36.8166	36.8166	36.8166	(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)	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	(71)
Water heating gains (Table 5)	52.1840	50.8696	48.8407	45.0604	42.5673	40.0082	38.7520	40.2858	42.0105	44.8228	48.4769	51.7607	(72)
Total internal gains	512.7446	528.6485	505.2901	491.5150	466.1901	450.9313	433.6591	432.4882	445.5441	458.3514	484.8372	500.8206	(73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains							
	m2	Table 6a	Specific data	Specific data	factor	W							
		W/m2	or Table 6b	or Table 6c	Table 6d								
East	2.8500	19.6403	0.6300	0.7000	0.7700	17.1066 (76)							
West	6.1100	19.6403	0.6300	0.7000	0.7700	36.6742 (80)							
East	6.0800	19.6403	0.6300	0.7000	0.7700	36.4941 (76)							
East	2.0900	26.6072	0.7600	0.7000	1.0000	26.6256 (82)							
Solar gains	116.9005	230.4262	383.8404	566.6973	700.6605	719.9826	684.3298	583.7038	448.6596	274.5643	146.0736	95.9340	(83)
Total gains	629.6451	759.0746	889.1305	1058.2122	1166.8505	1170.9140	1117.9889	1016.1920	894.2037	732.9157	630.9108	596.7546	(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	68.3494	68.5431	68.7341	69.6456	69.8189	70.6368	70.6368	70.7904	70.3195	69.8189	69.4693	69.1076	
alpha	5.5566	5.5695	5.5823	5.6430	5.6546	5.7091	5.7091	5.7194	5.6880	5.6546	5.6313	5.6072	
util living area	0.9985	0.9955	0.9844	0.9308	0.7925	0.5856	0.4292	0.4904	0.7733	0.9704	0.9962	0.9989	(86)
MIT	19.7555	19.9521	20.2524	20.6441	20.8949	20.9846	20.9978	20.9954	20.9326	20.5628	20.0901	19.7301	(87)
Th 2	19.9989	20.0014	20.0039	20.0156	20.0178	20.0281	20.0281	20.0300	20.0242	20.0178	20.0134	20.0087	(88)
util rest of house	0.9980	0.9939	0.9786	0.9068	0.7349	0.5027	0.3355	0.3895	0.6919	0.9555	0.9946	0.9985	(89)
MIT 2	18.8657	19.0635	19.3619	19.7428	19.9539	20.0220	20.0276	20.0289	19.9911	19.6776	19.2112	18.8483	(90)
Living area fraction	19.0294	19.2269	19.5257	19.9086	20.1270	20.1990	20.2060	20.2066	20.1643	19.8404	19.3728	19.0104	(91)
MIT	19.0294	19.2269	19.5257	19.9086	20.1270	20.1990	20.2060	20.2066	20.1643	19.8404	19.3728	19.0104	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0294	19.2269	19.5257	19.9086	20.1270	20.1990	20.2060	20.2066	20.1643	19.8404	19.3728	19.0104	(93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Utilisation	0.9972	0.9921	0.9750	0.9037	0.7418	0.5176	0.3528	0.4081	0.7047	0.9520	0.9930	0.9979 (94)
Useful gains	627.8951	753.0785	866.8921	956.3155	865.6025	606.1081	394.4479	414.7061	630.1192	697.7184	626.5238	595.5154 (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	1667.9497	1617.7910	1466.7669	1223.4071	934.1834	613.4967	395.1223	416.2000	667.4755	1024.3564	1367.3633	1658.7290 (97)
Space heating kWh	773.8006	581.0868	446.3068	192.3060	51.0242	0.0000	0.0000	0.0000	0.0000	243.0187	533.4045	791.0310 (98a)
Space heating requirement - total per year (kWh/year)												3611.9784
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	773.8006	581.0868	446.3068	192.3060	51.0242	0.0000	0.0000	0.0000	0.0000	243.0187	533.4045	791.0310 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3611.9784
Space heating per m2												35.1633 (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	1029.9839	810.8384	830.9464	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9263	0.9654	0.9441	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	954.0537	782.8229	784.5366	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1279.4998	1222.0714	1110.7211	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	234.3212	326.8009	242.6812	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	58.5803	81.7002	60.6703	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												200.9508 (107)
Energy for space heating												35.1633 (99)
Energy for space cooling												1.9563 (108)
Total												37.1196 (109)
Fabric Energy Efficiency (DFEE)												37.1 (109)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	38.2300 (1b)	x 2.6000 (2b)	= 99.3980 (1b) - (3b)
First floor	38.2300 (1c)	x 2.8000 (2c)	= 107.0440 (1c) - (3c)
Second floor	26.2600 (1d)	x 2.1700 (2d)	= 56.9842 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.7200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	263.4262 (5)

2. Ventilation rate

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1518 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.4018	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3416 (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	0.4355	0.4270	0.4184	0.3757	0.3672	0.3245	0.3245	0.3160	0.3416	0.3672	0.3843	0.4013 (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	0.5948	0.5911	0.5875	0.5706	0.5674	0.5526	0.5526	0.5499	0.5583	0.5674	0.5738	0.5805 (25)

3. Heat losses and heat loss parameter

Full SAP Calculation Printout



Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Semi-glazed door			1.7800	1.0000	1.7800		(26a)
TER Opening Type (Uw = 1.20)			15.0400	1.1450	17.2214		(27)
E			2.0900	2.0221	4.2261		(27a)
Ground floor			38.2300	0.1300	4.9699		(28a)
External wall	119.0100	15.4100	103.6000	0.1800	18.6480		(29a)
Dormer wall	8.7200	1.4100	7.3100	0.1800	1.3158		(29a)
Secondary wall	10.5300		10.5300	0.1800	1.8954		(29a)
Sloped roof	28.4900	2.0900	26.4000	0.1100	2.9040		(30)
Dormer sloped roof	1.8400		1.8400	0.1100	0.2024		(30)
Secondary plane roof	11.9700		11.9700	0.1100	1.3167		(30)
Total net area of external elements Aum(A, m ²)			218.7900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	54.4797	(33)
Party wall			57.8500	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 271.2570 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	10.3100	0.0500	0.5155
E3 Sill	6.6500	0.0500	0.3325
E4 Jamb	24.9800	0.0500	1.2490
E5 Ground floor (normal)	19.0600	0.1600	3.0496
E6 Intermediate floor within a dwelling	37.9700	0.0000	0.0000
E11 Eaves (insulation at rafter level)	8.7200	0.0400	0.3488
E13 Gable (insulation at rafter level)	11.9400	0.0800	0.9552
E16 Corner (normal)	24.5000	0.0900	2.2050
E17 Corner (inverted - internal area greater than external area)	4.4000	-0.0900	-0.3960
P1 Party wall - Ground floor	8.6600	0.0800	0.6928
P2 Party wall - Intermediate floor within a dwelling	8.6600	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	5.1100	0.1200	0.6132
R1 Head of roof window	2.0400	0.0800	0.1632
R2 Sill of roof window	2.0400	0.0600	0.1224
R3 Jamb of roof window	3.6800	0.0800	0.2944

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.1456 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 64.6253 (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	51.7090	51.3888	51.0751	49.6013	49.3256	48.0419	48.0419	47.8042	48.5364	49.3256	49.8834	50.4665
Average = Sum(39)m / 12 =	116.3342	116.0141	115.7004	114.2266	113.9508	112.6672	112.6672	112.4295	113.1617	113.9508	114.5087	115.0918

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1325	1.1294	1.1264	1.1120	1.1093	1.0968	1.0968	1.0945	1.1017	1.1093	1.1148	1.1204
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

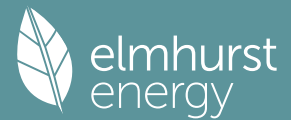
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.7633 (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	30.4627	30.0103	29.3732	28.1985	27.3189	26.3436	25.8168	26.4494	27.1382	28.1819	29.3807	30.3597	(42b)	
Hot water usage for other uses	42.9291	41.3681	39.8070	38.2460	36.6849	35.1238	35.1238	36.6849	38.2460	39.8070	41.3681	42.9291	(42c)	
Average daily hot water use (litres/day)													67.2702 (43)	
Daily hot water use	73.3919	71.3784	69.1802	66.4445	64.0038	61.4674	60.9406	63.1343	65.3842	67.9889	70.7488	73.2889	(44)	
Energy content (annual)	116.2348	101.6419	106.3274	90.9592	86.1615	75.5814	73.7024	78.1735	80.6253	92.2603	100.7947	114.7527	(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:													(56)	
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													(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	98.7995	86.3956	90.3783	77.3153	73.2372	64.2442	62.6470	66.4475	68.5315	78.4212	85.6755	97.5398	(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	98.7995	86.3956	90.3783	77.3153	73.2372	64.2442	62.6470	66.4475	68.5315	78.4212	85.6755	97.5398	(64)	
12Total per year (kWh/year)													949.6326 (64)	
Electric shower(s)													950 (64)	
Heat gains from water heating, kWh/month	56.5000	50.3420	54.9715	52.4587	53.4430	50.9795	52.6788	53.4430	52.4587	54.9715	53.9379	56.5000	(64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													642.6847 (64a)	

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	138.1659	138.1659	138.1659	138.1659	138.1659	138.1659	138.1659	138.1659	138.1659	138.1659	138.1659	138.1659
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	135.4593	149.9728	135.4593	139.9746	135.4593	139.9746	135.4593	135.4593	139.9746	135.4593	139.9746	135.4593
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	260.6515	263.3562	256.5404	242.0302	223.7137	206.4987	194.9981	192.2934	199.1092	213.6194	231.9359	249.1509
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.8166	36.8166	36.8166	36.8166	36.8166	36.8166	36.8166	36.8166	36.8166	36.8166	36.8166	36.8166
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Losses e.g. evaporation (negative values) (Table 5)	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328

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Water heating gains (Table 5)	52.1840	50.8696	48.8407	45.0604	42.5673	40.0082	38.7520	40.2858	42.0105	44.8228	48.4769	51.7607 (72)
Total internal gains	512.7446	528.6485	505.2901	491.5150	466.1901	450.9313	433.6591	432.4882	445.5441	458.3514	484.8372	500.8206 (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
East	8.9300	19.6403	0.6300	0.7000	0.7700	53.6007 (76)		
West	6.1100	19.6403	0.6300	0.7000	0.7700	36.6742 (80)		
East	2.0900	26.6072	0.6300	0.7000	1.0000	22.0713 (82)		

Solar gains	112.3461	221.2185	367.9307	542.3155	669.7275	687.8499	653.9302	558.2967	429.7733	263.4429	140.3414	92.2228 (83)
Total gains	625.0907	749.8670	873.2208	1033.8305	1135.9175	1138.7813	1087.5894	990.7849	875.3173	721.7943	625.1786	593.0434 (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	66.5313	66.7149	66.8958	67.7589	67.9229	68.6967	68.6967	68.8419	68.3965	67.9229	67.5920	67.2495
alpha	5.4354	5.4477	5.4597	5.5173	5.5282	5.5798	5.5798	5.5895	5.5598	5.5282	5.5061	5.4833
util living area	0.9986	0.9958	0.9862	0.9402	0.8160	0.6141	0.4527	0.5153	0.7953	0.9738	0.9965	0.9989 (86)
MIT	19.7068	19.8999	20.1984	20.5963	20.8692	20.9786	20.9967	20.9935	20.9165	20.5251	20.0470	19.6819 (87)
Th 2	19.9743	19.9769	19.9794	19.9910	19.9932	20.0034	20.0034	20.0053	19.9995	19.9932	19.9888	19.9842 (88)
util rest of house	0.9980	0.9943	0.9810	0.9184	0.7596	0.5269	0.3519	0.4075	0.7144	0.9601	0.9949	0.9985 (89)
MIT 2	18.7978	18.9921	19.2892	19.6786	19.9123	19.9948	20.0027	20.0037	19.9578	19.6216	19.1488	18.7808 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.9650	19.1591	19.4564	19.8474	20.0883	20.1757	20.1855	20.1857	20.1341	19.7878	19.3139	18.9465 (92)
Temperature adjustment												
adjusted MIT	18.9650	19.1591	19.4564	19.8474	20.0883	20.1757	20.1855	20.1857	20.1341	19.7878	19.3139	18.9465 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9973	0.9926	0.9775	0.9147	0.7655	0.5425	0.3705	0.4274	0.7264	0.9564	0.9934	0.9980 (94)
Useful gains	623.3989	744.3274	853.5492	945.5983	869.5112	617.7998	402.9532	423.4596	635.8700	690.3301	621.0519	591.8330 (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	1706.0377	1654.2513	1499.0603	1250.4798	955.8523	628.1985	403.9656	425.6265	682.8283	1046.9533	1398.6023	1697.2003 (97)
Space heating kWh	805.4832	611.4689	480.2602	219.5147	64.2377	0.0000	0.0000	0.0000	0.0000	265.3277	559.8363	822.3932 (98a)
Space heating requirement - total per year (kWh/year)	3828.5220											
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	805.4832	611.4689	480.2602	219.5147	64.2377	0.0000	0.0000	0.0000	0.0000	265.3277	559.8363	822.3932 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	3828.5220											
Space heating per m2	(98c) / (4) =											
	37.2714 (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	1059.0719	833.7375	854.4644	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9081	0.9548	0.9296	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	961.7649	796.0136	794.2679	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1247.3671	1191.6718	1085.3139	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	205.6336	294.3697	216.5382	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction	fC = cooled area / (4) =											
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	51.4084	73.5924	54.1346	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												
Energy for space heating												
Energy for space cooling												
Total												
Fabric Energy Efficiency (TFEE)												
	39.0 (109)											

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

1. Overall dwelling characteristics

Full SAP Calculation Printout



	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	38.2300 (1b)	x 2.6000 (2b)	= 99.3980 (1b) - (3b)
First floor	38.2300 (1c)	x 2.8000 (2c)	= 107.0440 (1c) - (3c)
Second floor	26.2600 (1d)	x 2.1700 (2d)	= 56.9842 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.7200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 263.4262 (5)

2. Ventilation rate

		m ³ per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	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) = 0.1139 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3639	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3093 (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
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
Adj infilt rate												
Effective ac	0.3944	0.3866	0.3789	0.3402	0.3325	0.2938	0.2938	0.2861	0.3093	0.3325	0.3480	0.3634
	0.5778	0.5747	0.5718	0.5579	0.5553	0.5432	0.5432	0.5409	0.5478	0.5553	0.5605	0.5660

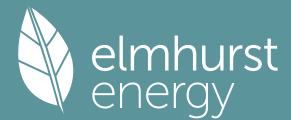
3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			8.9600	1.1450	10.2595		(27)
Half glazed door			1.7800	1.0000	1.7800		(26a)
Bi-fold (Uw = 1.20)			6.0800	1.1450	6.9618		(27)
E			2.0900	1.2357	2.5827		(27a)
Ground floor			38.2300	0.1300	4.9699	110.0000	4205.3000 (28a)
External wall	119.0100	15.4100	103.6000	0.1600	16.5760	150.0000	15540.0000 (29a)
Dormer wall	8.7200	1.4100	7.3100	0.1800	1.3158	9.0000	65.7900 (29a)
Secondary wall	10.5300		10.5300	0.1800	1.8954	9.0000	94.7700 (29a)
Sloped roof	28.4900	2.0900	26.4000	0.1500	3.9600	9.0000	237.6000 (30)
Dormer sloped roof	1.8400		1.8400	0.1500	0.2760	9.0000	16.5600 (30)
Secondary plane roof	11.9700		11.9700	0.1500	1.7955	9.0000	107.7300 (30)
Total net area of external elements Aum(A, m ²)			218.7900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.3727		(33)
Party wall			57.8500	0.0000	0.0000	70.0000	4049.5000 (32)
Internal stud wall			200.5600			9.0000	1805.0400 (32c)
First floor			38.2300			18.0000	688.1400 (32d)
Second floor			26.2600			18.0000	472.6800 (32d)
Ground floor ceiling			38.2300			9.0000	344.0700 (32e)
First floor ceiling			26.2600			9.0000	236.3400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	27863.5200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							271.2570 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element	10.3100	0.0120	0.1237
E2 Other lintels (including other steel lintels)	6.6500	0.0150	0.0998
E3 Sill	24.9800	0.0260	0.6495
E4 Jamb	19.0600	0.0720	1.3723
E5 Ground floor (normal)	37.9700	0.0200	0.7594
E6 Intermediate floor within a dwelling	8.7200	0.0200	0.1744
E11 Eaves (insulation at rafter level)	11.9400	0.0410	0.4895
E13 Gable (insulation at rafter level)	24.5000	0.0320	0.7840
E16 Corner (normal)	4.4000	-0.0530	-0.2332
E17 Corner (inverted - internal area greater than external area)	8.6600	0.0720	0.6235
P1 Party wall - Ground floor	8.6600	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	5.1100	0.4800	2.4528
P4 Party wall - Roof (insulation at ceiling level)	2.0400	0.2400	0.4896
R1 Head of roof window	2.0400	0.2400	0.4896
R2 Sill of roof window	3.6800	0.2400	0.8832
R3 Jamb of roof window			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			9.1581 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 61.5308 (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	50.2250	49.9625	49.7052	48.4968	48.2707	47.2181	47.2181	47.0232	47.6235	48.2707	48.7281	49.2063
Heat transfer coeff	111.7558	111.4933	111.2360	110.0276	109.8015	108.7489	108.7489	108.5540	109.1543	109.8015	110.2589	110.7371
Average = Sum(39)m / 12 =												110.0265
HLP	1.0880	1.0854	1.0829	1.0711	1.0689	1.0587	1.0587	1.0568	1.0626	1.0689	1.0734	1.0780
HLP (average)												1.0711
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7633 (42)
Hot water usage for mixer showers												105.4219 (42a)
Hot water usage for baths												30.3597 (42b)
Hot water usage for other uses												42.9291 (42c)
Average daily hot water use (litres/day)												164.8395 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	179.2192	175.6154	171.0997	163.9299	158.2169	152.0314	149.4303	153.9240	158.6951	165.2179	172.5072	178.7108 (44)
Energy content (annual)	283.8394	250.0739	262.9739	224.4118	212.9904	186.9403	180.7230	190.5900	195.6869	224.1991	245.7681	279.8179 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 2738.0147
Water storage loss:	42.5759	37.5111	39.4461	33.6618	31.9486	28.0410	27.1085	28.5885	29.3530	33.6299	36.8652	41.9727 (46)
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0800 (55)
Total storage loss												33.4800 (56)
If cylinder contains dedicated solar storage												33.4800 (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	340.5818	301.3251	319.7163	279.3238	269.7328	241.8523	237.4654	247.3324	250.5989	280.9415	300.6801	336.5603 (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	340.5818	301.3251	319.7163	279.3238	269.7328	241.8523	237.4654	247.3324	250.5989	280.9415	300.6801	336.5603 (64)
												Total per year (kWh/year) = Sum(64)m = 3406.1107 (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	139.7705	124.1505	132.8327	118.5465	116.2132	106.0872	105.4843	108.7651	108.9955	119.9401	125.6475	138.4334 (65)

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

Metabolic gains (Table 5), Watts												(66)m
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												32.9007 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												389.0321 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												54.3432 (69)
Pumps, fans												0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												-110.5328 (71)
Water heating gains (Table 5)												187.8636 (72)
Total internal gains												719.4060 (73)

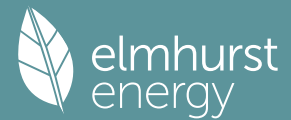
6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
East	2.8500	19.6403	0.6300	0.7000	0.7700	17.1066 (76)						
West	6.1100	19.6403	0.6300	0.7000	0.7700	36.6742 (80)						
East	6.0800	19.6403	0.6300	0.7000	0.7700	36.4941 (76)						
East	2.0900	26.6072	0.7600	0.7000	1.0000	26.6256 (82)						
Solar gains	116.9005	230.4262	383.8404	566.6973	700.6605	719.9826	684.3298	583.7038	448.6596	274.5643	146.0736	95.9340 (83)
Total gains	836.3065	947.0747	1078.6497	1220.1855	1313.8206	1296.4969	1239.0299	1142.4553	1028.2340	891.3963	808.0869	797.2920 (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)												0.9939 (86)
tau	69.2569	69.4200	69.5806	70.3448	70.4897	71.1719	71.1719	71.2997	70.9076	70.4897	70.1972	69.8941
alpha	5.6171	5.6280	5.6387	5.6897	5.6993	5.7448	5.7448	5.7533	5.7272	5.6993	5.6798	5.6596
util living area	0.9939	0.9869	0.9632	0.8849	0.7267	0.5297	0.3852	0.4350	0.6949	0.9340	0.9874	0.9953 (86)
Living	20.1775	20.3068	20.5192	20.7585	20.8962	20.9391	20.9451	20.9443	20.9171	20.7155	20.3994	20.1530
Non living	19.0588	19.2241	19.4898	19.7784	19.9196	19.9620	19.9651	19.9665	19.9450	19.7397	19.3508	19.0343
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	20.5792	20.3068	20.5192	20.7585	20.8962	20.9391	20.9451	20.9443	20.9171	20.7155	20.3994	20.2715 (87)
Th 2	20.0107	20.0128	20.0148	20.0245	20.0263	20.0347	20.0347	20.0363	20.0315	20.0263	20.0226	20.0188 (88)
util rest of house	0.9918	0.9825	0.9512	0.8518	0.6665	0.4531	0.3012	0.3450	0.6124	0.9063	0.9823	0.9936 (89)
MIT 2	19.6312	19.2241	19.4898	19.7784	19.9196	19.9620	19.9651	19.9665	19.9450	19.7397	19.3508	19.2117 (90)
Living area fraction												fLA = Living area / (4) = 0.1839 (91)
MIT	19.8055	19.4232	19.6791	19.9586	20.0992	20.1417	20.1454	20.1463	20.1238	19.9191	19.5436	19.4066 (92)
Temperature adjustment												0.0000
adjusted MIT	19.8055	19.4232	19.6791	19.9586	20.0992	20.1417	20.1454	20.1463	20.1238	19.9191	19.5436	19.4066 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9913	0.9791	0.9461	0.8493	0.6712	0.4618	0.3109	0.3554	0.6207	0.9027	0.9791	0.9923	(94)
Useful gains	829.0207	927.2946	1020.5490	1036.3227	881.8982	598.6760	385.2283	405.9905	638.2553	804.6393	791.1686	791.1498	(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	1732.8328	1619.2427	1465.9879	1216.7556	922.2425	602.6546	385.5532	406.6787	657.5187	1023.2556	1372.0225	1683.9314	(97)
Space heating kWh	672.4362	464.9891	331.4065	129.9116	30.0162	0.0000	0.0000	0.0000	0.0000	162.6506	418.2148	664.2295	(98a)
Space heating requirement - total per year (kWh/year)												2873.8545	
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	672.4362	464.9891	331.4065	129.9116	30.0162	0.0000	0.0000	0.0000	0.0000	162.6506	418.2148	664.2295	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2873.8545	
Space heating per m2												27.9776	(99)

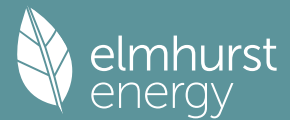
9a. Energy requirements - Individual heating systems, including micro-CHP

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 %)													264.4181	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement	672.4362	464.9891	331.4065	129.9116	30.0162	0.0000	0.0000	0.0000	0.0000	162.6506	418.2148	664.2295	(98)	
Space heating efficiency (main heating system 1)	264.4181	264.4181	264.4181	264.4181	264.4181	0.0000	0.0000	0.0000	0.0000	264.4181	264.4181	264.4181	(210)	
Space heating fuel (main heating system)	254.3079	175.8537	125.3343	49.1311	11.3518	0.0000	0.0000	0.0000	0.0000	61.5126	158.1642	251.2042	(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	340.5818	301.3251	319.7163	279.3238	269.7328	241.8523	237.4654	247.3324	250.5989	280.9415	300.6801	336.5603	(64)	
Efficiency of water heater (217)m	171.5938	171.5938	171.5938	171.5938	171.5938	171.5938	171.5938	171.5938	171.5938	171.5938	171.5938	171.5938	(216)	
Fuel for water heating, kWh/month	198.4815	175.6038	186.3216	162.7820	157.1927	140.9447	138.3882	144.1384	146.0419	163.7248	175.2279	196.1378	(219)	
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)	
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)	
Lighting	28.7978	23.1026	20.8014	15.2400	11.7718	9.6177	10.7386	13.9585	18.1307	23.7884	26.8690	29.5981	(232)	
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)	
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)	
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													1086.8600	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													171.5938	
Water heating fuel used													1984.9851	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
Total electricity for the above, kWh/year													0.0000	(231)
Electricity for lighting (calculated in Appendix L)													232.4144	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													0.0000	(233)
Wind generation													0.0000	(234)
Hydro-electric generation (Appendix N)													0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)													0.0000	(235)
Appendix Q - special features														
Energy saved or generated													-0.0000	(236)
Energy used													0.0000	(237)
Total delivered energy for all uses													3304.2595	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1086.8600	16.4900	179.2232	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1984.9851	16.4900	327.3241	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	232.4144	16.4900	38.3251	(250)
Additional standing charges			0.0000	(251)

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Total energy cost

544.8724 (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] = 1.3279 (257)
 SAP value 78.4751
 SAP rating (Section 12) 78 (258)
 SAP band C

 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	1086.8600	0.1569	170.4839 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1984.9851	0.1410	279.9151 (264)
Space and water heating			450.3990 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	232.4144	0.1443	33.5446 (268)
Total CO2, kg/year			483.9436 (272)
CO2 emissions per m2			4.7100 (273)
EI value			95.6100
EI rating			96 (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	38.2300 (1b)	x 2.6000 (2b)	= 99.3980 (1b) - (3b)
First floor	38.2300 (1c)	x 2.8000 (2c)	= 107.0440 (1c) - (3c)
Second floor	26.2600 (1d)	x 2.1700 (2d)	= 56.9842 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.7200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	263.4262 (5)

 2. Ventilation rate

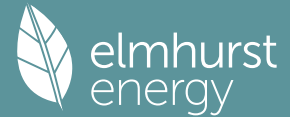
		m3 per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number 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) =	0.1139 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.36339	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3093 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.7000	3.5000	3.4000	3.2000	3.1000	2.8000	3.0000	2.7000	2.6000	2.8000	2.9000	3.2000 (22)
Wind factor	0.9250	0.8750	0.8500	0.8000	0.7750	0.7000	0.7500	0.6750	0.6500	0.7000	0.7250	0.8000 (22a)
Adj infilt rate												
Effective ac	0.2861	0.2706	0.2629	0.2474	0.2397	0.2165	0.2320	0.2088	0.2010	0.2165	0.2242	0.2474 (22b)
	0.5409	0.5366	0.5346	0.5306	0.5287	0.5234	0.5269	0.5218	0.5202	0.5234	0.5251	0.5306 (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)			8.9600	1.1450	10.2595		(27)
Half glazed door			1.7800	1.0000	1.7800		(26a)
Bi-fold (Uw = 1.20)			6.0800	1.1450	6.9618		(27)
E			2.0900	1.2357	2.5827		(27a)
Ground floor			38.2300	0.1300	4.9699	110.0000	4205.3000 (28a)
External wall	119.0100	15.4100	103.6000	0.1600	16.5760	150.0000	15540.0000 (29a)
Dormer wall	8.7200	1.4100	7.3100	0.1800	1.3158	9.0000	65.7900 (29a)
Secondary wall	10.5300		10.5300	0.1800	1.8954	9.0000	94.7700 (29a)
Sloped roof	28.4900	2.0900	26.4000	0.1500	3.9600	9.0000	237.6000 (30)

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Dormer sloped roof	1.8400	1.8400	0.1500	0.2760	9.0000	16.5600 (30)
Secondary plane roof	11.9700	11.9700	0.1500	1.7955	9.0000	107.7300 (30)
Total net area of external elements Aum(A, m2)		218.7900				(31)
Fabric heat loss, W/K = Sum (A x U)		(26)...(30) + (32) =	52.3727			(33)
Party wall	57.8500	0.0000	0.0000	70.0000	4049.5000	(32)
Internal stud wall	200.5600			9.0000	1805.0400	(32c)
First floor	38.2300			18.0000	688.1400	(32d)
Second floor	26.2600			18.0000	472.6800	(32d)
Ground floor ceiling	38.2300			9.0000	344.0700	(32e)
First floor ceiling	26.2600			9.0000	236.3400	(32e)

Heat capacity Cm = Sum(A x k)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K (28)...(30) + (32) + (32a)...(32e) = 27863.5200 (34)
 List of Thermal Bridges 271.2570 (35)

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	10.3100	0.0120	0.1237
E3 Sill	6.6500	0.0150	0.0998
E4 Jamb	24.9800	0.0260	0.6495
E5 Ground floor (normal)	19.0600	0.0720	1.3723
E6 Intermediate floor within a dwelling	37.9700	0.0200	0.7594
E11 Eaves (insulation at rafter level)	8.7200	0.0200	0.1744
E13 Gable (insulation at rafter level)	11.9400	0.0410	0.4895
E16 Corner (normal)	24.5000	0.0320	0.7840
E17 Corner (inverted - internal area greater than external area)	4.4000	-0.0530	-0.2332
P1 Party wall - Ground floor	8.6600	0.0720	0.6235
P2 Party wall - Intermediate floor within a dwelling	8.6600	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	5.1100	0.4800	2.4528
R1 Head of roof window	2.0400	0.2400	0.4896
R2 Sill of roof window	2.0400	0.2400	0.4896
R3 Jamb of roof window	3.6800	0.2400	0.8832

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
 Point Thermal bridges (36a) = 9.1581 (36)
 Total fabric heat loss (33) + (36) + (36a) = 61.5308 (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	47.0232	46.6490	46.4696	46.1266	45.9628	45.5028	45.8043	45.3599	45.2222	45.5028	45.6510	46.1266 (38)
Average = Sum(39)m / 12 =	108.5540	108.1798	108.0004	107.6574	107.4937	107.0336	107.3351	106.8907	106.7530	107.0336	107.1818	107.6574 (39)
												107.4809
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0568	1.0532	1.0514	1.0481	1.0465	1.0420	1.0449	1.0406	1.0393	1.0420	1.0434	1.0481 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	1.0463 (40)
												31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.7633 (42)
Hot water usage for mixer showers	105.8274	104.2370	101.9195	97.4854	94.2131	90.5639	88.4897	90.7897	93.3108	97.2290	101.7583	105.4219	105.4219 (42a)
Hot water usage for baths	30.4627	30.0103	29.3732	28.1985	27.3189	26.3436	25.8168	26.4494	27.1382	28.1819	29.3807	30.3597	30.3597 (42b)
Hot water usage for other uses	42.9291	41.3681	39.8070	38.2460	36.6849	35.1238	35.1238	36.6849	38.2460	39.8070	41.3681	42.9291	42.9291 (42c)
Average daily hot water use (litres/day)													164.8395 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	179.2192	175.6154	171.0997	163.9299	158.2169	152.0314	149.4303	153.9240	158.6951	165.2179	172.5072	178.7108	178.7108 (44)
Energy content (annual)	283.8394	250.0739	262.9739	224.4118	212.9904	186.9403	180.7230	190.5900	195.6869	224.1991	245.7681	279.8179	279.8179 (45)
Distribution loss (46)m = 0.15 x (45)m	42.5759	37.5111	39.4461	33.6618	31.9486	28.0410	27.1085	28.5885	29.3530	33.6299	36.8652	41.9727	41.9727 (46)
Water storage loss:													200.0000 (47)
Store volume													2.0000 (48)
a) If manufacturer declared loss factor is known (kWh/day):													0.5400 (49)
Temperature factor from Table 2b													1.0800 (55)
Enter (49) or (54) in (55)													
Total storage loss	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800 (56)
If cylinder contains dedicated solar storage	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800 (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	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	0.0000 (61)
Total heat required for water heating calculated for each month	340.5818	301.3251	319.7163	279.3238	269.7328	241.8523	237.4654	247.3324	250.5989	280.9415	300.6801	336.5603	336.5603 (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	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)
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	0.0000 (63d)
Output from w/h	340.5818	301.3251	319.7163	279.3238	269.7328	241.8523	237.4654	247.3324	250.5989	280.9415	300.6801	336.5603	336.5603 (64)
Total per year (kWh/year) = Sum(64)m =													3406.1107 (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	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	139.7705	124.1505	132.8327	118.5465	116.2132	106.0872	105.4843	108.7651	108.9955	119.9401	125.6475	138.4334	138.4334 (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	165.7991	165.7991	165.7991	165.7991	165.7991	165.7991	165.7991	165.7991	165.7991	165.7991	165.7991	165.7991 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.9007	29.2221	23.7650	17.9916	13.4490	11.3542	12.2686	15.9472	21.4043	27.1776	31.7203	33.8151 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	389.0321	393.0690	382.8961	361.2391	333.9010	308.2071	291.0419	287.0050	297.1780	318.8350	346.1730	371.8670 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.3432	54.3432	54.3432	54.3432	54.3432	54.3432	54.3432	54.3432	54.3432	54.3432	54.3432	54.3432 (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)	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328 (71)
Water heating gains (Table 5)												

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Total internal gains	187.8636	184.7478	178.5386	164.6479	156.2006	147.3434	141.7800	146.1897	151.3826	161.2098	174.5104	186.0663 (72)
	719.4060	716.6485	694.8093	653.4883	613.1601	576.5142	554.7001	558.7514	579.5744	616.8320	662.0133	701.3580 (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
East	2.8500	22.2970	0.6300	0.7000	0.7700	19.4206 (76)
West	6.1100	22.2970	0.6300	0.7000	0.7700	41.6351 (80)
East	6.0800	22.2970	0.6300	0.7000	0.7700	41.4307 (76)
East	2.0900	30.4656	0.7600	0.7000	1.0000	30.4866 (82)

Solar gains	132.9731	231.6205	387.4633	591.6727	713.9719	787.2728	744.7445	641.7582	494.2690	308.1290	170.2343	108.0564 (83)
Total gains	852.3791	948.2691	1082.2726	1245.1609	1327.1321	1363.7870	1299.4447	1200.5097	1073.8435	924.9610	832.2476	809.4144 (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	71.2997	71.5463	71.6651	71.8935	72.0030	72.3125	72.1094	72.4092	72.5026	72.3125	72.2125	71.8935
alpha	5.7533	5.7698	5.7777	5.7929	5.8002	5.8208	5.8073	5.8273	5.8335	5.8208	5.8142	5.7929
util living area	0.9903	0.9813	0.9437	0.8220	0.6079	0.3682	0.2312	0.2581	0.5393	0.8701	0.9761	0.9922 (86)
Living	20.3131	20.4220	20.6367	20.8426	20.9308	20.9460	20.9465	20.9467	20.9408	20.8283	20.5447	20.3003
Non living	19.2521	19.3913	19.6547	19.8855	19.9665	19.9799	19.9775	19.9813	19.9800	19.8826	19.5531	19.2421
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	20.6486	20.4220	20.6367	20.8426	20.9308	20.9460	20.9465	20.9467	20.9408	20.8283	20.5447	20.3982 (87)
Th 2	20.0363	20.0393	20.0407	20.0435	20.0448	20.0485	20.0461	20.0496	20.0507	20.0485	20.0473	20.0435 (88)
util rest of house	0.9869	0.9749	0.9254	0.7762	0.5387	0.2940	0.1525	0.1736	0.4500	0.8214	0.9663	0.9893 (89)
MIT 2	19.7237	19.3913	19.6547	19.8855	19.9665	19.9799	19.9775	19.9813	19.9800	19.8826	19.5531	19.3865 (90)
Living area fraction	FLA = Living area / (4) =											0.1839 (91)
MIT	19.8938	19.5808	19.8353	20.0615	20.1439	20.1575	20.1557	20.1588	20.1567	20.0565	19.7354	19.5726 (92)
Temperature adjustment												0.0000
adjusted MIT	19.8938	19.5808	19.8353	20.0615	20.1439	20.1575	20.1557	20.1588	20.1567	20.0565	19.7354	19.5726 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9863	0.9710	0.9207	0.7772	0.5461	0.3025	0.1615	0.1833	0.4601	0.8219	0.9622	0.9875 (94)
Useful gains	840.7055	920.8039	996.4303	967.7294	724.7708	412.6098	209.9100	220.0601	494.1106	760.1877	800.8031	799.2891 (95)
Ext temp.	5.4000	5.9000	7.7000	10.2000	13.3000	16.3000	18.2000	18.1000	15.5000	12.0000	8.4000	5.5000 (96)
Heat loss rate W	1573.3563	1479.9870	1310.6128	1061.6644	735.6711	412.8845	209.9144	220.0692	497.1134	862.3146	1214.9510	1515.0153 (97)
Space heating kWh	545.0922	375.7710	233.7518	67.6332	8.1098	0.0000	0.0000	0.0000	0.0000	75.9824	298.1865	532.5003 (98a)
Space heating requirement - total per year (kWh/year)												2137.0272
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	545.0922	375.7710	233.7518	67.6332	8.1098	0.0000	0.0000	0.0000	0.0000	75.9824	298.1865	532.5003 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2137.0272
Space heating per m2												(98c) / (4) = 20.8044 (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 %)												265.3503 (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	545.0922	375.7710	233.7518	67.6332	8.1098	0.0000	0.0000	0.0000	0.0000	75.9824	298.1865	532.5003 (98)
Space heating efficiency (main heating system 1)	265.3503	265.3503	265.3503	265.3503	265.3503	0.0000	0.0000	0.0000	0.0000	265.3503	265.3503	265.3503 (210)
Space heating fuel (main heating system)	205.4236	141.6132	88.0918	25.4883	3.0563	0.0000	0.0000	0.0000	0.0000	28.6348	112.3747	200.6783 (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	340.5818	301.3251	319.7163	279.3238	269.7328	241.8523	237.4654	247.3324	250.5989	280.9415	300.6801	336.5603 (64)
Efficiency of water heater (217)m	171.5496	171.5496	171.5496	171.5496	171.5496	171.5496	171.5496	171.5496	171.5496	171.5496	171.5496	171.5496 (216)
Fuel for water heating, kWh/month	198.5326	175.6490	186.3696	162.8239	157.2332	140.9810	138.4238	144.1755	146.0796	163.7669	175.2730	196.1883 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	28.7978	23.1026	20.8014	15.2400	11.7718	9.6177	10.7386	13.9585	18.1307	23.7884	26.8690	29.5981 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)

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Potential energy efficiency rating: B 87
 Potential environmental impact rating: A 97

Fuel prices for cost data on this page from database revision number 531 TEST (31 Oct 2023)
 Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current £650	Potential £569	Saving £82
Electricity			
Space heating	£173	£191	-£17
Water heating	£427	£328	£99
Lighting	£50	£50	£0
Generated (PV)	-£0	-£199	£199
Total cost of fuels	£650	£370	£281
Total cost of uses	£650	£370	£281
Delivered energy	29 kWh/m ²	17 kWh/m ²	13 kWh/m ²
Carbon dioxide emissions	0.4 tonnes	0.3 tonnes	0.2 tonnes
CO2 emissions per m ²	4 kg/m ²	3 kg/m ²	2 kg/m ²
Primary energy	45 kWh/m ²	26 kWh/m ²	19 kWh/m ²

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 ²)	Storey height (m)	Volume (m ³)
Ground floor	38.2300 (1b)	x 2.6000 (2b)	= 99.3980 (1b) - (3b)
First floor	38.2300 (1c)	x 2.8000 (2c)	= 107.0440 (1c) - (3c)
Second floor	26.2600 (1d)	x 2.1700 (2d)	= 56.9842 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.7200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	263.4262 (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) =	0.1139 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3639 (18)
Number of sides sheltered		2 (19)
Shelter factor (20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) =		0.3093 (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 infiltr rate	0.3944	0.3866	0.3789	0.3402	0.3325	0.2938	0.2938	0.2861	0.3093	0.3325	0.3480	0.3634 (22b)
Effective ac	0.5778	0.5747	0.5718	0.5579	0.5553	0.5432	0.5432	0.5409	0.5478	0.5553	0.5605	0.5660 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			8.9600	1.1450	10.2595		(27)
Half glazed door			1.7800	1.0000	1.7800		(26a)
Bi-fold (Uw = 1.20)			6.0800	1.1450	6.9618		(27)
E			2.0900	1.2357	2.5827		(27a)
Ground floor			38.2300	0.1300	4.9699	110.0000	4205.3000 (28a)
External wall	119.0100	15.4100	103.6000	0.1600	16.5760	150.0000	15540.0000 (29a)
Dormer wall	8.7200	1.4100	7.3100	0.1800	1.3158	9.0000	65.7900 (29a)
Secondary wall	10.5300		10.5300	0.1800	1.8954	9.0000	94.7700 (29a)
Sloped roof	28.4900	2.0900	26.4000	0.1500	3.9600	9.0000	237.6000 (30)
Dormer sloped roof	1.8400		1.8400	0.1500	0.2760	9.0000	16.5600 (30)
Secondary plane roof	11.9700		11.9700	0.1500	1.7955	9.0000	107.7300 (30)
Total net area of external elements Aum (A, m²)			218.7900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	52.3727	(33)
Party wall			57.8500	0.0000	0.0000	70.0000	4049.5000 (32)
Internal stud wall			200.5600			9.0000	1805.0400 (32c)
First floor			38.2300			18.0000	688.1400 (32a)
Second floor			26.2600			18.0000	472.6800 (32a)
Ground floor ceiling			38.2300			9.0000	344.0700 (32e)

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First floor ceiling 26.2600 9.0000 236.3400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 27863.5200 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 271.2570 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	10.3100	0.0120	0.1237
E3 Sill	6.6500	0.0150	0.0998
E4 Jamb	24.9800	0.0260	0.6495
E5 Ground floor (normal)	19.0600	0.0720	1.3723
E6 Intermediate floor within a dwelling	37.9700	0.0200	0.7594
E11 Eaves (insulation at rafter level)	8.7200	0.0200	0.1744
E13 Gable (insulation at rafter level)	11.9400	0.0410	0.4895
E16 Corner (normal)	24.5000	0.0320	0.7840
E17 Corner (inverted - internal area greater than external area)	4.4000	-0.0530	-0.2332
P1 Party wall - Ground floor	8.6600	0.0720	0.6235
P2 Party wall - Intermediate floor within a dwelling	8.6600	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	5.1100	0.4800	2.4528
R1 Head of roof window	2.0400	0.2400	0.4896
R2 Sill of roof window	2.0400	0.2400	0.4896
R3 Jamb of roof window	3.6800	0.2400	0.8832

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.1581 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 61.5308 (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	50.2250	49.9625	49.7052	48.4968	48.2707	47.2181	47.2181	47.0232	47.6235	48.2707	48.7281	49.2063 (38)
Average = Sum(39)m / 12 =	111.7558	111.4933	111.2360	110.0276	109.8015	108.7489	108.7489	108.5540	109.1543	109.8015	110.2589	110.7371 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0880	1.0854	1.0829	1.0711	1.0689	1.0587	1.0587	1.0568	1.0626	1.0689	1.0734	1.0780 (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												2.7633 (42)
Hot water usage for mixer showers												
Hot water usage for baths	105.8274	104.2370	101.9195	97.4854	94.2131	90.5639	88.4897	90.7897	93.3108	97.2290	101.7583	105.4219 (42a)
Hot water usage for other uses	30.4627	30.0103	29.3732	28.1985	27.3189	26.3436	25.8168	26.4494	27.1382	28.1819	29.3807	30.3597 (42b)
Average daily hot water use (litres/day)	42.9291	41.3681	39.8070	38.2460	36.6849	35.1238	35.1238	36.6849	38.2460	39.8070	41.3681	42.9291 (42c)
Daily hot water use	179.2192	175.6154	171.0997	163.9299	158.2169	152.0314	149.4303	153.9240	158.6951	165.2179	172.5072	178.7108 (44)
Energy content (annual)	283.8394	250.0739	262.9739	224.4118	212.9904	186.9403	180.7230	190.5900	195.6869	224.1991	245.7681	279.8179 (45)
Distribution loss (46)m = 0.15 x (45)m	42.5759	37.5111	39.4461	33.6618	31.9486	28.0410	27.1085	28.5885	29.3530	33.6299	36.8652	41.9727 (46)
Water storage loss:												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0800 (55)
Total storage loss	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (56)
If cylinder contains dedicated solar storage	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	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	340.5818	301.3251	318.3205	272.5702	256.9385	229.2456	224.4385	235.2360	245.1960	279.5457	300.6801	336.5603 (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)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												651.7699 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												651.7699
Solar input	-0.0000	-16.1662	-59.8375	-83.5408	-110.9439	-102.5672	-101.9562	-88.1483	-59.7164	-28.8935	-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	340.5818	285.1589	258.4830	189.0294	145.9946	126.6784	122.4823	147.0877	185.4796	250.6522	300.6801	336.5603 (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	139.7705	124.1505	131.7161	113.1436	105.9778	96.0019	95.0628	99.0880	104.6732	118.8235	125.6475	138.4334 (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	165.7991	165.7991	165.7991	165.7991	165.7991	165.7991	165.7991	165.7991	165.7991	165.7991	165.7991	165.7991 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.9007	29.2221	23.7650	17.9916	13.4490	11.3542	12.2686	15.9472	21.4043	27.1776	31.7203	33.8151 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												

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Cooking gains	389.0321	393.0690	382.8961	361.2391	333.9010	308.2071	291.0419	287.0050	297.1780	318.8350	346.1730	371.8670 (68)
(calculated in Appendix L, equation L15 or L15a), also see Table 5												
Pumps, fans	54.3432	54.3432	54.3432	54.3432	54.3432	54.3432	54.3432	54.3432	54.3432	54.3432	54.3432	54.3432 (69)
Losses e.g. evaporation	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)
(negative values) (Table 5)												
Water heating gains (Table 5)	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328 (71)
Total internal gains	187.8636	184.7478	177.0378	157.1439	142.4432	133.3359	127.7725	133.1827	145.3794	159.7090	174.5104	186.0663 (72)
	719.4060	716.6485	693.3085	645.9843	599.4028	562.5068	540.6927	545.7445	573.5712	615.3312	662.0133	701.3580 (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						
East	2.8500	19.6403	0.6300	0.7000	0.7700	17.1066 (76)						
West	6.1100	19.6403	0.6300	0.7000	0.7700	36.6742 (80)						
East	6.0800	19.6403	0.6300	0.7000	0.7700	36.4941 (76)						
East	2.0900	26.6072	0.7600	0.7000	1.0000	26.6256 (82)						
Solar gains	116.9005	230.4262	383.8404	566.6973	700.6605	719.9826	684.3298	583.7038	448.6596	274.5643	146.0736	95.9340 (83)
Total gains	836.3065	947.0747	1077.1489	1212.6815	1300.0633	1282.4894	1225.0225	1129.4483	1022.2308	889.8955	808.0869	797.2920 (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	69.2569	69.4200	69.5806	70.3448	70.4897	71.1719	71.1719	71.2997	70.9076	70.4897	70.1972	69.8941
alpha	5.6171	5.6280	5.6387	5.6897	5.6993	5.7448	5.7448	5.7533	5.7272	5.6993	5.6798	5.6596
util living area	0.9939	0.9869	0.9634	0.8872	0.7324	0.5352	0.3895	0.4399	0.6981	0.9344	0.9874	0.9953 (86)
Living	20.1775	20.3068	20.5182	20.7556	20.8942	20.9388	20.9450	20.9442	20.9164	20.7147	20.3994	20.1530
Non living	19.0588	19.2241	19.4887	19.7753	19.9180	19.9618	19.9651	19.9665	19.9446	19.7389	19.3508	19.0343
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	20.5792	20.3068	20.5182	20.7556	20.8942	20.9388	20.9450	20.9442	20.9164	20.7147	20.3994	20.2715 (87)
Th 2	20.0107	20.0128	20.0148	20.0245	20.0263	20.0347	20.0347	20.0363	20.0315	20.0263	20.0226	20.0188 (88)
util rest of house	0.9918	0.9825	0.9514	0.8544	0.6722	0.4579	0.3047	0.3490	0.6156	0.9069	0.9823	0.9936 (89)
MIT 2	19.6312	19.2241	19.4887	19.7753	19.9180	19.9618	19.9651	19.9665	19.9446	19.7389	19.3508	19.2117 (90)
Living area fraction	FLA = Living area / (4) =											0.1839 (91)
MIT	19.8055	19.4232	19.6780	19.9556	20.0975	20.1415	20.1453	20.1463	20.1233	19.9183	19.5436	19.4066 (92)
Temperature adjustment												0.0000
adjusted MIT	19.8055	19.4232	19.6780	19.9556	20.0975	20.1415	20.1453	20.1463	20.1233	19.9183	19.5436	19.4066 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9913	0.9791	0.9464	0.8518	0.6769	0.4666	0.3144	0.3594	0.6239	0.9032	0.9791	0.9923 (94)
Useful gains	829.0207	927.2946	1019.4216	1032.9873	880.0131	598.4354	385.2056	405.9432	637.7207	803.7463	791.1686	791.1498 (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	1732.8328	1619.2427	1465.8708	1216.4186	922.0592	602.6309	385.5507	406.6736	657.4665	1023.1644	1372.0225	1683.9314 (97)
Space heating kWh	672.4362	464.9891	332.1582	132.0706	31.2823	0.0000	0.0000	0.0000	0.0000	163.2470	418.2148	664.2295 (98a)
Space heating requirement - total per year (kWh/year)												2878.6277
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	672.4362	464.9891	332.1582	132.0706	31.2823	0.0000	0.0000	0.0000	0.0000	163.2470	418.2148	664.2295 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2878.6277
Space heating per m2												(98c) / (4) = 28.0240 (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 %)												264.4181 (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	672.4362	464.9891	332.1582	132.0706	31.2823	0.0000	0.0000	0.0000	0.0000	163.2470	418.2148	664.2295 (98)
Space heating efficiency (main heating system 1)	264.4181	264.4181	264.4181	264.4181	264.4181	0.0000	0.0000	0.0000	0.0000	264.4181	264.4181	264.4181 (210)
Space heating fuel (main heating system)	254.3079	175.8537	125.6185	49.9476	11.8306	0.0000	0.0000	0.0000	0.0000	61.7382	158.1642	251.2042 (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	340.5818	285.1589	258.4830	189.0294	145.9946	126.6784	122.4823	147.0877	185.4796	250.6522	300.6801	336.5603 (64)
Efficiency of water heater												171.5938 (216)
(217)m	171.5938	171.5938	171.5938	171.5938	171.5938	171.5938	171.5938	171.5938	171.5938	171.5938	171.5938	171.5938 (217)
Fuel for water heating, kWh/month												

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Space cooling fuel requirement (221)m	198.4815	166.1826	150.6366	110.1610	85.0815	73.8246	71.3792	85.7186	108.0923	146.0730	175.2279	196.1378	(219)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	28.7978	23.1026	20.8014	15.2400	11.7718	9.6177	10.7386	13.9585	18.1307	23.7884	26.8690	29.5981	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-39.0104	-58.3369	-87.2448	-99.0626	-105.6510	-98.2602	-96.7609	-91.1400	-80.3214	-66.7936	-43.7308	-33.2762	(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												1088.6651	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												171.5938	
Water heating fuel used												1566.9966	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												232.4144	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-899.5888	(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												2068.4873	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1088.6651	16.4900	179.5209	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1566.9966	16.4900	258.3977	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	232.4144	16.4900	38.3251	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-899.5888	16.4900	-148.3422	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-148.3422	(252)
Total energy cost			341.0936	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.8313	(257)
SAP value		86.5253	
SAP rating (Section 12)		87	(258)
SAP band		B	

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	1088.6651	0.1568	170.7381	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1566.9966	0.1448	226.8385	(264)
Space and water heating			397.5765	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	232.4144	0.1443	33.5446	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-899.5888	0.1343	-120.8028	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-120.8028	(269)
Total CO2, kg/year			321.4153	(272)
CO2 emissions per m2			3.1300	(273)
EI value			97.0844	
EI rating			97	(274)
EI band			A	

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1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	38.2300 (1b)	x 2.6000 (2b)	= 99.3980 (1b) - (3b)
First floor	38.2300 (1c)	x 2.8000 (2c)	= 107.0440 (1c) - (3c)
Second floor	26.2600 (1d)	x 2.1700 (2d)	= 56.9842 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.7200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 263.4262 (5)

2. Ventilation rate

		m ³ per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	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) = 0.1139 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate		0.3639 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3093 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.7000	3.5000	3.4000	3.2000	3.1000	2.8000	3.0000	2.7000	2.6000	2.8000	2.9000	3.2000 (22)
Wind factor	0.9250	0.8750	0.8500	0.8000	0.7750	0.7000	0.7500	0.6750	0.6500	0.7000	0.7250	0.8000 (22a)
Adj infilt rate												
Effective ac	0.2861	0.2706	0.2629	0.2474	0.2397	0.2165	0.2320	0.2088	0.2010	0.2165	0.2242	0.2474 (22b)
	0.5409	0.5366	0.5346	0.5306	0.5287	0.5234	0.5269	0.5218	0.5202	0.5234	0.5251	0.5306 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			8.9600	1.1450	10.2595		(27)
Half glazed door			1.7800	1.0000	1.7800		(26a)
Bi-fold (Uw = 1.20)			6.0800	1.1450	6.9618		(27)
E			2.0900	1.2357	2.5827		(27a)
Ground floor			38.2300	0.1300	4.9699	110.0000	4205.3000 (28a)
External wall	119.0100	15.4100	103.6000	0.1600	16.5760	150.0000	15540.0000 (29a)
Dormer wall	8.7200	1.4100	7.3100	0.1800	1.3158	9.0000	65.7900 (29a)
Secondary wall	10.5300		10.5300	0.1800	1.8954	9.0000	94.7700 (29a)
Sloped roof	28.4900	2.0900	26.4000	0.1500	3.9600	9.0000	237.6000 (30)
Dormer sloped roof	1.8400		1.8400	0.1500	0.2760	9.0000	16.5600 (30)
Secondary plane roof	11.9700		11.9700	0.1500	1.7955	9.0000	107.7300 (30)
Total net area of external elements Aum(A, m ²)			218.7900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	52.3727	(33)
Party wall			57.8500	0.0000	0.0000	70.0000	4049.5000 (32)
Internal stud wall			200.5600			9.0000	1805.0400 (32c)
First floor			38.2300			18.0000	688.1400 (32d)
Second floor			26.2600			18.0000	472.6800 (32d)
Ground floor ceiling			38.2300			9.0000	344.0700 (32e)
First floor ceiling			26.2600			9.0000	236.3400 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 27863.5200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							271.2570 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	10.3100	0.0120	0.1237
E3 Sill	6.6500	0.0150	0.0998
E4 Jamb	24.9800	0.0260	0.6495
E5 Ground floor (normal)	19.0600	0.0720	1.3723
E6 Intermediate floor within a dwelling	37.9700	0.0200	0.7594
E11 Eaves (insulation at rafter level)	8.7200	0.0200	0.1744
E13 Gable (insulation at rafter level)	11.9400	0.0410	0.4895
E16 Corner (normal)	24.5000	0.0320	0.7840
E17 Corner (inverted - internal area greater than external area)	4.4000	-0.0530	-0.2332
P1 Party wall - Ground floor	8.6600	0.0720	0.6235
P2 Party wall - Intermediate floor within a dwelling	8.6600	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	5.1100	0.4800	2.4528
R1 Head of roof window	2.0400	0.2400	0.4896
R2 Sill of roof window	2.0400	0.2400	0.4896
R3 Jamb of roof window	3.6800	0.2400	0.8832

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

Point Thermal bridges	(36a) =	9.1581 (36)
Total fabric heat loss	(33) + (36) + (36a) =	61.5308 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	47.0232	46.6490	46.4696	46.1266	45.9628	45.5028	45.8043	45.3599	45.2222	45.5028	45.6510	46.1266 (38)
Heat transfer coeff	108.5540	108.1798	108.0004	107.6574	107.4937	107.0336	107.3351	106.8907	106.7530	107.0336	107.1818	107.6574 (39)
Average = Sum(39)m / 12 =												107.4809

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0568	1.0532	1.0514	1.0481	1.0465	1.0420	1.0449	1.0406	1.0393	1.0420	1.0434	1.0481 (40)

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HLP (average)	31	28	31	30	31	30	31	31	30	31	30	1.0463
Days in mont												31

4. Water heating energy requirements (kWh/year)												

Assumed occupancy												2.7633 (42)
Hot water usage for mixer showers												105.4219 (42a)
Hot water usage for baths												30.3597 (42b)
Hot water usage for other uses												42.9291 (42c)
Average daily hot water use (litres/day)												164.8395 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	179.2192	175.6154	171.0997	163.9299	158.2169	152.0314	149.4303	153.9240	158.6951	165.2179	172.5072	178.7108 (44)
Energy content (annual)	283.8394	250.0739	262.9739	224.4118	212.9904	186.9403	180.7230	190.5900	195.6869	224.1991	245.7681	279.8179 (45)
Distribution loss (46)m = 0.15 x (45)m												42.5759 (46)
Water storage loss:												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0800 (55)
Total storage loss												33.4800 (56)
If cylinder contains dedicated solar storage												33.4800 (57)
Primary loss												23.2624 (59)
Combi loss												0.0000 (61)
Total heat required for water heating calculated for each month												340.5818 (62)
WWHRS												0.0000 (63a)
PV diverter												-0.0000 (63b)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												724.6904 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												724.6904
Solar input	-0.0000	-16.7813	-61.0969	-89.1888	-114.7275	-115.3181	-113.9244	-100.6984	-70.0157	-38.6416	-4.2977	-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	340.5818	284.5438	257.2236	183.3813	142.2110	113.9275	110.5141	134.5376	175.1803	240.9042	296.3824	336.5603 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	139.7705	124.1505	131.7161	113.1436	105.9778	96.0019	95.0628	99.0880	104.6732	118.8235	125.6475	138.4334 (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	165.7991	165.7991	165.7991	165.7991	165.7991	165.7991	165.7991	165.7991	165.7991	165.7991	165.7991	165.7991 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.9007	29.2221	23.7650	17.9916	13.4490	11.3542	12.2686	15.9472	21.4043	27.1776	31.7203	33.8151 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	389.0321	393.0690	382.8961	361.2391	333.9010	308.2071	291.0419	287.0050	297.1780	318.8350	346.1730	371.8670 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.3432	54.3432	54.3432	54.3432	54.3432	54.3432	54.3432	54.3432	54.3432	54.3432	54.3432	54.3432 (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)	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328	-110.5328 (71)
Water heating gains (Table 5)	187.8636	184.7478	177.0378	157.1439	142.4432	133.3359	127.7725	133.1827	145.3794	159.7090	174.5104	186.0663 (72)
Total internal gains	719.4060	716.6485	693.3085	645.9843	599.4028	562.5068	540.6927	545.7445	573.5712	615.3312	662.0133	701.3580 (73)

6. Solar gains												

[Jan]			Area	Solar flux	g	FF	Access	Gains				
			m2	Table 6a	Specific data	Specific data	factor	W				
				W/m2	or Table 6b	or Table 6c	Table 6d					
East			2.8500	22.2970	0.6300	0.7000	0.7700	19.4206 (76)				
West			6.1100	22.2970	0.6300	0.7000	0.7700	41.6351 (80)				
East			6.0800	22.2970	0.6300	0.7000	0.7700	41.4307 (76)				
East			2.0900	30.4656	0.7600	0.7000	1.0000	30.4866 (82)				

Solar gains	132.9731	231.6205	387.4633	591.6727	713.9719	787.2728	744.7445	641.7582	494.2690	308.1290	170.2343	108.0564 (83)
Total gains	852.3791	948.2691	1080.7718	1237.6569	1313.3747	1349.7796	1285.4372	1187.5027	1067.8403	923.4602	832.2476	809.4144 (84)

7. Mean internal temperature (heating season)												

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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	71.2997	71.5463	71.6651	71.8935	72.0030	72.3125	72.1094	72.4092	72.5026	72.3125	72.2125	71.8935	
alpha	5.7533	5.7698	5.7777	5.7929	5.8002	5.8208	5.8073	5.8273	5.8335	5.8208	5.8142	5.7929	
util living area	0.9903	0.9813	0.9440	0.8249	0.6135	0.3719	0.2338	0.2610	0.5422	0.8708	0.9761	0.9922	(86)
Living	20.3131	20.4220	20.6359	20.8406	20.9301	20.9459	20.9465	20.9467	20.9407	20.8278	20.5447	20.3003	
Non living	19.2521	19.3913	19.6537	19.8836	19.9660	19.9798	19.9775	19.9813	19.9799	19.8821	19.5531	19.2421	
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	20.6486	20.4220	20.6359	20.8406	20.9301	20.9459	20.9465	20.9467	20.9407	20.8278	20.5447	20.3982	(87)
Th 2	20.0363	20.0393	20.0407	20.0435	20.0448	20.0485	20.0461	20.0496	20.0507	20.0485	20.0473	20.0435	(88)
util rest of house	0.9869	0.9749	0.9257	0.7794	0.5440	0.2971	0.1541	0.1755	0.4524	0.8222	0.9663	0.9893	(89)
MIT 2	19.7237	19.3913	19.6537	19.8836	19.9660	19.9798	19.9775	19.9813	19.9799	19.8821	19.5531	19.3865	(90)
Living area fraction									FLA = Living area / (4) =				0.1839 (91)
MIT	19.8938	19.5808	19.8343	20.0596	20.1433	20.1575	20.1557	20.1588	20.1566	20.0560	19.7354	19.5726	(92)
Temperature adjustment													0.0000 (93)
adjusted MIT	19.8938	19.5808	19.8343	20.0596	20.1433	20.1575	20.1557	20.1588	20.1566	20.0560	19.7354	19.5726	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9863	0.9710	0.9211	0.7802	0.5514	0.3057	0.1633	0.1853	0.4626	0.8226	0.9622	0.9875	(94)
Useful gains	840.7055	920.8039	995.4512	965.6131	724.1752	412.5922	209.9097	220.0594	494.0161	759.6328	800.8031	799.2891	(95)
Ext temp.	5.4000	5.9000	7.7000	10.2000	13.3000	16.3000	18.2000	18.1000	15.5000	12.0000	8.4000	5.5000	(96)
Heat loss rate W	1573.3563	1479.9870	1310.5138	1061.4583	735.6142	412.8826	209.9144	220.0691	497.1040	862.2601	1214.9510	1515.0153	(97)
Space heating kWh	545.0922	375.7710	234.4066	69.0086	8.5106	0.0000	0.0000	0.0000	0.0000	76.3547	298.1865	532.5003	(98a)
Space heating requirement - total per year (kWh/year)												2139.8305	
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	545.0922	375.7710	234.4066	69.0086	8.5106	0.0000	0.0000	0.0000	0.0000	76.3547	298.1865	532.5003	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2139.8305	
Space heating per m2										(98c) / (4) =		20.8317	(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 %)													265.3503 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	545.0922	375.7710	234.4066	69.0086	8.5106	0.0000	0.0000	0.0000	0.0000	76.3547	298.1865	532.5003	(98)
Space heating efficiency (main heating system 1)	265.3503	265.3503	265.3503	265.3503	265.3503	0.0000	0.0000	0.0000	0.0000	265.3503	265.3503	265.3503	(210)
Space heating fuel (main heating system)	205.4236	141.6132	88.3385	26.0066	3.2073	0.0000	0.0000	0.0000	0.0000	28.7751	112.3747	200.6783	(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	340.5818	284.5438	257.2236	183.3813	142.2110	113.9275	110.5141	134.5376	175.1803	240.9042	296.3824	336.5603	(64)
Efficiency of water heater													171.5496 (216)
(217)m	171.5496	171.5496	171.5496	171.5496	171.5496	171.5496	171.5496	171.5496	171.5496	171.5496	171.5496	171.5496	(217)
Fuel for water heating, kWh/month	198.5326	165.8668	149.9413	106.8970	82.8979	66.4108	64.4211	78.4249	102.1164	140.4283	172.7678	196.1883	(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	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	28.7978	23.1026	20.8014	15.2400	11.7718	9.6177	10.7386	13.9585	18.1307	23.7884	26.8690	29.5981	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-42.5942	-57.2268	-85.5771	-99.2046	-105.1947	-101.8935	-100.0889	-95.0707	-84.4071	-70.5251	-48.3378	-36.0638	(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													806.4173 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													171.5496
Water heating fuel used													1524.8933 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
pump for solar water heating													80.0000 (230g)
Total electricity for the above, kWh/year													80.0000 (231)
Electricity for lighting (calculated in Appendix L)													232.4144 (232)

Full SAP Calculation Printout



Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-926.1842	(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	1717.5408	(238)

10a. Fuel costs - using BEDF prices (531)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	806.4173	21.5100	173.4604 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1524.8933	21.5100	328.0045 (247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	21.5100	17.2080 (249)
Energy for lighting	232.4144	21.5100	49.9923 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-926.1842	21.5100	-199.2222
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-199.2222 (252)
Total energy cost			369.4430 (255)

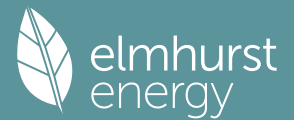
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	806.4173	0.1580	127.3928 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1524.8933	0.1453	221.5960 (264)
Space and water heating			348.9888 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	232.4144	0.1443	33.5446 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-926.1842	0.1342	-124.3159
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-124.3159 (269)
Total CO2, kg/year			269.3145 (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	806.4173	1.5848	1277.9981 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1524.8933	1.5375	2344.5799 (278)
Space and water heating			3622.5780 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	232.4144	1.5338	356.4850 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-926.1842	1.4960	-1385.6115
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1385.6115 (283)
Total Primary energy kWh/year			2714.4754 (286)

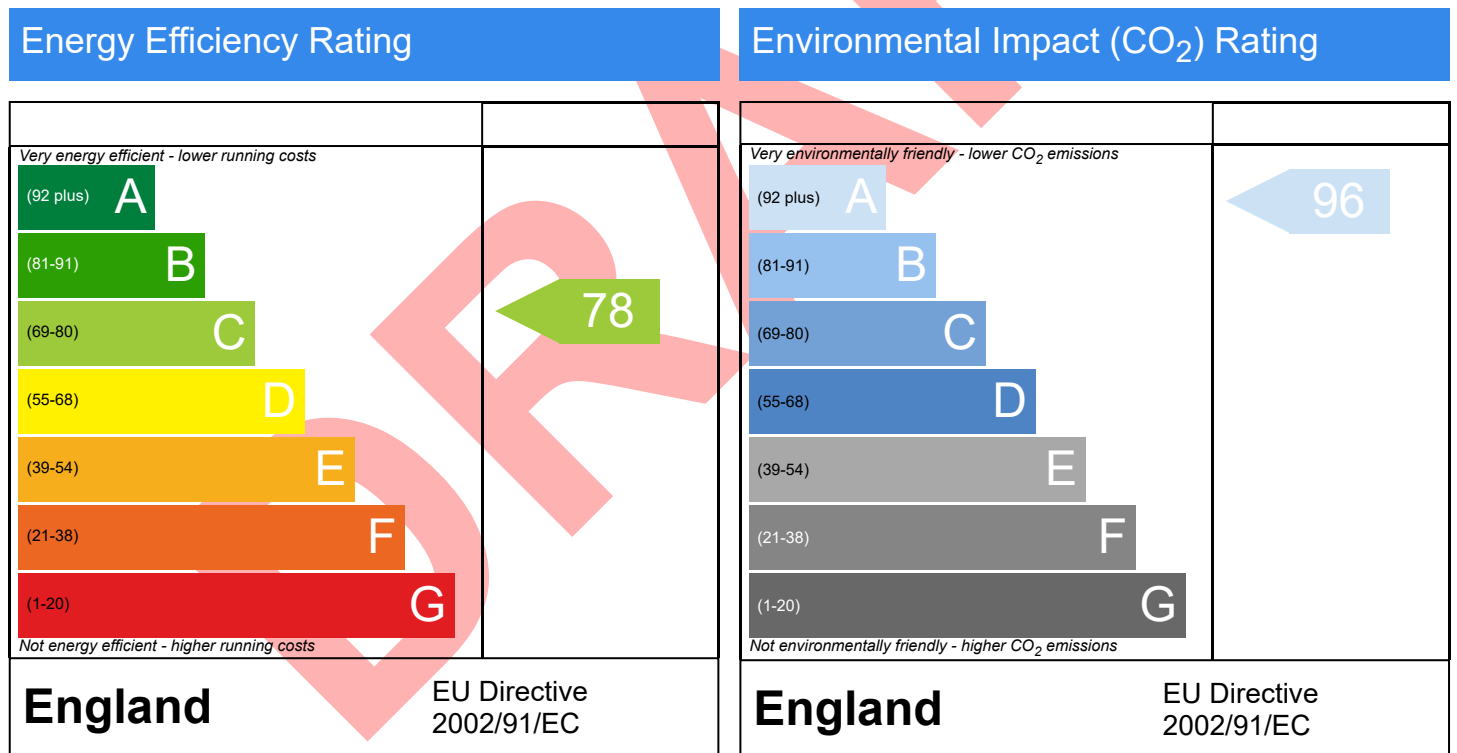
Predicted Energy Assessment



House 1, 10 Palmerston Road, Sutton, Surrey, SM1 4QL Dwelling type: House, End-Terrace
 Date of assessment: 01/12/2023
 Produced by: Kyle Jones
 Total floor area: 102.72 m²
 DRRN:

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

The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) 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 (CO₂) emissions. The higher the rating the less impact it has on the environment.