Development of 1 unit at 22b Harley Road, London, NW3 3BN

Energy Strategy, Sustainable Design & Construction Statement

For

Sei Howe

7th September 2023

Council – London Borough of Camden

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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

Project Reference: 304340 | Date Issued: 07/09/2023 | Revision: First Issue | Report Author: Kyle Jones | Function: Technical Consultant | Authorised By: Darren Baker | Function: Senior Consultant

Contents

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 (CO_2) emissions.

In formulating designed energy and carbon emissions, Elmhurst's SAP10.2 software has been used to calculate the estimated CO_2 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 CO_2 emissions from the baseline dwelling can be achieved from on-site renewable energy, through the adoption of 1.00 kWp solar photovoltaics (PV) situated on the top green roof. This is assumed from 4 panels at a minimum 250W each and covers approximately 8m^2.

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

The following ratings were calculated for detached house and meet the requirements of a 35% reduction in CO_2 emissions along with a 10% reduction in fabric energy efficiency over the baseline set out in the London Plan (2021-):

	Result (kgCO_2/yr/m^2)
DER (Dwelling Emission Rate)	2.26
TER (Target Emission Rate)	7.84
% reduction	**71.17**
Overall Result	Pass

	Result (kWh/m^2/yr)
DFEE (Dwelling Fabric Energy Efficiency)	40.87
TFEE (Target Fabric Energy Efficiency)	45.46
% reduction	**10.09**
Overall Result	Pass

	Result (kWh/m^2/yr)
DPER (Dwelling Primary Energy Rate)	23.50
TPER (Target Primary Energy Rate)	42.20
% reduction	**44.31**
Overall Result	Pass

2 Introduction

2.1 Background

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

It is intended to provide a clear and straightforward assessment of the proposed development's energy requirements and subsequent CO_2 emissions.

This statement assesses expected energy demand at the site, showing how CO_2 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 London Borough Camden 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 CO_2 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 Camden 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 CO_2 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

CO_2, 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 Camden Local Plan (2017-)

Policy CC1: Climate change mitigation

The Council will require all development to minimise the effects of climate change and encourage all developments to meet the highest feasible environmental standards that are financially viable during construction and occupation.

We will:

a. promote zero carbon development and require all development to reduce carbon dioxide emissions through following the steps in the energy hierarchy;

b. require all major development to demonstrate how London Plan targets for carbon dioxide emissions have been met;

c. ensure that the location of development and mix of land uses minimise the need to travel by car and help to support decentralised energy networks;

d. support and encourage sensitive energy efficiency improvements to existing buildings;

e. require all proposals that involve substantial demolition to demonstrate that it is not possible to retain and improve the existing building;

and f. expect all developments to optimise resource efficiency.

For decentralised energy networks, we will promote decentralised energy by:

g. working with local organisations and developers to implement decentralised energy networks in the parts of Camden most likely to support them;

h. protecting existing decentralised energy networks (e.g. at Gower Street, Bloomsbury, King's Cross, Gospel Oak and Somers Town) and safeguarding potential network routes; and

i. requiring all major developments to assess the feasibility of connecting to an existing decentralised energy network, or where this is not possible establishing a new network.

To ensure that the Council can monitor the effectiveness of renewable and low carbon technologies, major developments will be required to install appropriate monitoring equipment.

Policy CC2: Adapting to climate change
The Council will require development to be resilient to climate change.

All development should adopt appropriate climate change adaptation measures such as:

a. the protection of existing green spaces and promoting new appropriate green infrastructure;

b. not increasing, and wherever possible reducing, surface water runoff through increasing permeable surfaces and use of Sustainable Drainage Systems;

c. incorporating bio-diverse roofs, combination green and blue roofs and green walls where appropriate; and

d. measures to reduce the impact of urban and dwelling overheating, including application of the cooling hierarchy.

Any development involving 5 or more residential units or 500 sqm or more of any additional floorspace is required to demonstrate the above in a Sustainability Statement.

Sustainable design and construction measures

The Council will promote and measure sustainable design and construction by:

e. ensuring development schemes demonstrate how adaptation measures and sustainable development principles have been incorporated into the design and proposed implementation;

f. encourage new build residential development to use the Home Quality Mark and Passivhaus design standards;

g. encouraging conversions and extensions of 500 sqm of residential floorspace or above or five or more dwellings to achieve "excellent" in BREEAM domestic refurbishment; and

h. expecting non-domestic developments of 500 sqm of floorspace or above to achieve "excellent" in BREEAM assessments and encouraging zero carbon in new development from 2019

Policy CC3: Water and flooding

The council will seek to ensure that development does not increase flood risk and reduces the risk of flooding where possible.

We will require development to:

a. incorporate water efficiency measures;

b. avoid harm to the water environment and improve water quality;

c. consider the impact of development in areas at risk of flooding (including drainage);

d. incorporate flood resilient measures in areas prone to flooding;

e. utilise Sustainable Drainage Systems (SuDS) in line with the drainage hierarchy to achieve a greenfield run-off rate where feasible; and

f. not locate vulnerable development in flood-prone areas. Where an assessment of flood risk is required, developments should consider surface water flooding in detail and groundwater flooding where applicable.

The Council will protect the borough's existing drinking water and foul water infrastructure, including the reservoirs at Barrow Hill, Hampstead Heat, Highgate and Kidderpore.

2.2.3 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 22b Harley Road in London. Figure one below highlights the area of the development.

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

Situated on 22b Harley Road in, London, the site is close to several good transport links. South Hampstead train station is 0.5 miles from the site and provides services to London Euston and Watford Junction. Additionally, St. John's Wood Underground station is 0.7 miles away and provides services to North Greenwich, Stanmore, Stratford, Wembley Park, West Hampstead & Willesden Green. Moreover, Finchley Road and Frognal bus Station is 1.5 miles and Kentish Town Road Bus Stop is 1.5 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 Swiss Cottage at Harley Road and the construction of a new three-bedroom house which has green roof, courtyard garden and garden as recreational spaces.

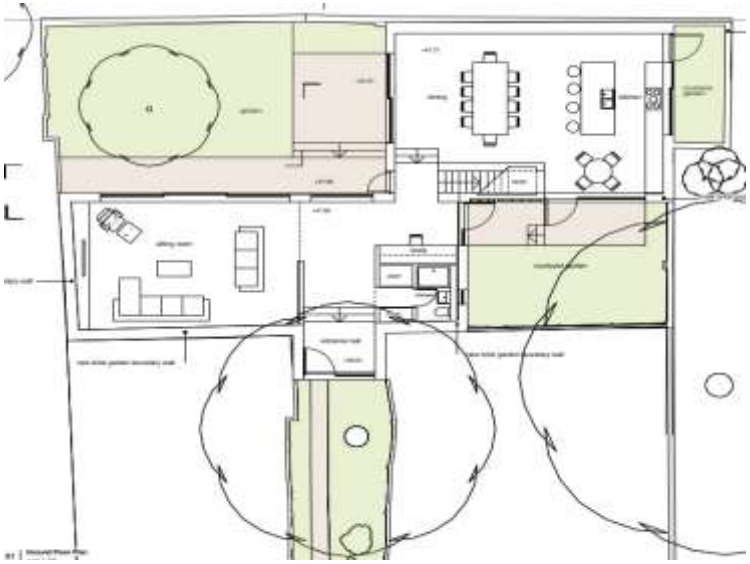


Figure 2: 2D Site including ground floor plan of proposal development.

4 Energy Efficient Design Measures

To supplement the London Borough of Camden 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 Air Source Heat Pump and a 250L hot water cylinder to the dwelling. There is no secondary heating system (i.e., log burner) present.

4.5 Ventilation Strategy

Mechanical Ventilation with Heat Recovery (MVHR) will be used throughout to ensure all areas are ventilated to an adequate level and reduce heat levels within the building.

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 – 0.16 W/m^2K
- Flat Roof – 0.11 W/m^2K
- Ground Floor - 0.11 W/m^2K
- Window – 1.00 W/m^2K
- Glazed Door – 1.20 W/m^2K
- Roof Light – 0.80 W/m^2K
- Thermal Bridging: Psi values have been taken from R.O.I Acceptable Construction Details
- An Air Permeability of 2.60 $m^3/h/m^2$ at 50 Pa has been allowed for proposed house at 50 Pa respectively.
- Heating: Air source heat pump with Minimum efficiency of 389.0%
- Renewables: 1.00 kWp of Solar PV situated on the green roof with no obstruction.

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.

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 not 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 low to medium 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)
Low and Medium 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 CO_2 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 CO_2 emissions for a building that is complaint with Part L (baseline building). this is followed by a final set of calculations 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/m^{2}K.
- Flat Roof U-value is set at 0.11 W/m^{2}K.
- Ground Floor U-value is set at 0.13 W/m^{2}K.
- Window U-value is set at 1.20 W/m^{2}K.
- Glazed door U-value is set at 1.00 W/m^{2}K.
- Roof Light U-value is set at 2.20 W/m^{2}K.
- An air permeability figure of 5.00 m^3/h/m^2 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: 5.92 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 Air Source Heat Pump has been considered the most suitable technology along with 1.00 kWp of Solar PV.

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 (CO_2) 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	1.50
After energy demand reduction (be lean)	0.40
After heat network connection (be clean)	0.40
After renewable energy (be green)	0.40

Table 2: Regulated carbon dioxide (CO_2) 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	1.10	76.00
Be clean: savings from heat network	0.00	0.00%
Be green: savings from renewable energy	-0.10	-4.00%
Cumulative on-site savings	1.10	71.00%
Annual savings from off-set payment	0.40	
Tonnes CO_2		
Cumulative savings for off-set payment	13	

7 Conclusion

With the inclusion of energy efficient measures including low U-values, efficient Air Source Heat Pump, MVHR and the adoption of solar PV on the roof, 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	0.16
Ground Floor	0.18	0.11
Flat Roof	0.16	0.11
Window	1.60	1.00 – Triple glazed - standard g' value
Glazed Door	1.60	1.20 - Double glazed - standard g' value
Roof Light	2.20	0.80 – Triple glazed - standard g' value
Air Permeability (m^3/ (h.m^2))	A design air permeability rate of 2.60 m^3/ (h.m^2) at 50 Pa has been allowed for.	
Primary Heating	Air Source Heat Pump, For example – MIDEA Riello NXHM008 (389% efficiency). 250L HWT, Heat Loss = 2 kWh/day	
Ventilation	MVHR – E.g., Vent Axia Sentinel Kinetic Plus B (90% efficiency).	
Thermal Bridging	Psi values obtained from Acceptable Construction Details (R.O.I)	
Lighting	100% L.E.L fittings have been allowed for, Efficacy = 75 lm/W, Power = 10W as standard.	
Solar Photovoltaics (PV)	1.00 kWp, horizontal facing.	

Appendix A:

GLA Energy Summary Tool Tables

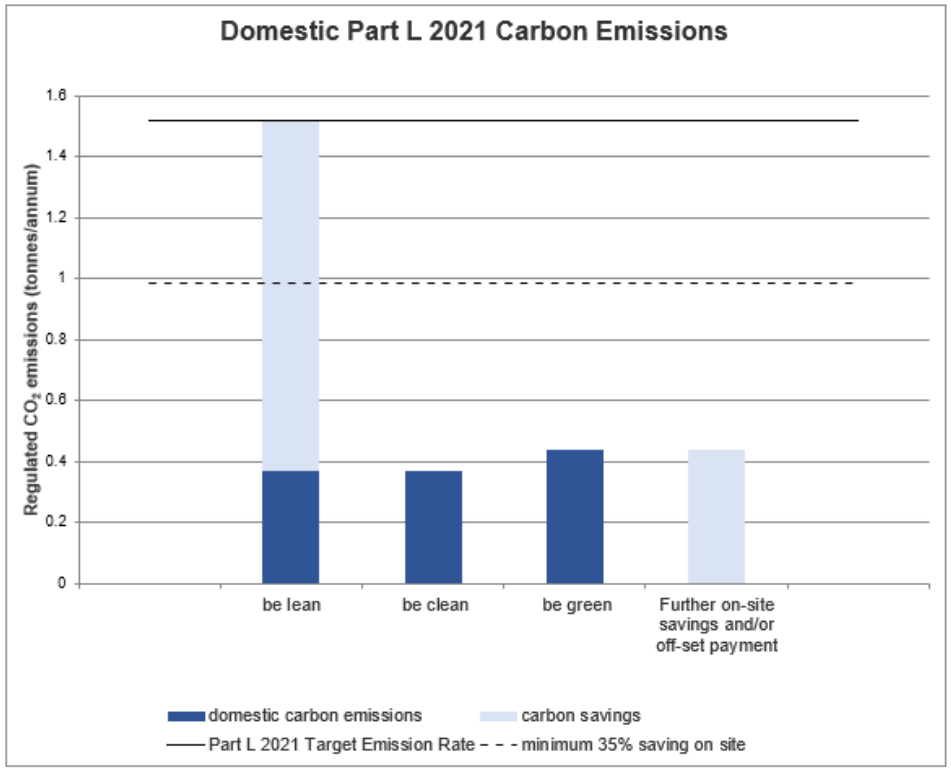
Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for residential buildings

	Carbon Dioxide Emissions for residential buildings (Tonnes CO_2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2021 of the Building Regulations Compliant Development	1.5	2.2
After energy demand reduction (be lean)	0.4	2.2
After heat network connection (be clean)	0.4	2.2
After renewable energy (be green)	0.4	2.2

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	1.1	76%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	-0.1	-4%
Cumulative on site savings	**1.1**	**71%**
Annual savings from off-set payment	0.4	-
	(Tonnes CO_2)	
Cumulative savings for off-set payment	**13**	-
Cash in-lieu contribution (£)	**1,247**	

*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless Local Planning Authority price is inputted in the 'Development



	Total regulated emissions (Tonnes CO_2 / year)	CO_2 savings (Tonnes CO_2 / year)	Percentage savings (%)
Part L 2021 baseline	1.5		
Be lean	0.4	1.1	76%
Be clean	0.4	0.0	0%
Be green	0.4	-0.1	-4%
Total Savings	-	1.1	71%
	-	CO_2 savings off-set (Tonnes CO_2)	-
Off-set	-	**13.1**	-

	Target Fabric Energy Efficiency (kWh/m²)	Dwelling Fabric Energy Efficiency (kWh/m²)	Improvement (%)
Development total	45.46	40.87	10%

Building type	EUI (kWh/m²/year) (excluding renewable energy)	Space heating demand (kWh/m²/year) (excluding renewable energy)	EUI value from Table 4 of the guidance (kWh/m²/year) (excluding renewable energy)	Space heating demand from Table 4 of the guidance(kWh/m²/year) (excluding renewable energy)	Methodology used (e.g. 'be seen' methodology or an alternative predictive energy modelling methodology)	Explanatory notes (if expected performance differs from the Table 4 values in the guidance)
Residential	4.572748864	24.55916976	35	15	Part L1 - SAP 10.2 & none dwellings / & Landlord Circulation	

Appendix B:
Software Outputs

Building Regulations England Part L (BREL) Compliance Report

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

Date: Thu 07 Sep 2023 15:08:10

Project Information			
Assessed By	Kyle Jones	Building Type	House, Detached
OCDEA Registration	EES/027281	Assessment Date	2023-09-07

Dwelling Details			
Assessment Type	As designed	Total Floor Area	194 m^2
Site Reference	304340	Plot Reference	304340
Address	22b Harley Road, London, NW3 3BN		

Client Details	
Name	Sei Howe
Company	NA
Address	22b Harley Road, London, NW3 3BN

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

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*7.84 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	2.26 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*42.2 kWh_{PE}/m^2*	
Dwelling primary energy	23.5 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*45.5 kWh/m^2*	
Dwelling fabric energy efficiency	40.9 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.16	Walls (1) (0.16)	OK
Party walls	*0.2*	N/A	N/A	**N/A**
Curtain walls	*1.6*	N/A	N/A	**N/A**
Floors	*0.18*	0.11	Ground Floor (0.11)	OK
Roofs	*0.16*	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	*1.6*	1.03	E (1.2)	OK
Rooflights	*2.2*	0.8	Roof Light Green Roof, North (0.8)	OK

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	176.39	0.16
Exposed wall: Walls (2)	15.97	0.16
Ground floor: Ground Floor, Ground Floor	138.15	0.11
Exposed roof: Roof (1)	73.8	0.11
Exposed roof: Roof (2)	53.48	0.11

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
E, Glazed Door	3.1	East	0.7	1.2
E, Window	2.35	East	0.7	1 **(!)**
E, Window	2.3	East	0.7	1 **(!)**
E, Cladded Window	13.52	East	0.7	1 **(!)**
W, Window	21	West	0.7	1 **(!)**
N, Glazed Door	5.3	North	0.7	1.2
N, Window	5.85	North	0.7	1 **(!)**
N, Window	1.33	North	0.7	1 **(!)**
S, Window	14.23	South	0.7	1 **(!)**
S, Window	1.92	South	0.7	1 **(!)**
S, Glazed Door	1.84	South	0.7	1.2

Name	Area [m^2]	Orientation	Frame factor	U-Value [W/m^2K]
Roof Light Green Roof, Roof Light	8.82	North	0.7	0.8
Roof Light Zinc Clad roof, Roof Light	2.05	North	0.7	0.8

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.084	
External wall	E3: Sill	Calculated by person with suitable expertise	0.034 **(!)**	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.043	
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.021 **(!)**	
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.08	
External wall	E14: Flat roof	Calculated by person with suitable expertise	0.046	
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	-0.015 **(!)**	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.03 **(!)**	
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	2.6 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	389.0%
Emitter type	Both radiators and underfloor
Flow temperature	45°C
System type	Heat Pump
Manufacturer	MIDEA
Model	NXHM 008
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	250 litres
Declared heat loss	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: Programmer and at least two room thermostats	
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: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.63 W/(l/s)	**OK**
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	**OK**
Manufacturer/Model	Sentinel Kinetic Plus B	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	1 kWp
Orientation	Horizontal
Pitch	Horizontal
Overshading	None or very little
Manufacturer	
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

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

Full SAP Calculation Printout

Property Reference	304340	Issued on Date	07/09/2023
Assessment Reference	304340	Prop Type Ref	304340
Property	22b, Harley Road, London, NW3 3BN		

SAP Rating	88 B	DER	2.26	TER	7.84
Environmental	98 A	% DER < TER			71.17
CO_2 Emissions (t/year)	0.4	DFEE	40.87	TFEE	45.46
Compliance Check	See BREL	% DFEE < TFEE			10.09
% DPER < TPER	44.31	DPER	23.50	TPER	42.20

Assessor Details	Mr. Kyle Jones	Assessor ID	AV53-0001
Client	304340, Sei Howe		

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	138.1500 (1b)	x	2.3300 (2b)	=	321.8895 (1b)	-
First floor	55.5300 (1c)	x	2.5200 (2c)	=	139.9356 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	193.6800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	461.8251	(5)

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2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		2.6000	(17)
Infiltration rate		0.1300	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1300	(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	0.1657	0.1625	0.1593	0.1430	0.1397	0.1235	0.1235	0.1203	0.1300	0.1397	0.1462	0.1528	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	81.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2607	0.2575	0.2542	0.2380	0.2347	0.2185	0.2185	0.2152	0.2250	0.2347	0.2412	0.2477	(25)

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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 = 1.00)			48.9800	0.9615	47.0962			(27)
Glazed Door (Uw = 1.20)			10.2400	1.1450	11.7252			(27)

Cladded Window (Uw = 1.00)			13.5200	0.9615	13.0000			(27)
Roof Light Green Roof			8.8200	0.7752	6.8372			(27a)
Roof Light Zinc Clad roof			2.0500	0.7752	1.5891			(27a)
Ground Floor			138.1500	0.1100	15.1965	75.0000	10361.2500	(28a)
External Timber clad Wall	241.7400	65.3500	176.3900	0.1600	28.2224	9.0000	1587.5100	(29a)
External Zinc Clad Wall	23.3600	7.3900	15.9700	0.1600	2.5552	9.0000	143.7300	(29a)
External Green Roof	82.6200	8.8200	73.8000	0.1100	8.1180	9.0000	664.2000	(30)
External Zinc Roof	55.5300	2.0500	53.4800	0.1100	5.8828	9.0000	481.3200	(30)
Total net area of external elements Aum(A, m2)			541.4000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		140.2226			(33)
Internal Wall			202.4000			9.0000	1821.6000	(32c)
First Floor			55.5300			18.0000	999.5400	(32d)
Internal Ceiling			55.5300			9.0000	499.7700	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 16558.9200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 85.4963 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	28.1100	0.0840	2.3612
E3 Sill	9.7000	0.0340	0.3298
E4 Jamb	53.6600	0.0430	2.3074
E5 Ground floor (normal)	70.0000	0.0210	1.4700
E6 Intermediate floor within a dwelling	32.1400	0.0800	2.5712
E14 Flat roof	70.0000	0.0460	3.2200
E17 Corner (inverted – internal area greater than external area)	11.8400	-0.0150	-0.1776
E16 Corner (normal)	31.2400	0.0300	0.9372
R1 Head of roof window	9.9800	0.2400	2.3952
R2 Sill of roof window	9.9800	0.2400	2.3952
R3 Jamb of roof window	3.1600	0.2400	0.7584

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 18.5680 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 158.7906 (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	39.7389	39.2436	38.7483	36.2717	35.7764	33.2999	33.2999	32.8046	34.2905	35.7764	36.7671	37.7577	(38)
Heat transfer coeff	198.5295	198.0342	197.5389	195.0624	194.5671	192.0905	192.0905	191.5952	193.0811	194.5671	195.5577	196.5483	(39)
Average = Sum(39)m / 12 =												194.9385	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0250	1.0225	1.0199	1.0071	1.0046	0.9918	0.9918	0.9892	0.9969	1.0046	1.0097	1.0148	(40)
HLP (average)												1.0065	
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 2.9937 (42)
Hot water usage for mixer showers

111.6213	109.9439	107.4995	102.8226	99.3712	95.5222	93.3345	95.7604	98.4196	102.5522	107.3295	111.1937	(42a)

Hot water usage for baths

33.8145	33.3123	32.6051	31.3012	30.3248	29.2422	28.6574	29.3596	30.1242	31.2827	32.6135	33.7002	(42b)

Hot water usage for other uses

47.6720	45.9385	44.2049	42.4714	40.7379	39.0044	39.0044	40.7379	42.4714	44.2049	45.9385	47.6720	(42c)

Average daily hot water use (litres/day) 177.6007 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	193.1078	189.1947	184.3096	176.5952	170.4339	163.7688	160.9962	165.8579	171.0152	178.0399	185.8815	192.5659	(44)
Energy conte	305.8356	269.4107	283.2769	241.7501	229.4368	201.3728	194.7110	205.3667	210.8789	241.5984	264.8223	301.5116	(45)
Energy content (annual)										Total = Sum(45)m =		2949.9717	
Distribution loss (46)m = 0.15 x (45)m	45.8753	40.4116	42.4915	36.2625	34.4155	30.2059	29.2066	30.8050	31.6318	36.2398	39.7233	45.2267	(46)

Water storage loss:
Store volume 250.0000 (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)
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)
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)

Primary loss
Combi loss
Total heat required for water heating calculated for each month

362.5780	320.6619	340.0193	296.6621	286.1792	256.2848	251.4534	262.1091	265.7909	298.3408	319.7343	358.2540	(62)
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)
-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)
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)
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)

WWHRS
PV diverter
Solar input
FGHRS
Output from w/h

362.5780	320.6619	340.0193	296.6621	286.1792	256.2848	251.4534	262.1091	265.7909	298.3408	319.7343	358.2540	(64)

Total per year (kWh/year) = Sum(64)m = 3618.0677 (64)
12Total per year (kWh/year) 3618 (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

147.0843	130.5800	139.5835	124.3115	121.6817	110.8861	110.1353	113.6783	114.0468	125.7254	131.9830	145.6465	(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	149.6846	149.6846	149.6846	149.6846	149.6846	149.6846	149.6846	149.6846	149.6846	149.6846	149.6846	149.6846	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	184.0999	203.8249	184.0999	190.2366	184.0999	190.2366	184.0999	184.0999	190.2366	184.0999	190.2366	184.0999	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	364.9986	368.7862	359.2417	338.9226	313.2734	289.1668	273.0621	269.2745	278.8190	299.1381	324.7873	348.8939	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.9685	37.9685	37.9685	37.9685	37.9685	37.9685	37.9685	37.9685	37.9685	37.9685	37.9685	37.9685	(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)

	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	(71)

Water heating gains (Table 5)

	197.6939	194.3155	187.6122	172.6549	163.5506	154.0084	148.0313	152.7935	158.3984	168.9857	183.3097	195.7615	(72)

Total internal gains

	814.6978	834.8320	798.8592	769.7194	728.8293	701.3172	673.0987	674.0733	695.3593	720.1291	766.2390	796.6607	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.1800	10.6334	0.6800	0.7000	0.7700	25.1847	(74)
East	4.6500	19.6403	0.6800	0.7000	0.7700	30.1259	(76)
South	16.1500	46.7521	0.6800	0.7000	0.7700	249.0655	(78)
West	21.0000	19.6403	0.6800	0.7000	0.7700	136.0526	(80)
North	5.3000	10.6334	0.7600	0.7000	0.7700	20.7775	(74)
East	3.1000	19.6403	0.7600	0.7000	0.7700	22.4468	(76)
South	1.8400	46.7521	0.7600	0.7000	0.7700	31.7149	(78)
North	10.8700	26.0000	0.6800	0.7000	1.0000	121.0744	(82)
East	13.5200	19.6403	0.6800	0.7000	0.7700	87.5919	(76)

Solar gains	724.0342	1339.4837	2071.9231	2898.0971	3497.4428	3569.1698	3401.6832	2948.6646	2361.8184	1549.0453	887.6025	605.8749	(83)
Total gains	1538.7320	2174.3156	2870.7824	3667.8165	4226.2721	4270.4870	4074.7819	3622.7379	3057.1777	2269.1745	1653.8415	1402.5356	(84)

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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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	23.1688	23.2268	23.2850	23.5807	23.6407	23.9455	23.9455	24.0074	23.8226	23.6407	23.5209	23.4024	
alpha	2.5446	2.5485	2.5523	2.5720	2.5760	2.5964	2.5964	2.6005	2.5882	2.5760	2.5681	2.5602	
util living area	0.9187	0.8386	0.7177	0.5504	0.3992	0.2797	0.2046	0.2386	0.4056	0.6780	0.8683	0.9326	(86)
Living	19.1525	19.6390	20.1484	20.5687	20.7693	20.8500	20.8717	20.8667	20.7970	20.4371	19.7092	19.0620	
Non living	18.3708	18.8399	19.3195	19.7069	19.8792	19.9528	19.9675	19.9671	19.9128	19.6066	18.9248	18.2893	
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	20.0549	19.6390	20.1484	20.5687	20.7693	20.8500	20.8717	20.8667	20.7970	20.4371	19.7092	19.3331	(87)
Th 2	20.0625	20.0646	20.0668	20.0774	20.0795	20.0902	20.0902	20.0923	20.0859	20.0795	20.0753	20.0710	(88)
util rest of house	0.9092	0.8223	0.6934	0.5195	0.3647	0.2420	0.1633	0.1930	0.3585	0.6424	0.8518	0.9245	(89)
MIT 2	19.1971	18.8399	19.3195	19.7069	19.8792	19.9528	19.9675	19.9671	19.9128	19.6066	18.9248	18.5385	(90)
Living area fraction									fLA = Living area / (4) =			0.2127	(91)
MIT	19.3796	19.0099	19.4958	19.8903	20.0685	20.1437	20.1599	20.1585	20.1009	19.7833	19.0916	18.7075	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3796	19.0099	19.4958	19.8903	20.0685	20.1437	20.1599	20.1585	20.1009	19.7833	19.0916	18.7075	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9013	0.8014	0.6773	0.5130	0.3643	0.2442	0.1665	0.1964	0.3593	0.6300	0.8312	0.9102	(94)
Useful gains	1386.8836	1742.4361	1944.3498	1881.4363	1539.5499	1043.0274	678.2825	711.4365	1098.3895	1429.6062	1374.7215	1276.5918	(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	2993.7367	2794.2380	2567.1774	2143.7851	1628.2424	1064.8862	683.8194	720.1027	1158.6519	1786.7633	2345.0583	2851.4308	(97)
Space heating kWh	1195.4987	706.8109	463.3837	188.8911	65.9873	0.0000	0.0000	0.0000	0.0000	265.7249	698.6425	1171.6803	(98a)
Space heating requirement - total per year (kWh/year)												4756.6194	
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	1195.4987	706.8109	463.3837	188.8911	65.9873	0.0000	0.0000	0.0000	0.0000	265.7249	698.6425	1171.6803	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4756.6194	
Space heating per m2											(98c) / (4) =	24.5592	(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 %) 389.0090 (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													
	1195.4987	706.8109	463.3837	188.8911	65.9873	0.0000	0.0000	0.0000	0.0000	265.7249	698.6425	1171.6803	(98)
Space heating efficiency (main heating system 1)													
	389.0090	389.0090	389.0090	389.0090	389.0090	0.0000	0.0000	0.0000	0.0000	389.0090	389.0090	389.0090	(210)
Space heating fuel (main heating system)													
	307.3191	181.6953	119.1190	48.5570	16.9629	0.0000	0.0000	0.0000	0.0000	68.3082	179.5955	301.1962	(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													
	362.5780	320.6619	340.0193	296.6621	286.1792	256.2848	251.4534	262.1091	265.7909	298.3408	319.7343	358.2540	(64)
Efficiency of water heater												270.7347	(216)
(217)m	270.7347	270.7347	270.7347	270.7347	270.7347	270.7347	270.7347	270.7347	270.7347	270.7347	270.7347	270.7347	(217)
Fuel for water heating, kWh/month													
	133.9237	118.4414	125.5913	109.5767	105.7047	94.6627	92.8781	96.8140	98.1739	110.1967	118.0987	132.3266	(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	42.2061	38.1216	42.2061	40.8446	42.2061	40.8446	42.2061	42.2061	40.8446	42.2061	40.8446	42.2061	(231)
Lighting	48.1635	38.6386	34.7897	25.4885	19.6880	16.0853	17.9601	23.3452	30.3231	39.7855	44.9376	49.5021	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-13.6581	-23.9307	-43.2885	-59.1246	-72.1672	-70.2172	-68.7808	-59.8809	-45.7300	-30.5143	-16.2467	-11.1584	(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 1222.7532 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 270.7347
Water heating fuel used 1336.3885 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8820)
mechanical ventilation fans (SFP = 0.8820) 496.9423 (230a)
Total electricity for the above, kWh/year 496.9423 (231)
Electricity for lighting (calculated in Appendix L) 388.7071 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation -514.6974 (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 2930.0936 (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	1222.7532	0.1571	192.0760	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1336.3885	0.1410	188.4964	(264)
Space and water heating			380.5724	(265)
Pumps, fans and electric keep-hot	496.9423	0.1387	68.9320	(267)
Energy for lighting	388.7071	0.1443	56.1024	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-514.6974	0.1310	-67.4277	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-67.4277	(269)

Total CO2, kg/year	438.1792 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)	2.2600 (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	1222.7532	1.5815	1933.7244	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1336.3885	1.5216	2033.3900	(278)
Space and water heating			3967.1145	(279)
Pumps, fans and electric keep-hot	496.9423	1.5128	751.7743	(281)
Energy for lighting	388.7071	1.5338	596.2119	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-514.6974	1.4840	-763.7939	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-763.7939	(283)
Total Primary energy kWh/year			4551.3068	(286)
Dwelling Primary energy Rate (DPER)			23.5000	(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	138.1500 (1b)	x	2.3300 (2b)	=	321.8895 (1b)	-
First floor	55.5300 (1c)	x	2.5200 (2c)	=	139.9356 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	193.6800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	461.8251	(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) =	0.0866	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3366	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3366	(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	0.4292	0.4208	0.4124	0.3703	0.3619	0.3198	0.3198	0.3114	0.3366	0.3619	0.3787	0.3955	(22b)
Effective ac	0.5921	0.5885	0.5850	0.5686	0.5655	0.5511	0.5511	0.5485	0.5567	0.5655	0.5717	0.5782	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.20)			42.1300	1.1450	48.2405			(27)
Roof Light Green Roof			5.1100	2.0221	10.3327			(27a)

Roof Light Zinc Clad roof			1.1900	2.0221	2.4062	(27a)
Ground Floor			138.1500	0.1300	17.9595	(28a)
External Timber clad Wall	241.7400	37.8500	203.8900	0.1800	36.7002	(29a)
External Zinc Clad Wall	23.3600	4.2800	19.0800	0.1800	3.4344	(29a)
External Green Roof	82.6200	5.1100	77.5100	0.1100	8.5261	(30)
External Zinc Roof	55.5300	1.1900	54.3400	0.1100	5.9774	(30)
Total net area of external elements Aum(A, m2)			541.4000			(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	133.5770	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 85.4963 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	28.1100	0.0500	1.4055
E3 Sill	9.7000	0.0500	0.4850
E4 Jamb	53.6600	0.0500	2.6830
E5 Ground floor (normal)	70.0000	0.1600	11.2000
E6 Intermediate floor within a dwelling	32.1400	0.0000	0.0000
E14 Flat roof	70.0000	0.0800	5.6000
E17 Corner (inverted – internal area greater than external area)	11.8400	-0.0900	-1.0656
E16 Corner (normal)	31.2400	0.0900	2.8116
R1 Head of roof window	9.9800	0.0800	0.7984
R2 Sill of roof window	9.9800	0.0600	0.5988
R3 Jamb of roof window	3.1600	0.0800	0.2528

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 24.7695 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 158.3465 (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	90.2371	89.6921	89.1579	86.6485	86.1791	83.9935	83.9935	83.5888	84.8354	86.1791	87.1288	88.1218	(38)
Heat transfer coeff	248.5837	248.0386	247.5044	244.9951	244.5256	242.3401	242.3401	241.9353	243.1819	244.5256	245.4754	246.4683	(39)

Average = Sum(39)m / 12 = 244.9928

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2835	1.2807	1.2779	1.2649	1.2625	1.2512	1.2512	1.2491	1.2556	1.2625	1.2674	1.2726	(40)
HLP (average)												1.2649	
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 2.9937 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	74.4142	73.2959	71.6663	68.5484	66.2475	63.6815	62.2230	63.8402	65.6130	68.3681	71.5530	74.1291	(42a)
Hot water usage for baths	32.1238	31.6467	30.9749	29.7361	28.8086	27.7801	27.2245	27.8916	28.6180	29.7186	30.9828	32.0152	(42b)
Hot water usage for other uses	45.2884	43.6415	41.9947	40.3478	38.7010	37.0541	37.0541	38.7010	40.3478	41.9947	43.6415	45.2884	(42c)

Average daily hot water use (litres/day) 139.5625 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	151.8264	148.5842	144.6359	138.6324	133.7570	128.5157	126.5016	130.4329	134.5789	140.0814	146.1774	151.4327	(44)
Energy conte	240.4559	211.5819	222.3000	189.7808	180.0627	158.0250	152.9928	161.5031	165.9493	190.0891	208.2565	237.1070	(45)

Energy content (annual) Total = Sum(45)m = 2318.1041

Distribution loss (46)m = 0.15 x (45)m	36.0684	31.7373	33.3450	28.4671	27.0094	23.7038	22.9489	24.2255	24.8924	28.5134	31.2385	35.5660	(46)

Water storage loss:

Store volume 250.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.8903 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 1.0208 (55)

Total storage loss	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(56)
If cylinder contains dedicated solar storage	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	295.3627	261.1751	277.2068	242.9164	234.9695	211.1606	207.8996	216.4099	219.0849	244.9959	261.3921	292.0138	(62)
WWHRS	-34.0191	-30.0868	-31.5051	-26.0875	-24.3126	-20.8045	-19.5009	-20.7372	-21.5251	-25.3757	-28.7476	-33.3891	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	261.3436	231.0884	245.7017	216.8289	210.6569	190.3562	188.3987	195.6727	197.5598	219.6202	232.6445	258.6247	(64)

Total per year (kWh/year) = Sum(64)m = 2648.4962 (64)

12Total per year (kWh/year) 2648 (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	123.8770	110.0256	117.8402	105.6106	103.7963	95.0518	94.7955	97.6252	97.6866	107.1301	111.7538	122.7635	(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	149.6846	149.6846	149.6846	149.6846	149.6846	149.6846	149.6846	149.6846	149.6846	149.6846	149.6846	149.6846	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	184.0999	203.8249	184.0999	190.2366	184.0999	190.2366	184.0999	184.0999	190.2366	184.0999	190.2366	184.0999	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	364.9986	368.7862	359.2417	338.9226	313.2734	289.1668	273.0621	269.2745	278.8190	299.1381	324.7873	348.8939	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.9685	37.9685	37.9685	37.9685	37.9685	37.9685	37.9685	37.9685	37.9685	37.9685	37.9685	37.9685	(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)													
	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	(71)
Water heating gains (Table 5)													
	166.5014	163.7285	158.3873	146.6814	139.5111	132.0164	127.4133	131.2167	135.6759	143.9920	155.2136	165.0047	(72)
Total internal gains													
	786.5053	807.2450	772.6343	746.7460	707.7898	679.3251	652.4807	652.4965	672.6368	698.1354	741.1428	768.9039	(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	
North	7.2300	10.6334	0.6300	0.7000	0.7700	23.4954	(74)
East	12.3200	19.6403	0.6300	0.7000	0.7700	73.9486	(76)
South	10.4200	46.7521	0.6300	0.7000	0.7700	148.8814	(78)
West	12.1600	19.6403	0.6300	0.7000	0.7700	72.9882	(80)
North	6.3000	26.0000	0.6300	0.7000	1.0000	65.0122	(82)

Solar gains	384.3257	711.1950	1100.3099	1539.0487	1857.0787	1894.9925	1806.1429	1565.8272	1254.2930	822.5436	471.1881	321.5776	(83)
Total gains	1170.8310	1518.4400	1872.9442	2285.7947	2564.8686	2574.3177	2458.6236	2218.3237	1926.9298	1520.6790	1212.3310	1090.4816	(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, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	18.5036	18.5443	18.5843	18.7747	18.8107	18.9804	18.9804	19.0121	18.9146	18.8107	18.7379	18.6624	
alpha	2.2336	2.2363	2.2390	2.2516	2.2540	2.2654	2.2654	2.2675	2.2610	2.2540	2.2492	2.2442	
util living area													
	0.9568	0.9254	0.8731	0.7766	0.6501	0.5085	0.3941	0.4432	0.6442	0.8447	0.9349	0.9626	(86)
MIT	17.6722	18.1555	18.8508	19.6854	20.3288	20.7313	20.8919	20.8558	20.5157	19.6077	18.4836	17.5930	(87)
Th 2	19.8538	19.8560	19.8582	19.8684	19.8703	19.8792	19.8792	19.8809	19.8758	19.8703	19.8664	19.8624	(88)
util rest of house													
	0.9506	0.9152	0.8556	0.7463	0.6027	0.4399	0.3059	0.3523	0.5787	0.8160	0.9241	0.9572	(89)
MIT 2	15.9785	16.5872	17.4553	18.4776	19.2291	19.6698	19.8184	19.7944	19.4640	18.4147	17.0152	15.8820	(90)
Living area fraction										fLA = Living area / (4) =		0.2127	(91)
MIT	16.3388	16.9208	17.7522	18.7345	19.4631	19.8956	20.0467	20.0202	19.6877	18.6685	17.3276	16.2459	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.3388	16.9208	17.7522	18.7345	19.4631	19.8956	20.0467	20.0202	19.6877	18.6685	17.3276	16.2459	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9214	0.8777	0.8138	0.7105	0.5838	0.4409	0.3197	0.3643	0.5664	0.7769	0.8890	0.9305	(94)
Useful gains	1078.7792	1332.7554	1524.1196	1624.0318	1497.3629	1135.1016	786.0320	808.1557	1091.3430	1181.4571	1077.7638	1014.6532	(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													
	2992.6455	2981.6225	2784.9615	2409.4095	1898.2678	1283.3297	835.2809	875.8462	1358.8236	1972.9515	2510.6146	2968.9426	(97)
Space heating kWh													
	1423.9165	1108.0387	938.0663	565.4720	298.2732	0.0000	0.0000	0.0000	0.0000	588.8718	1031.6526	1453.9913	(98a)
Space heating requirement - total per year (kWh/year)												7408.2824	
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													
	1423.9165	1108.0387	938.0663	565.4720	298.2732	0.0000	0.0000	0.0000	0.0000	588.8718	1031.6526	1453.9913	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7408.2824	
Space heating per m2											(98c) / (4) =	38.2501	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1423.9165	1108.0387	938.0663	565.4720	298.2732	0.0000	0.0000	0.0000	0.0000	588.8718	1031.6526	1453.9913	(98)

Space heating efficiency (main heating system 1)

	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)

	1542.7048	1200.4753	1016.3232	612.6457	323.1563	0.0000	0.0000	0.0000	0.0000	637.9976	1117.7168	1575.2885 (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

	261.3436	231.0884	245.7017	216.8289	210.6569	190.3562	188.3987	195.6727	197.5598	219.6202	232.6445	258.6247 (64)

Efficiency of water heater

(217)m	87.2736	87.1047	86.7688	86.1083	84.8395	79.8000	79.8000	79.8000	79.8000	86.1604	86.9946	87.3129 (217)

Fuel for water heating, kWh/month

	299.4532	265.2994	283.1681	251.8096	248.3006	238.5416	236.0886	245.2039	247.5686	254.8970	267.4241	296.2043 (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	38.2523	30.6874	27.6306	20.2434	15.6366	12.7752	14.2642	18.5412	24.0831	31.5984	35.6903	39.3155 (232)

Electricity generated by PVs (Appendix M) (negative quantity)

(233a)m	-103.7296	-134.9652	-179.1366	-185.3660	-187.1421	-170.0549	-167.5951	-163.9379	-156.4197	-145.7556	-109.7693	-91.0293 (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	-98.5492	-200.8837	-388.1613	-567.8320	-736.9909	-735.8405	-727.4633	-622.3816	-464.7835	-282.3266	-129.8321	-78.4642 (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	8026.3082 (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	3133.9591 (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)	308.7182 (232)

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

PV generation	-6828.4099 (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	4726.5755 (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	8026.3082	0.2100	1685.5247	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3133.9591	0.2100	658.1314	(264)
Space and water heating			2343.6561	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	308.7182	0.1443	44.5576	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1794.9011	0.1364	-244.8099	
PV Unit electricity exported	-5033.5088	0.1267	-637.6554	
Total			-882.4653	(269)
Total CO2, kg/year			1517.6776	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			7.8400	(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	8026.3082	1.1300	9069.7282	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3133.9591	1.1300	3541.3738	(278)
Space and water heating			12611.1020	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	308.7182	1.5338	473.5222	(282)

Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1794.9011	1.5042	-2699.8531
PV Unit electricity exported	-5033.5088	0.4650	-2340.8036
Total			-5040.6567 (283)
Total Primary energy kWh/year			8174.0683 (286)
Target Primary Energy Rate (TPER)			42.2000 (287)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	138.1500 (1b)	x	2.3300 (2b)	=	321.8895 (1b)	-
First floor	55.5300 (1c)	x	2.5200 (2c)	=	139.9356 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	193.6800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	461.8251	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	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) =	0.0866	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		2.6000	(17)
Infiltration rate		0.2166	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2166	(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	0.2762	0.2708	0.2654	0.2383	0.2329	0.2058	0.2058	0.2004	0.2166	0.2329	0.2437	0.2545	(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	0.5381	0.5367	0.5352	0.5284	0.5271	0.5212	0.5212	0.5201	0.5235	0.5271	0.5297	0.5324	(25)

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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 = 1.00)			48.9800	0.9615	47.0962			(27)
Glazed Door (Uw = 1.20)			10.2400	1.1450	11.7252			(27)
Cladded Window (Uw = 1.00)			13.5200	0.9615	13.0000			(27)
Roof Light Green Roof			8.8200	0.7752	6.8372			(27a)
Roof Light Zinc Clad roof			2.0500	0.7752	1.5891			(27a)
Ground Floor			138.1500	0.1100	15.1965	75.0000	10361.2500	(28a)
External Timber clad Wall	241.7400	65.3500	176.3900	0.1600	28.2224	9.0000	1587.5100	(29a)
External Zinc Clad Wall	23.3600	7.3900	15.9700	0.1600	2.5552	9.0000	143.7300	(29a)
External Green Roof	82.6200	8.8200	73.8000	0.1100	8.1180	9.0000	664.2000	(30)
External Zinc Roof	55.5300	2.0500	53.4800	0.1100	5.8828	9.0000	481.3200	(30)
Total net area of external elements Aum(A, m2)			541.4000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		140.2226			(33)
Internal Wall			202.4000			9.0000	1821.6000	(32c)
First Floor			55.5300			18.0000	999.5400	(32d)
Internal Ceiling			55.5300			9.0000	499.7700	(32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =				16558.9200	(34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 85.4963 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	28.1100	0.0840	2.3612
E3 Sill	9.7000	0.0340	0.3298
E4 Jamb	53.6600	0.0430	2.3074
E5 Ground floor (normal)	70.0000	0.0210	1.4700
E6 Intermediate floor within a dwelling	32.1400	0.0800	2.5712
E14 Flat roof	70.0000	0.0460	3.2200
E17 Corner (inverted – internal area greater than external area)	11.8400	-0.0150	-0.1776
E16 Corner (normal)	31.2400	0.0300	0.9372
R1 Head of roof window	9.9800	0.2400	2.3952
R2 Sill of roof window	9.9800	0.2400	2.3952
R3 Jamb of roof window	3.1600	0.2400	0.7584

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 18.5680 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 158.7906 (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	82.0135	81.7878	81.5665	80.5274	80.3330	79.4280	79.4280	79.2604	79.7766	80.3330	80.7263	81.1375	(38)
Heat transfer coeff	240.8041	240.5784	240.3572	239.3181	239.1236	238.2186	238.2186	238.0510	238.5672	239.1236	239.5169	239.9281	(39)

Average = Sum(39)m / 12 = 239.3171

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2433	1.2421	1.2410	1.2356	1.2346	1.2300	1.2300	1.2291	1.2318	1.2346	1.2367	1.2388	(40)
HLP (average)												1.2356	
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 2.9937 (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

32.1238	31.6467	30.9749	29.7361	28.8086	27.7801	27.2245	27.8916	28.6180	29.7186	30.9828	32.0152	(42b)

Hot water usage for other uses

45.2884	43.6415	41.9947	40.3478	38.7010	37.0541	37.0541	38.7010	40.3478	41.9947	43.6415	45.2884	(42c)

Average daily hot water use (litres/day) 70.9551 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	77.4122	75.2882	72.9696	70.0840	67.5096	64.8342	64.2786	66.5926	68.9659	71.7133	74.6244	77.3036	(44)
Energy conte	122.6020	107.2094	112.1515	95.9414	90.8808	79.7212	77.7395	82.4556	85.0418	97.3142	106.3161	121.0387	(45)

Energy content (annual) Total = Sum(45)m = 1178.4123

Distribution loss (46)m = 0.15 x (45)m												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)

Water storage loss:
Total storage loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

104.2117	91.1280	95.3288	81.5502	77.2487	67.7630	66.0785	70.0873	72.2855	82.7171	90.3687	102.8829	(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

104.2117	91.1280	95.3288	81.5502	77.2487	67.7630	66.0785	70.0873	72.2855	82.7171	90.3687	102.8829	(64)

Total per year (kWh/year) = Sum(64)m = 1001.6504 (64)
12Total per year (kWh/year) 1002 (64)
Electric shower(s)

59.5934	53.0982	57.9812	55.3308	56.3690	53.7706	55.5629	56.3690	55.3308	57.9812	56.8909	59.5934	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 677.8714 (64a)
Heat gains from water heating, kWh/month

40.9513	36.0566	38.3275	34.2202	33.4044	30.3834	30.4104	31.6141	31.9041	35.1746	36.8149	40.6191	(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	149.6846	149.6846	149.6846	149.6846	149.6846	149.6846	149.6846	149.6846	149.6846	149.6846	149.6846	149.6846	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	184.0999	203.8249	184.0999	190.2366	184.0999	190.2366	184.0999	184.0999	190.2366	184.0999	190.2366	184.0999	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	364.9986	368.7862	359.2417	338.9226	313.2734	289.1668	273.0621	269.2745	278.8190	299.1381	324.7873	348.8939	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9685	37.9685	37.9685	37.9685	37.9685	37.9685	37.9685	37.9685	37.9685	37.9685	37.9685	37.9685	(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)	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	(71)
Water heating gains (Table 5)	55.0420	53.6556	51.5154	47.5281	44.8984	42.1992	40.8741	42.4920	44.3112	47.2777	51.1318	54.5955	(72)

Total internal gains

	672.0459	694.1721	662.7624	644.5927	610.1771	589.5079	565.9415	563.7718	581.2722	598.4210	634.0611	655.4947 (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	
North	7.1800	10.6334	0.6800	0.7000	0.7700	25.1847	(74)
East	4.6500	19.6403	0.6800	0.7000	0.7700	30.1259	(76)
South	16.1500	46.7521	0.6800	0.7000	0.7700	249.0655	(78)
West	21.0000	19.6403	0.6800	0.7000	0.7700	136.0526	(80)
North	5.3000	10.6334	0.7600	0.7000	0.7700	20.7775	(74)
East	3.1000	19.6403	0.7600	0.7000	0.7700	22.4468	(76)
South	1.8400	46.7521	0.7600	0.7000	0.7700	31.7149	(78)
North	10.8700	26.0000	0.6800	0.7000	1.0000	121.0744	(82)
East	13.5200	19.6403	0.6800	0.7000	0.7700	87.5919	(76)

Solar gains	724.0342	1339.4837	2071.9231	2898.0971	3497.4428	3569.1698	3401.6832	2948.6646	2361.8184	1549.0453	887.6025	605.8749 (83)
Total gains	1396.0801	2033.6557	2734.6856	3542.6898	4107.6199	4158.6777	3967.6248	3512.4364	2943.0906	2147.4664	1521.6636	1261.3696 (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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.1014	19.1193	19.1369	19.2200	19.2357	19.3087	19.3087	19.3223	19.2805	19.2357	19.2041	19.1712	
alpha	2.2734	2.2746	2.2758	2.2813	2.2824	2.2872	2.2872	2.2882	2.2854	2.2824	2.2803	2.2781	
util living area	0.9392	0.8752	0.7738	0.6227	0.4708	0.3423	0.2548	0.2965	0.4826	0.7446	0.9014	0.9502	(86)
MIT	17.9806	18.6667	19.4734	20.2295	20.6758	20.8869	20.9584	20.9401	20.7475	20.0076	18.8137	17.8395	(87)
Th 2	19.8855	19.8864	19.8873	19.8916	19.8924	19.8961	19.8961	19.8968	19.8947	19.8924	19.8908	19.8891	(88)
util rest of house	0.9310	0.8600	0.7490	0.5870	0.4264	0.2893	0.1940	0.2302	0.4214	0.7071	0.8865	0.9433	(89)
MIT 2	17.1523	17.8174	18.5834	19.2763	19.6607	19.8305	19.8787	19.8702	19.7355	19.1061	17.9759	17.0163	(90)
Living area fraction										fLA = Living area / (4) =		0.2127	(91)
MIT	17.3285	17.9980	18.7727	19.4790	19.8766	20.0552	20.1084	20.0978	19.9508	19.2979	18.1541	17.1914	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.3285	17.9980	18.7727	19.4790	19.8766	20.0552	20.1084	20.0978	19.9508	19.2979	18.1541	17.1914	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9052	0.8280	0.7206	0.5728	0.4258	0.2971	0.2059	0.2426	0.4247	0.6841	0.8564	0.9201	(94)
Useful gains	1263.7781	1683.9629	1970.5782	2029.1802	1748.9435	1235.6799	816.9300	852.1544	1249.8103	1469.1885	1303.1262	1160.5543	(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	3137.3246	3151.1045	2949.8407	2531.7553	1955.2185	1299.5389	835.7553	880.2572	1395.8060	2079.8730	2647.6502	3117.0118	(97)
Space heating kWh	1393.9186	985.9192	728.5713	361.8540	153.4686	0.0000	0.0000	0.0000	0.0000	454.3492	968.0572	1455.6044	(98a)
Space heating requirement - total per year (kWh/year)												6501.7425	
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	1393.9186	985.9192	728.5713	361.8540	153.4686	0.0000	0.0000	0.0000	0.0000	454.3492	968.0572	1455.6044	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6501.7425	
Space heating per m2											(98c) / (4) =	33.5695	(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	2239.2549	1762.8176	1809.1876	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8917	0.9225	0.8998	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1996.6776	1626.1329	1627.8276	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	4620.2466	4409.0665	3905.9061	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1888.9697	2070.5026	1694.8904	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	472.2424	517.6257	423.7226	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												1413.5907	(107)
Energy for space heating												33.5695	(99)
Energy for space cooling												7.2986	(108)

Total 40.8681 (109)
Fabric Energy Efficiency (DFEE) 40.9 (109)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	138.1500 (1b)	x	2.3300 (2b)	=	321.8895 (1b)	-
First floor	55.5300 (1c)	x	2.5200 (2c)	=	139.9356 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 193.6800						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	461.8251	(5)

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2. Ventilation rate
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	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	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) =	0.0866	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3366	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3366	(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	0.4292	0.4208	0.4124	0.3703	0.3619	0.3198	0.3198	0.3114	0.3366	0.3619	0.3787	0.3955	(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	0.5921	0.5885	0.5850	0.5686	0.5655	0.5511	0.5511	0.5485	0.5567	0.5655	0.5717	0.5782	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.20)			42.1300	1.1450	48.2405			(27)
Roof Light Green Roof			5.1100	2.0221	10.3327			(27a)
Roof Light Zinc Clad roof			1.1900	2.0221	2.4062			(27a)
Ground Floor			138.1500	0.1300	17.9595			(28a)
External Timber clad Wall	241.7400	37.8500	203.8900	0.1800	36.7002			(29a)
External Zinc Clad Wall	23.3600	4.2800	19.0800	0.1800	3.4344			(29a)
External Green Roof	82.6200	5.1100	77.5100	0.1100	8.5261			(30)
External Zinc Roof	55.5300	1.1900	54.3400	0.1100	5.9774			(30)
Total net area of external elements Aum(A, m2)			541.4000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		133.5770			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 85.4963 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	28.1100	0.0500	1.4055
E3 Sill	9.7000	0.0500	0.4850
E4 Jamb	53.6600	0.0500	2.6830
E5 Ground floor (normal)	70.0000	0.1600	11.2000
E6 Intermediate floor within a dwelling	32.1400	0.0000	0.0000
E14 Flat roof	70.0000	0.0800	5.6000
E17 Corner (inverted – internal area greater than external area)	11.8400	-0.0900	-1.0656

E16 Corner (normal)	31.2400	0.0900	2.8116	
R1 Head of roof window	9.9800	0.0800	0.7984	
R2 Sill of roof window	9.9800	0.0600	0.5988	
R3 Jamb of roof window	3.1600	0.0800	0.2528	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 24.7695 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 158.3465 (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	90.2371	89.6921	89.1579	86.6485	86.1791	83.9935	83.9935	83.5888	84.8354	86.1791	87.1288	88.1218	(38)
Heat transfer coeff	248.5837	248.0386	247.5044	244.9951	244.5256	242.3401	242.3401	241.9353	243.1819	244.5256	245.4754	246.4683	(39)

Average = Sum(39)m / 12 = 244.9928

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2835	1.2807	1.2779	1.2649	1.2625	1.2512	1.2512	1.2491	1.2556	1.2625	1.2674	1.2726	(40)
HLP (average)												1.2649	
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 2.9937 (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

32.1238	31.6467	30.9749	29.7361	28.8086	27.7801	27.2245	27.8916	28.6180	29.7186	30.9828	32.0152	(42b)

Hot water usage for other uses

45.2884	43.6415	41.9947	40.3478	38.7010	37.0541	37.0541	38.7010	40.3478	41.9947	43.6415	45.2884	(42c)

Average daily hot water use (litres/day) 70.9551 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	77.4122	75.2882	72.9696	70.0840	67.5096	64.8342	64.2786	66.5926	68.9659	71.7133	74.6244	77.3036	(44)
Energy conte	122.6020	107.2094	112.1515	95.9414	90.8808	79.7212	77.7395	82.4556	85.0418	97.3142	106.3161	121.0387	(45)

Energy content (annual) Total = Sum(45)m = 1178.4123

Distribution loss (46)m = 0.15 x (45)m

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)

Water storage loss:

Total storage loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

104.2117	91.1280	95.3288	81.5502	77.2487	67.7630	66.0785	70.0873	72.2855	82.7171	90.3687	102.8829	(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

104.2117	91.1280	95.3288	81.5502	77.2487	67.7630	66.0785	70.0873	72.2855	82.7171	90.3687	102.8829	(64)

Total per year (kWh/year) = Sum(64)m = 1001.6504 (64)

12Total per year (kWh/year) 1002 (64)

Electric shower(s)

59.5934	53.0982	57.9812	55.3308	56.3690	53.7706	55.5629	56.3690	55.3308	57.9812	56.8909	59.5934	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 677.8714 (64a)

Heat gains from water heating, kWh/month

40.9513	36.0566	38.3275	34.2202	33.4044	30.3834	30.4104	31.6141	31.9041	35.1746	36.8149	40.6191	(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	149.6846	149.6846	149.6846	149.6846	149.6846	149.6846	149.6846	149.6846	149.6846	149.6846	149.6846	149.6846	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	184.0999	203.8249	184.0999	190.2366	184.0999	190.2366	184.0999	184.0999	190.2366	184.0999	190.2366	184.0999	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	364.9986	368.7862	359.2417	338.9226	313.2734	289.1668	273.0621	269.2745	278.8190	299.1381	324.7873	348.8939	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9685	37.9685	37.9685	37.9685	37.9685	37.9685	37.9685	37.9685	37.9685	37.9685	37.9685	37.9685	(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)	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	(71)
Water heating gains (Table 5)	55.0420	53.6556	51.5154	47.5281	44.8984	42.1992	40.8741	42.4920	44.3112	47.2777	51.1318	54.5955	(72)
Total internal gains	672.0459	694.1721	662.7624	644.5927	610.1771	589.5079	565.9415	563.7718	581.2722	598.4210	634.0611	655.4947	(73)

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6. Solar gains

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

	W/m2	or Table 6b	or Table 6c	Table 6d	
North	7.2300	10.6334	0.6300	0.7000	0.7700	23.4954 (74)
East	12.3200	19.6403	0.6300	0.7000	0.7700	73.9486 (76)
South	10.4200	46.7521	0.6300	0.7000	0.7700	148.8814 (78)
West	12.1600	19.6403	0.6300	0.7000	0.7700	72.9882 (80)
North	6.3000	26.0000	0.6300	0.7000	1.0000	65.0122 (82)

Solar gains	384.3257	711.1950	1100.3099	1539.0487	1857.0787	1894.9925	1806.1429	1565.8272	1254.2930	822.5436	471.1881	321.5776 (83)
Total gains	1056.3717	1405.3671	1763.0723	2183.6414	2467.2559	2484.5004	2372.0844	2129.5991	1835.5652	1420.9646	1105.2492	977.0724 (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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	18.5036	18.5443	18.5843	18.7747	18.8107	18.9804	18.9804	19.0121	18.9146	18.8107	18.7379	18.6624	
alpha	2.2336	2.2363	2.2390	2.2516	2.2540	2.2654	2.2654	2.2675	2.2610	2.2540	2.2492	2.2442	
util living area													
	0.9645	0.9351	0.8849	0.7899	0.6640	0.5215	0.4059	0.4575	0.6617	0.8601	0.9450	0.9698	(86)
MIT	17.5609	18.0554	18.7682	19.6299	20.2966	20.7165	20.8850	20.8459	20.4861	19.5388	18.3854	17.4804	(87)
Th 2	19.8538	19.8560	19.8582	19.8684	19.8703	19.8792	19.8792	19.8809	19.8758	19.8703	19.8664	19.8624	(88)
util rest of house													
	0.9593	0.9259	0.8687	0.7607	0.6170	0.4522	0.3158	0.3648	0.5967	0.8333	0.9357	0.9654	(89)
MIT 2	16.7215	17.2091	17.9058	18.7342	19.3443	19.7061	19.8285	19.8083	19.5327	18.6725	17.5478	16.6471	(90)
Living area fraction										fLA = Living area / (4) =		0.2127	(91)
MIT	16.9000	17.3892	18.0893	18.9247	19.5469	19.9211	20.0532	20.0290	19.7355	18.8568	17.7260	16.8244	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.9000	17.3892	18.0893	18.9247	19.5469	19.9211	20.0532	20.0290	19.7355	18.8568	17.7260	16.8244	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9397	0.8989	0.8366	0.7321	0.6021	0.4550	0.3305	0.3779	0.5876	0.8030	0.9110	0.9478	(94)
Useful gains	992.6968	1263.2553	1475.0341	1598.5587	1485.6172	1130.4263	783.9687	804.7404	1078.5206	1141.0222	1006.8807	926.0712	(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													
	3132.1656	3097.7962	2868.3920	2456.0047	1918.7586	1289.5077	836.8597	877.9931	1370.4590	2018.9998	2608.4211	3111.5112	(97)
Space heating kWh													
	1591.7648	1232.8114	1036.6583	617.3611	322.2572	0.0000	0.0000	0.0000	0.0000	653.2153	1153.1091	1625.9674	(98a)
Space heating requirement - total per year (kWh/year)												8233.1446	
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													
	1591.7648	1232.8114	1036.6583	617.3611	322.2572	0.0000	0.0000	0.0000	0.0000	653.2153	1153.1091	1625.9674	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8233.1446	
Space heating per m2											(98c) / (4) =	42.5090	(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	2277.9965	1793.3164	1838.7084	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7545	0.8110	0.7734	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1718.7436	1454.3777	1422.0186	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2736.2240	2612.9529	2346.7570	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	732.5858	861.9799	688.0053	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	183.1465	215.4950	172.0013	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												570.6428	(107)
Energy for space heating												42.5090	(99)
Energy for space cooling												2.9463	(108)
Total												45.4553	(109)
Fabric Energy Efficiency (TFEE)												45.5	(109)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	138.1500 (1b)	x	2.3300 (2b)	=	321.8895 (1b)	-
First floor	55.5300 (1c)	x	2.5200 (2c)	=	139.9356 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	193.6800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	461.8251	(5)

2. Ventilation rate

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

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		2.6000 (17)
Infiltration rate		0.1300 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1300 (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	0.1657	0.1625	0.1593	0.1430	0.1397	0.1235	0.1235	0.1203	0.1300	0.1397	0.1462	0.1528	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	81.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2607	0.2575	0.2542	0.2380	0.2347	0.2185	0.2185	0.2152	0.2250	0.2347	0.2412	0.2477	(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 = 1.00)			48.9800	0.9615	47.0962			(27)
Glazed Door (Uw = 1.20)			10.2400	1.1450	11.7252			(27)
Cladded Window (Uw = 1.00)			13.5200	0.9615	13.0000			(27)
Roof Light Green Roof			8.8200	0.7752	6.8372			(27a)
Roof Light Zinc Clad roof			2.0500	0.7752	1.5891			(27a)
Ground Floor			138.1500	0.1100	15.1965	75.0000	10361.2500	(28a)
External Timber clad Wall	241.7400	65.3500	176.3900	0.1600	28.2224	9.0000	1587.5100	(29a)
External Zinc Clad Wall	23.3600	7.3900	15.9700	0.1600	2.5552	9.0000	143.7300	(29a)
External Green Roof	82.6200	8.8200	73.8000	0.1100	8.1180	9.0000	664.2000	(30)
External Zinc Roof	55.5300	2.0500	53.4800	0.1100	5.8828	9.0000	481.3200	(30)
Total net area of external elements Aum(A, m2)			541.4000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		140.2226			(33)
Internal Wall			202.4000			9.0000	1821.6000	(32c)
First Floor			55.5300			18.0000	999.5400	(32d)
Internal Ceiling			55.5300			9.0000	499.7700	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 16558.9200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	85.4963 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	28.1100	0.0840	2.3612
E3 Sill	9.7000	0.0340	0.3298
E4 Jamb	53.6600	0.0430	2.3074
E5 Ground floor (normal)	70.0000	0.0210	1.4700
E6 Intermediate floor within a dwelling	32.1400	0.0800	2.5712
E14 Flat roof	70.0000	0.0460	3.2200
E17 Corner (inverted – internal area greater than external area)	11.8400	-0.0150	-0.1776
E16 Corner (normal)	31.2400	0.0300	0.9372
R1 Head of roof window	9.9800	0.2400	2.3952
R2 Sill of roof window	9.9800	0.2400	2.3952
R3 Jamb of roof window	3.1600	0.2400	0.7584

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	18.5680 (36)

Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 158.7906 (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	39.7389	39.2436	38.7483	36.2717	35.7764	33.2999	33.2999	32.8046	34.2905	35.7764	36.7671	37.7577	(38)
Heat transfer coeff	198.5295	198.0342	197.5389	195.0624	194.5671	192.0905	192.0905	191.5952	193.0811	194.5671	195.5577	196.5483	(39)

Average = Sum(39)m / 12 = 194.9385

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0250	1.0225	1.0199	1.0071	1.0046	0.9918	0.9918	0.9892	0.9969	1.0046	1.0097	1.0148	(40)
HLP (average)												1.0065	
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 2.9937 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	111.6213	109.9439	107.4995	102.8226	99.3712	95.5222	93.3345	95.7604	98.4196	102.5522	107.3295	111.1937	(42a)
Hot water usage for baths	33.8145	33.3123	32.6051	31.3012	30.3248	29.2422	28.6574	29.3596	30.1242	31.2827	32.6135	33.7002	(42b)
Hot water usage for other uses	47.6720	45.9385	44.2049	42.4714	40.7379	39.0044	39.0044	40.7379	42.4714	44.2049	45.9385	47.6720	(42c)

Average daily hot water use (litres/day) 177.6007 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	193.1078	189.1947	184.3096	176.5952	170.4339	163.7688	160.9962	165.8579	171.0152	178.0399	185.8815	192.5659	(44)
Energy conte	305.8356	269.4107	283.2769	241.7501	229.4368	201.3728	194.7110	205.3667	210.8789	241.5984	264.8223	301.5116	(45)

Energy content (annual) Total = Sum(45)m = 2949.9717

Distribution loss (46)m = 0.15 x (45)m	45.8753	40.4116	42.4915	36.2625	34.4155	30.2059	29.2066	30.8050	31.6318	36.2398	39.7233	45.2267	(46)

Water storage loss:

Store volume 250.0000 (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	362.5780	320.6619	340.0193	296.6621	286.1792	256.2848	251.4534	262.1091	265.7909	298.3408	319.7343	358.2540	(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	362.5780	320.6619	340.0193	296.6621	286.1792	256.2848	251.4534	262.1091	265.7909	298.3408	319.7343	358.2540	(64)

Total per year (kWh/year) = Sum(64)m = 3618.0677 (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	147.0843	130.5800	139.5835	124.3115	121.6817	110.8861	110.1353	113.6783	114.0468	125.7254	131.9830	145.6465	(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	179.6215	179.6215	179.6215	179.6215	179.6215	179.6215	179.6215	179.6215	179.6215	179.6215	179.6215	179.6215	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.0255	48.8732	39.7463	30.0905	22.4930	18.9896	20.5189	26.6712	35.7981	45.4539	53.0514	56.5548	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	544.7741	550.4272	536.1816	505.8547	467.5723	431.5922	407.5554	401.9023	416.1478	446.4748	484.7572	520.7372	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9558	55.9558	55.9558	55.9558	55.9558	55.9558	55.9558	55.9558	55.9558	55.9558	55.9558	55.9558	(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)	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	(71)
Water heating gains (Table 5)	197.6939	194.3155	187.6122	172.6549	163.5506	154.0084	148.0313	152.7935	158.3984	168.9857	183.3097	195.7615	(72)
Total internal gains	913.3232	909.4455	879.3699	824.4297	769.4456	720.4199	691.9353	697.1967	726.1739	776.7441	836.9480	888.8832	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W

North	7.1800	10.6334	0.6800	0.7000	0.7700	25.1847	(74)
East	4.6500	19.6403	0.6800	0.7000	0.7700	30.1259	(76)
South	16.1500	46.7521	0.6800	0.7000	0.7700	249.0655	(78)
West	21.0000	19.6403	0.6800	0.7000	0.7700	136.0526	(80)
North	5.3000	10.6334	0.7600	0.7000	0.7700	20.7775	(74)
East	3.1000	19.6403	0.7600	0.7000	0.7700	22.4468	(76)
South	1.8400	46.7521	0.7600	0.7000	0.7700	31.7149	(78)
North	10.8700	26.0000	0.6800	0.7000	1.0000	121.0744	(82)
East	13.5200	19.6403	0.6800	0.7000	0.7700	87.5919	(76)

Solar gains	724.0342	1339.4837	2071.9231	2898.0971	3497.4428	3569.1698	3401.6832	2948.6646	2361.8184	1549.0453	887.6025	605.8749	(83)
Total gains	1637.3574	2248.9292	2951.2930	3722.5268	4266.8884	4289.5897	4093.6185	3645.8613	3087.9923	2325.7894	1724.5505	1494.7581	(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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	23.1688	23.2268	23.2850	23.5807	23.6407	23.9455	23.9455	24.0074	23.8226	23.6407	23.5209	23.4024	
alpha	2.5446	2.5485	2.5523	2.5720	2.5760	2.5964	2.5964	2.6005	2.5882	2.5760	2.5681	2.5602	
util living area	0.9084	0.8296	0.7077	0.5446	0.3960	0.2785	0.2037	0.2371	0.4022	0.6686	0.8585	0.9235	(86)
Living	19.2195	19.6774	20.1741	20.5765	20.7714	20.8503	20.8718	20.8669	20.7987	20.4522	19.7498	19.1281	
Non living	18.4356	18.8760	19.3426	19.7135	19.8808	19.9530	19.9676	19.9672	19.9139	19.6195	18.9629	18.3535	
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	20.0892	19.6774	20.1741	20.5765	20.7714	20.8503	20.8718	20.8669	20.7987	20.4522	19.7498	19.3900	(87)
Th 2	20.0625	20.0646	20.0668	20.0774	20.0795	20.0902	20.0902	20.0923	20.0859	20.0795	20.0753	20.0710	(88)
util rest of house	0.8980	0.8127	0.6831	0.5138	0.3616	0.2410	0.1625	0.1918	0.3553	0.6328	0.8411	0.9146	(89)
MIT 2	19.2303	18.8760	19.3426	19.7135	19.8808	19.9530	19.9676	19.9672	19.9139	19.6195	18.9629	18.5937	(90)
Living area fraction										fLA = Living area / (4) =		0.2127	(91)
MIT	19.4130	19.0465	19.5195	19.8970	20.0703	20.1439	20.1599	20.1586	20.1021	19.7966	19.1303	18.7631	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4130	19.0465	19.5195	19.8970	20.0703	20.1439	20.1599	20.1586	20.1021	19.7966	19.1303	18.7631	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8898	0.7919	0.6675	0.5075	0.3613	0.2432	0.1657	0.1952	0.3562	0.6209	0.8205	0.8995	(94)
Useful gains	1457.0009	1780.8808	1970.0026	1889.1669	1541.5707	1043.2898	678.3557	711.5911	1099.8470	1444.1594	1414.9469	1344.5443	(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	3000.3694	2801.4831	2571.8485	2145.1088	1628.5760	1064.9292	683.8319	720.1290	1158.8951	1789.3624	2352.6196	2862.3533	(97)
Space heating kWh	1148.2662	685.8447	447.7733	184.2782	64.7319	0.0000	0.0000	0.0000	0.0000	256.8310	675.1244	1129.2499	(98a)
Space heating requirement - total per year (kWh/year)												4592.0996	
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	1148.2662	685.8447	447.7733	184.2782	64.7319	0.0000	0.0000	0.0000	0.0000	256.8310	675.1244	1129.2499	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4592.0996	
Space heating per m2											(98c) / (4) =	23.7097	(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 %)	389.0090 (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	1148.2662	685.8447	447.7733	184.2782	64.7319	0.0000	0.0000	0.0000	0.0000	256.8310	675.1244	1129.2499	(98)
Space heating efficiency (main heating system 1)	389.0090	389.0090	389.0090	389.0090	389.0090	0.0000	0.0000	0.0000	0.0000	389.0090	389.0090	389.0090	(210)
Space heating fuel (main heating system)	295.1773	176.3056	115.1062	47.3712	16.6402	0.0000	0.0000	0.0000	0.0000	66.0219	173.5498	290.2889	(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	362.5780	320.6619	340.0193	296.6621	286.1792	256.2848	251.4534	262.1091	265.7909	298.3408	319.7343	358.2540	(64)
Efficiency of water heater												270.7347	(216)
(217)m	270.7347	270.7347	270.7347	270.7347	270.7347	270.7347	270.7347	270.7347	270.7347	270.7347	270.7347	270.7347	(217)

Fuel for water heating, kWh/month

	133.9237	118.4414	125.5913	109.5767	105.7047	94.6627	92.8781	96.8140	98.1739	110.1967	118.0987	132.3266 (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	42.2061	38.1216	42.2061	40.8446	42.2061	40.8446	42.2061	42.2061	40.8446	42.2061	40.8446	42.2061 (231)
Lighting	48.1635	38.6386	34.7897	25.4885	19.6880	16.0853	17.9601	23.3452	30.3231	39.7855	44.9376	49.5021 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-13.6469	-23.9140	-43.2550	-59.1022	-72.1573	-70.2172	-68.7808	-59.8809	-45.7300	-30.4996	-16.2362	-11.1507 (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	1180.4611 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	270.7347
Water heating fuel used	1336.3885 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8820)	
mechanical ventilation fans (SFP = 0.8820)	496.9423 (230a)
Total electricity for the above, kWh/year	496.9423 (231)
Electricity for lighting (calculated in Appendix L)	388.7071 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-514.5708 (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	2887.9283 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1180.4611	16.4900	194.6580	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1336.3885	16.4900	220.3705	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	496.9423	16.4900	81.9458	(249)
Energy for lighting	388.7071	16.4900	64.0978	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-514.5708	16.4900	-84.8527	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-84.8527	(252)
Total energy cost			476.2194	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7183 (257)
SAP value		88.3567
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	1180.4611	0.1571	185.4067	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1336.3885	0.1410	188.4964	(264)
Space and water heating			373.9031	(265)
Pumps, fans and electric keep-hot	496.9423	0.1387	68.9320	(267)
Energy for lighting	388.7071	0.1443	56.1024	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-514.5708	0.1310	-67.4087	

PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-67.4087 (269)
Total CO2, kg/year			431.5289 (272)
CO2 emissions per m2			2.2300 (273)
EI value			97.5773
EI rating			98 (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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	138.1500 (1b)	x	2.3300 (2b)	=	321.8895 (1b)	-
First floor	55.5300 (1c)	x	2.5200 (2c)	=	139.9356 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	193.6800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	461.8251	(5)

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2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		2.6000	(17)
Infiltration rate		0.1300	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1300	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.5000	4.4000	4.1000	4.1000	3.7000	3.8000	3.7000	3.7000	4.0000	3.9000	4.3000	(22)
Wind factor	1.1500	1.1250	1.1000	1.0250	1.0250	0.9250	0.9500	0.9250	0.9250	1.0000	0.9750	1.0750	(22a)
Adj infilt rate	0.1495	0.1462	0.1430	0.1332	0.1332	0.1203	0.1235	0.1203	0.1203	0.1300	0.1268	0.1397	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	81.0000 (23c)

Effective ac	0.2445	0.2412	0.2380	0.2282	0.2282	0.2152	0.2185	0.2152	0.2152	0.2250	0.2217	0.2347	(25)

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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 = 1.00)			48.9800	0.9615	47.0962			(27)
Glazed Door (Uw = 1.20)			10.2400	1.1450	11.7252			(27)
Cladded Window (Uw = 1.00)			13.5200	0.9615	13.0000			(27)
Roof Light Green Roof			8.8200	0.7752	6.8372			(27a)
Roof Light Zinc Clad roof			2.0500	0.7752	1.5891			(27a)
Ground Floor			138.1500	0.1100	15.1965	75.0000	10361.2500	(28a)
External Timber clad Wall	241.7400	65.3500	176.3900	0.1600	28.2224	9.0000	1587.5100	(29a)
External Zinc Clad Wall	23.3600	7.3900	15.9700	0.1600	2.5552	9.0000	143.7300	(29a)
External Green Roof	82.6200	8.8200	73.8000	0.1100	8.1180	9.0000	664.2000	(30)
External Zinc Roof	55.5300	2.0500	53.4800	0.1100	5.8828	9.0000	481.3200	(30)
Total net area of external elements Aum(A, m2)			541.4000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		140.2226			(33)
Internal Wall			202.4000			9.0000	1821.6000	(32c)

First Floor	55.5300	18.0000	999.5400 (32d)
Internal Ceiling	55.5300	9.0000	499.7700 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 16558.9200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 85.4963 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	28.1100	0.0840	2.3612
E3 Sill	9.7000	0.0340	0.3298
E4 Jamb	53.6600	0.0430	2.3074
E5 Ground floor (normal)	70.0000	0.0210	1.4700
E6 Intermediate floor within a dwelling	32.1400	0.0800	2.5712
E14 Flat roof	70.0000	0.0460	3.2200
E17 Corner (inverted – internal area greater than external area)	11.8400	-0.0150	-0.1776
E16 Corner (normal)	31.2400	0.0300	0.9372
R1 Head of roof window	9.9800	0.2400	2.3952
R2 Sill of roof window	9.9800	0.2400	2.3952
R3 Jamb of roof window	3.1600	0.2400	0.7584

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 18.5680 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 158.7906 (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	37.2624	36.7671	36.2717	34.7858	34.7858	32.8046	33.2999	32.8046	32.8046	34.2905	33.7952	35.7764	(38)
Heat transfer coeff	196.0530	195.5577	195.0624	193.5764	193.5764	191.5952	192.0905	191.5952	191.5952	193.0811	192.5858	194.5671	(39)

Average = Sum(39)m / 12 = 193.4113

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0123	1.0097	1.0071	0.9995	0.9995	0.9892	0.9918	0.9892	0.9892	0.9969	0.9944	1.0046	(40)
HLP (average)												0.9986	
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 2.9937 (42)
Hot water usage for mixer showers

111.6213	109.9439	107.4995	102.8226	99.3712	95.5222	93.3345	95.7604	98.4196	102.5522	107.3295	111.1937	(42a)

Hot water usage for baths

33.8145	33.3123	32.6051	31.3012	30.3248	29.2422	28.6574	29.3596	30.1242	31.2827	32.6135	33.7002	(42b)

Hot water usage for other uses

47.6720	45.9385	44.2049	42.4714	40.7379	39.0044	39.0044	40.7379	42.4714	44.2049	45.9385	47.6720	(42c)

Average daily hot water use (litres/day) 177.6007 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	193.1078	189.1947	184.3096	176.5952	170.4339	163.7688	160.9962	165.8579	171.0152	178.0399	185.8815	192.5659	(44)
Energy conte	305.8356	269.4107	283.2769	241.7501	229.4368	201.3728	194.7110	205.3667	210.8789	241.5984	264.8223	301.5116	(45)
Energy content (annual)										Total = Sum(45)m =		2949.9717	
Distribution loss (46)m = 0.15 x (45)m	45.8753	40.4116	42.4915	36.2625	34.4155	30.2059	29.2066	30.8050	31.6318	36.2398	39.7233	45.2267	(46)

Water storage loss:
Store volume 250.0000 (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

362.5780	320.6619	340.0193	296.6621	286.1792	256.2848	251.4534	262.1091	265.7909	298.3408	319.7343	358.2540	(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

362.5780	320.6619	340.0193	296.6621	286.1792	256.2848	251.4534	262.1091	265.7909	298.3408	319.7343	358.2540	(64)

Total per year (kWh/year) = Sum(64)m = 3618.0677 (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

147.0843	130.5800	139.5835	124.3115	121.6817	110.8861	110.1353	113.6783	114.0468	125.7254	131.9830	145.6465	(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	179.6215	179.6215	179.6215	179.6215	179.6215	179.6215	179.6215	179.6215	179.6215	179.6215	179.6215	179.6215	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.0255	48.8732	39.7463	30.0905	22.4930	18.9896	20.5189	26.6712	35.7981	45.4539	53.0514	56.5548	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	544.7741	550.4272	536.1816	505.8547	467.5723	431.5922	407.5554	401.9023	416.1478	446.4748	484.7572	520.7372	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	55.9558	55.9558	55.9558	55.9558	55.9558	55.9558	55.9558	55.9558	55.9558	55.9558	55.9558	55.9558	(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)													
	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	(71)
Water heating gains (Table 5)													
	197.6939	194.3155	187.6122	172.6549	163.5506	154.0084	148.0313	152.7935	158.3984	168.9857	183.3097	195.7615	(72)
Total internal gains													
	913.3232	909.4455	879.3699	824.4297	769.4456	720.4199	691.9353	697.1967	726.1739	776.7441	836.9480	888.8832	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.1800	11.5821	0.6800	0.7000	0.7700	27.4316	(74)
East	4.6500	21.5869	0.6800	0.7000	0.7700	33.1119	(76)
South	16.1500	49.2853	0.6800	0.7000	0.7700	262.5611	(78)
West	21.0000	21.5869	0.6800	0.7000	0.7700	149.5376	(80)
North	5.3000	11.5821	0.7600	0.7000	0.7700	22.6311	(74)
East	3.1000	21.5869	0.7600	0.7000	0.7700	24.6716	(76)
South	1.8400	49.2853	0.7600	0.7000	0.7700	33.4334	(78)
North	10.8700	29.0000	0.6800	0.7000	1.0000	135.0445	(82)
East	13.5200	21.5869	0.6800	0.7000	0.7700	96.2738	(76)

Solar gains	784.6966	1304.9807	2029.2141	2933.0053	3445.8843	3754.4133	3569.1698	3172.5969	2540.9807	1649.2761	993.7806	644.4187	(83)
Total gains	1698.0198	2214.4262	2908.5840	3757.4350	4215.3299	4474.8332	4261.1051	3869.7936	3267.1546	2426.0202	1830.7286	1533.3019	(84)

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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, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	23.4615	23.5209	23.5807	23.7617	23.7617	24.0074	23.9455	24.0074	24.0074	23.8226	23.8839	23.6407	
alpha	2.5641	2.5681	2.5720	2.5841	2.5841	2.6005	2.5964	2.6005	2.6005	2.5882	2.5923	2.5760	
util living area													
	0.8904	0.8177	0.6778	0.4946	0.3376	0.1987	0.1213	0.1428	0.3108	0.5979	0.8187	0.9089	(86)
Living	19.4332	19.8015	20.3112	20.6685	20.8199	20.8720	20.8804	20.8795	20.8470	20.6002	19.9936	19.3424	
Non living	18.6526	19.0047	19.4800	19.8000	19.9240	19.9697	19.9719	19.9739	19.9549	19.7551	19.2060	18.5706	
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	20.1985	19.8015	20.3112	20.6685	20.8199	20.8720	20.8804	20.8795	20.8470	20.6002	19.9936	19.5742	(87)
Th 2	20.0731	20.0753	20.0774	20.0838	20.0838	20.0923	20.0902	20.0923	20.0923	20.0859	20.0880	20.0795	(88)
util rest of house													
	0.8778	0.7993	0.6503	0.4612	0.3008	0.1612	0.0806	0.0984	0.2628	0.5561	0.7967	0.8980	(89)
MIT 2	19.3465	19.0047	19.4800	19.8000	19.9240	19.9697	19.9719	19.9739	19.9549	19.7551	19.2060	18.7817	(90)
Living area fraction										fLA = Living area / (4) =		0.2127	(91)
MIT	19.5277	19.1742	19.6568	19.9848	20.1146	20.1616	20.1651	20.1665	20.1447	19.9349	19.3736	18.9503	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5277	19.1742	19.6568	19.9848	20.1146	20.1616	20.1651	20.1665	20.1447	19.9349	19.3736	18.9503	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8695	0.7791	0.6368	0.4575	0.3021	0.1641	0.0840	0.1021	0.2656	0.5488	0.7771	0.8821	(94)
Useful gains	1476.4310	1725.2484	1852.3307	1719.0978	1273.3993	734.1289	357.7456	394.9862	867.6941	1331.3094	1422.7215	1352.6018	(95)
Ext temp.	5.2000	5.7000	7.7000	10.2000	13.3000	16.3000	18.3000	18.1000	15.5000	11.9000	8.2000	5.2000	(96)
Heat loss rate W													
	2808.9883	2634.9828	2332.3233	1894.1001	1319.1399	739.8664	358.2755	395.9329	889.8992	1551.3790	2151.8711	2675.3469	(97)
Space heating kWh													
	991.4226	611.3415	357.1145	126.0017	34.0310	0.0000	0.0000	0.0000	0.0000	163.7318	524.9877	984.1223	(98a)
Space heating requirement - total per year (kWh/year)												3792.7532	
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													
	991.4226	611.3415	357.1145	126.0017	34.0310	0.0000	0.0000	0.0000	0.0000	163.7318	524.9877	984.1223	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3792.7532	
Space heating per m2											(98c) / (4) =	19.5826	(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 %)	389.2087	(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													
	991.4226	611.3415	357.1145	126.0017	34.0310	0.0000	0.0000	0.0000	0.0000	163.7318	524.9877	984.1223	(98)
Space heating efficiency (main heating system 1)													
	389.2087	389.2087	389.2087	389.2087	389.2087	0.0000	0.0000	0.0000	0.0000	389.2087	389.2087	389.2087	(210)
Space heating fuel (main heating system)													
	254.7278	157.0729	91.7540	32.3738	8.7436	0.0000	0.0000	0.0000	0.0000	42.0679	134.8859	252.8521	(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													
	362.5780	320.6619	340.0193	296.6621	286.1792	256.2848	251.4534	262.1091	265.7909	298.3408	319.7343	358.2540	(64)
Efficiency of water heater												270.7457	(216)
(217)m	270.7457	270.7457	270.7457	270.7457	270.7457	270.7457	270.7457	270.7457	270.7457	270.7457	270.7457	270.7457	(217)
Fuel for water heating, kWh/month													
	133.9183	118.4365	125.5862	109.5722	105.7004	94.6589	92.8744	96.8100	98.1699	110.1922	118.0939	132.3212	(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	42.2061	38.1216	42.2061	40.8446	42.2061	40.8446	42.2061	42.2061	40.8446	42.2061	40.8446	42.2061	(231)
Lighting	48.1635	38.6386	34.7897	25.4885	19.6880	16.0853	17.9601	23.3452	30.3231	39.7855	44.9376	49.5021	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.0667	-23.8528	-43.0553	-60.0682	-71.6257	-73.3247	-71.7411	-63.9383	-49.2248	-32.7118	-18.3909	-12.1154	(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	974.4781	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	270.7457	
Water heating fuel used	1336.3341	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8820)		
mechanical ventilation fans (SFP = 0.8820)	496.9423	(230a)
Total electricity for the above, kWh/year	496.9423	(231)
Electricity for lighting (calculated in Appendix L)	388.7071	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-535.1157	(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	2661.3459	(238)

10a. Fuel costs - using BEDF prices (524)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	974.4781	21.5100	209.6102	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1336.3341	21.5100	287.4455	(247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(247a)
Pumps, fans and electric keep-hot	496.9423	21.5100	106.8923	(249)
Energy for lighting	388.7071	21.5100	83.6109	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-535.1157	21.5100	-115.1034	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-115.1034	(252)
Total energy cost			572.4555	(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	974.4781	0.1578	153.7782	(261)

Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1336.3341	0.1410	188.4887 (264)
Space and water heating			342.2669 (265)
Pumps, fans and electric keep-hot	496.9423	0.1387	68.9320 (267)
Energy for lighting	388.7071	0.1443	56.1024 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-535.1157	0.1309	-70.0335
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-70.0335 (269)
Total CO2, kg/year			397.2679 (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	974.4781	1.5841	1543.6922 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1336.3341	1.5216	2033.3073 (278)
Space and water heating			3576.9995 (279)
Pumps, fans and electric keep-hot	496.9423	1.5128	751.7743 (281)
Energy for lighting	388.7071	1.5338	596.2119 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-535.1157	1.4835	-793.8289
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-793.8289 (283)
Total Primary energy kWh/year			4131.1568 (286)

SAP 10 EPC IMPROVEMENTS

304340

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

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

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

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.7	-£ 43	-24 kg (6.1%)

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

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

Fuel prices for cost data on this page from database revision number 524 TEST (01 Aug 2023)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£688	£688	£0
Space heating	£317	£317	£0
Water heating	£287	£287	£0
Lighting	£84	£84	£0
Generated (PV)	-£115	-£115	£0
Total cost of fuels	£573	£573	£0
Total cost of uses	£573	£573	£0
Delivered energy	14 kWh/m²	14 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.4 tonnes	0.0 tonnes
CO2 emissions per m²	2 kg/m²	2 kg/m²	0 kg/m²
Primary energy	21 kWh/m²	21 kWh/m²	0 kWh/m²

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	138.1500 (1b)	x	2.3300 (2b)	=	321.8895 (1b)	-
First floor	55.5300 (1c)	x	2.5200 (2c)	=	139.9356 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	193.6800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	461.8251	(5)

2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		2.6000	(17)
Infiltration rate		0.1300	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1300	(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	0.1657	0.1625	0.1593	0.1430	0.1397	0.1235	0.1235	0.1203	0.1300	0.1397	0.1462	0.1528	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	81.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2607	0.2575	0.2542	0.2380	0.2347	0.2185	0.2185	0.2152	0.2250	0.2347	0.2412	0.2477	(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 = 1.00)			48.9800	0.9615	47.0962			(27)
Glazed Door (Uw = 1.20)			10.2400	1.1450	11.7252			(27)
Cladded Window (Uw = 1.00)			13.5200	0.9615	13.0000			(27)
Roof Light Green Roof			8.8200	0.7752	6.8372			(27a)
Roof Light Zinc Clad roof			2.0500	0.7752	1.5891			(27a)
Ground Floor			138.1500	0.1100	15.1965	75.0000	10361.2500	(28a)
External Timber clad Wall	241.7400	65.3500	176.3900	0.1600	28.2224	9.0000	1587.5100	(29a)
External Zinc Clad Wall	23.3600	7.3900	15.9700	0.1600	2.5552	9.0000	143.7300	(29a)
External Green Roof	82.6200	8.8200	73.8000	0.1100	8.1180	9.0000	664.2000	(30)
External Zinc Roof	55.5300	2.0500	53.4800	0.1100	5.8828	9.0000	481.3200	(30)
Total net area of external elements Aum(A, m2)			541.4000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		140.2226			(33)
Internal Wall			202.4000			9.0000	1821.6000	(32c)
First Floor			55.5300			18.0000	999.5400	(32d)
Internal Ceiling			55.5300			9.0000	499.7700	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 16558.9200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	85.4963 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	28.1100	0.0840	2.3612
E3 Sill	9.7000	0.0340	0.3298
E4 Jamb	53.6600	0.0430	2.3074
E5 Ground floor (normal)	70.0000	0.0210	1.4700
E6 Intermediate floor within a dwelling	32.1400	0.0800	2.5712
E14 Flat roof	70.0000	0.0460	3.2200
E17 Corner (inverted – internal area greater than external area)	11.8400	-0.0150	-0.1776
E16 Corner (normal)	31.2400	0.0300	0.9372
R1 Head of roof window	9.9800	0.2400	2.3952
R2 Sill of roof window	9.9800	0.2400	2.3952

R3 Jamb of roof window 3.1600 0.2400 0.7584

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 18.5680 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 158.7906 (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	39.7389	39.2436	38.7483	36.2717	35.7764	33.2999	33.2999	32.8046	34.2905	35.7764	36.7671	37.7577	(38)
Heat transfer coeff	198.5295	198.0342	197.5389	195.0624	194.5671	192.0905	192.0905	191.5952	193.0811	194.5671	195.5577	196.5483	(39)

Average = Sum(39)m / 12 = 194.9385

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0250	1.0225	1.0199	1.0071	1.0046	0.9918	0.9918	0.9892	0.9969	1.0046	1.0097	1.0148	(40)
HLP (average)												1.0065	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9937 (42)

Hot water usage for mixer showers	111.6213	109.9439	107.4995	102.8226	99.3712	95.5222	93.3345	95.7604	98.4196	102.5522	107.3295	111.1937	(42a)
Hot water usage for baths	33.8145	33.3123	32.6051	31.3012	30.3248	29.2422	28.6574	29.3596	30.1242	31.2827	32.6135	33.7002	(42b)
Hot water usage for other uses	47.6720	45.9385	44.2049	42.4714	40.7379	39.0044	39.0044	40.7379	42.4714	44.2049	45.9385	47.6720	(42c)

Average daily hot water use (litres/day) 177.6007 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	193.1078	189.1947	184.3096	176.5952	170.4339	163.7688	160.9962	165.8579	171.0152	178.0399	185.8815	192.5659	(44)
Energy conte	305.8356	269.4107	283.2769	241.7501	229.4368	201.3728	194.7110	205.3667	210.8789	241.5984	264.8223	301.5116	(45)

Energy content (annual) Total = Sum(45)m = 2949.9717

Distribution loss (46)m = 0.15 x (45)m	45.8753	40.4116	42.4915	36.2625	34.4155	30.2059	29.2066	30.8050	31.6318	36.2398	39.7233	45.2267	(46)

Water storage loss:

Store volume 250.0000 (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	362.5780	320.6619	340.0193	296.6621	286.1792	256.2848	251.4534	262.1091	265.7909	298.3408	319.7343	358.2540	(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	362.5780	320.6619	340.0193	296.6621	286.1792	256.2848	251.4534	262.1091	265.7909	298.3408	319.7343	358.2540	(64)

Total per year (kWh/year) = Sum(64)m = 3618.0677 (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	147.0843	130.5800	139.5835	124.3115	121.6817	110.8861	110.1353	113.6783	114.0468	125.7254	131.9830	145.6465	(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	179.6215	179.6215	179.6215	179.6215	179.6215	179.6215	179.6215	179.6215	179.6215	179.6215	179.6215	179.6215	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.0255	48.8732	39.7463	30.0905	22.4930	18.9896	20.5189	26.6712	35.7981	45.4539	53.0514	56.5548	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	544.7741	550.4272	536.1816	505.8547	467.5723	431.5922	407.5554	401.9023	416.1478	446.4748	484.7572	520.7372	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9558	55.9558	55.9558	55.9558	55.9558	55.9558	55.9558	55.9558	55.9558	55.9558	55.9558	55.9558	(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)	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	(71)
Water heating gains (Table 5)	197.6939	194.3155	187.6122	172.6549	163.5506	154.0084	148.0313	152.7935	158.3984	168.9857	183.3097	195.7615	(72)
Total internal gains	913.3232	909.4455	879.3699	824.4297	769.4456	720.4199	691.9353	697.1967	726.1739	776.7441	836.9480	888.8832	(73)

6. Solar gains

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

	W/m2	or Table 6b	or Table 6c	Table 6d	
North	7.1800	10.6334	0.6800	0.7000	0.7700	25.1847 (74)
East	4.6500	19.6403	0.6800	0.7000	0.7700	30.1259 (76)
South	16.1500	46.7521	0.6800	0.7000	0.7700	249.0655 (78)
West	21.0000	19.6403	0.6800	0.7000	0.7700	136.0526 (80)
North	5.3000	10.6334	0.7600	0.7000	0.7700	20.7775 (74)
East	3.1000	19.6403	0.7600	0.7000	0.7700	22.4468 (76)
South	1.8400	46.7521	0.7600	0.7000	0.7700	31.7149 (78)
North	10.8700	26.0000	0.6800	0.7000	1.0000	121.0744 (82)
East	13.5200	19.6403	0.6800	0.7000	0.7700	87.5919 (76)

Solar gains	724.0342	1339.4837	2071.9231	2898.0971	3497.4428	3569.1698	3401.6832	2948.6646	2361.8184	1549.0453	887.6025	605.8749 (83)
Total gains	1637.3574	2248.9292	2951.2930	3722.5268	4266.8884	4289.5897	4093.6185	3645.8613	3087.9923	2325.7894	1724.5505	1494.7581 (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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	23.1688	23.2268	23.2850	23.5807	23.6407	23.9455	23.9455	24.0074	23.8226	23.6407	23.5209	23.4024	
alpha	2.5446	2.5485	2.5523	2.5720	2.5760	2.5964	2.5964	2.6005	2.5882	2.5760	2.5681	2.5602	
util living area	0.9084	0.8296	0.7077	0.5446	0.3960	0.2785	0.2037	0.2371	0.4022	0.6686	0.8585	0.9235	(86)
Living	19.2195	19.6774	20.1741	20.5765	20.7714	20.8503	20.8718	20.8669	20.7987	20.4522	19.7498	19.1281	
Non living	18.4356	18.8760	19.3426	19.7135	19.8808	19.9530	19.9676	19.9672	19.9139	19.6195	18.9629	18.3535	
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	20.0892	19.6774	20.1741	20.5765	20.7714	20.8503	20.8718	20.8669	20.7987	20.4522	19.7498	19.3900	(87)
Th 2	20.0625	20.0646	20.0668	20.0774	20.0795	20.0902	20.0902	20.0923	20.0859	20.0795	20.0753	20.0710	(88)
util rest of house	0.8980	0.8127	0.6831	0.5138	0.3616	0.2410	0.1625	0.1918	0.3553	0.6328	0.8411	0.9146	(89)
MIT 2	19.2303	18.8760	19.3426	19.7135	19.8808	19.9530	19.9676	19.9672	19.9139	19.6195	18.9629	18.5937	(90)
Living area fraction										fLA = Living area / (4) =		0.2127	(91)
MIT	19.4130	19.0465	19.5195	19.8970	20.0703	20.1439	20.1599	20.1586	20.1021	19.7966	19.1303	18.7631	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4130	19.0465	19.5195	19.8970	20.0703	20.1439	20.1599	20.1586	20.1021	19.7966	19.1303	18.7631	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8898	0.7919	0.6675	0.5075	0.3613	0.2432	0.1657	0.1952	0.3562	0.6209	0.8205	0.8995	(94)
Useful gains	1457.0009	1780.8808	1970.0026	1889.1669	1541.5707	1043.2898	678.3557	711.5911	1099.8470	1444.1594	1414.9469	1344.5443	(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	3000.3694	2801.4831	2571.8485	2145.1088	1628.5760	1064.9292	683.8319	720.1290	1158.8951	1789.3624	2352.6196	2862.3533	(97)
Space heating kWh	1148.2662	685.8447	447.7733	184.2782	64.7319	0.0000	0.0000	0.0000	0.0000	256.8310	675.1244	1129.2499	(98a)
Space heating requirement - total per year (kWh/year)												4592.0996	
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	1148.2662	685.8447	447.7733	184.2782	64.7319	0.0000	0.0000	0.0000	0.0000	256.8310	675.1244	1129.2499	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4592.0996	
Space heating per m2											(98c) / (4) =	23.7097	(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 %)	389.0090 (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	1148.2662	685.8447	447.7733	184.2782	64.7319	0.0000	0.0000	0.0000	0.0000	256.8310	675.1244	1129.2499	(98)
Space heating efficiency (main heating system 1)	389.0090	389.0090	389.0090	389.0090	389.0090	0.0000	0.0000	0.0000	0.0000	389.0090	389.0090	389.0090	(210)
Space heating fuel (main heating system)	295.1773	176.3056	115.1062	47.3712	16.6402	0.0000	0.0000	0.0000	0.0000	66.0219	173.5498	290.2889	(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	362.5780	320.6619	340.0193	296.6621	286.1792	256.2848	251.4534	262.1091	265.7909	298.3408	319.7343	358.2540	(64)

Efficiency of water heater												270.7347 (216)
(217)m	270.7347	270.7347	270.7347	270.7347	270.7347	270.7347	270.7347	270.7347	270.7347	270.7347	270.7347	270.7347 (217)
Fuel for water heating, kWh/month												
	133.9237	118.4414	125.5913	109.5767	105.7047	94.6627	92.8781	96.8140	98.1739	110.1967	118.0987	132.3266 (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	42.2061	38.1216	42.2061	40.8446	42.2061	40.8446	42.2061	42.2061	40.8446	42.2061	40.8446	42.2061 (231)
Lighting	48.1635	38.6386	34.7897	25.4885	19.6880	16.0853	17.9601	23.3452	30.3231	39.7855	44.9376	49.5021 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-13.6469	-23.9140	-43.2550	-59.1022	-72.1573	-70.2172	-68.7808	-59.8809	-45.7300	-30.4996	-16.2362	-11.1507 (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	1180.4611 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	270.7347
Water heating fuel used	1336.3885 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8820)	
mechanical ventilation fans (SFP = 0.8820)	496.9423 (230a)
Total electricity for the above, kWh/year	496.9423 (231)
Electricity for lighting (calculated in Appendix L)	388.7071 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-514.5708 (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	2887.9283 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1180.4611	16.4900	194.6580	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1336.3885	16.4900	220.3705	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	496.9423	16.4900	81.9458	(249)
Energy for lighting	388.7071	16.4900	64.0978	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-514.5708	16.4900	-84.8527	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-84.8527	(252)
Total energy cost			476.2194	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7183 (257)
SAP value		88.3567
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	1180.4611	0.1571	185.4067	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1336.3885	0.1410	188.4964	(264)
Space and water heating			373.9031	(265)
Pumps, fans and electric keep-hot	496.9423	0.1387	68.9320	(267)
Energy for lighting	388.7071	0.1443	56.1024	(268)

Energy saving/generation technologies				
PV Unit electricity used in dwelling	-514.5708		0.1310	-67.4087
PV Unit electricity exported	0.0000		0.0000	0.0000
Total				-67.4087 (269)
Total CO2, kg/year				431.5289 (272)
CO2 emissions per m2				2.2300 (273)
EI value				97.5773
EI rating				98 (274)
EI band				A

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

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1. Overall dwelling characteristics

			Area (m2)		Storey height (m)		Volume (m3)
Ground floor			138.1500 (1b)	x	2.3300 (2b)	=	321.8895 (1b) -
First floor			55.5300 (1c)	x	2.5200 (2c)	=	139.9356 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	193.6800						(4)
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	461.8251 (5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys		0 * 80 =	0.0000 (6a)
Number of open flues		0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000 (6d)
Number of flues attached to other heater		0 * 35 =	0.0000 (6e)
Number of blocked chimneys		0 * 20 =	0.0000 (6f)
Number of intermittent extract fans		0 * 10 =	0.0000 (7a)
Number of passive vents		0 * 10 =	0.0000 (7b)
Number of flueless gas fires		0 * 40 =	0.0000 (7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		0.0000 / (5) =	0.0000 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			2.6000 (17)
Infiltration rate			0.1300 (18)
Number of sides sheltered			0 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.1300 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.5000	4.4000	4.1000	4.1000	3.7000	3.8000	3.7000	3.7000	4.0000	3.9000	4.3000	(22)
Wind factor	1.1500	1.1250	1.1000	1.0250	1.0250	0.9250	0.9500	0.9250	0.9250	1.0000	0.9750	1.0750	(22a)
Adj infilt rate	0.1495	0.1462	0.1430	0.1332	0.1332	0.1203	0.1235	0.1203	0.1203	0.1300	0.1268	0.1397	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	81.0000 (23c)

Effective ac	0.2445	0.2412	0.2380	0.2282	0.2282	0.2152	0.2185	0.2152	0.2152	0.2250	0.2217	0.2347	(25)

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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 = 1.00)			48.9800	0.9615	47.0962			(27)
Glazed Door (Uw = 1.20)			10.2400	1.1450	11.7252			(27)
Cladded Window (Uw = 1.00)			13.5200	0.9615	13.0000			(27)
Roof Light Green Roof			8.8200	0.7752	6.8372			(27a)
Roof Light Zinc Clad roof			2.0500	0.7752	1.5891			(27a)
Ground Floor			138.1500	0.1100	15.1965	75.0000	10361.2500	(28a)
External Timber clad Wall	241.7400	65.3500	176.3900	0.1600	28.2224	9.0000	1587.5100	(29a)
External Zinc Clad Wall	23.3600	7.3900	15.9700	0.1600	2.5552	9.0000	143.7300	(29a)
External Green Roof	82.6200	8.8200	73.8000	0.1100	8.1180	9.0000	664.2000	(30)
External Zinc Roof	55.5300	2.0500	53.4800	0.1100	5.8828	9.0000	481.3200	(30)
Total net area of external elements Aum(A, m2)			541.4000					(31)

Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) = 140.2226		(33)
Internal Wall	202.4000	9.0000	1821.6000 (32c)
First Floor	55.5300	18.0000	999.5400 (32d)
Internal Ceiling	55.5300	9.0000	499.7700 (32e)

Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =					16558.9200	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K											85.4963	(35)
List of Thermal Bridges												
K1 Element									Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)									28.1100	0.0840	2.3612	
E3 Sill									9.7000	0.0340	0.3298	
E4 Jamb									53.6600	0.0430	2.3074	
E5 Ground floor (normal)									70.0000	0.0210	1.4700	
E6 Intermediate floor within a dwelling									32.1400	0.0800	2.5712	
E14 Flat roof									70.0000	0.0460	3.2200	
E17 Corner (inverted – internal area greater than external area)									11.8400	-0.0150	-0.1776	
E16 Corner (normal)									31.2400	0.0300	0.9372	
R1 Head of roof window									9.9800	0.2400	2.3952	
R2 Sill of roof window									9.9800	0.2400	2.3952	
R3 Jamb of roof window									3.1600	0.2400	0.7584	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)											18.5680	(36)
Point Thermal bridges										(36a) =	0.0000	
Total fabric heat loss									(33) + (36) + (36a) =		158.7906	(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	37.2624	36.7671	36.2717	34.7858	34.7858	32.8046	33.2999	32.8046	32.8046	34.2905	33.7952	35.7764	(38)
Heat transfer coeff	196.0530	195.5577	195.0624	193.5764	193.5764	191.5952	192.0905	191.5952	191.5952	193.0811	192.5858	194.5671	(39)
Average = Sum(39)m / 12 =												193.4113	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0123	1.0097	1.0071	0.9995	0.9995	0.9892	0.9918	0.9892	0.9892	0.9969	0.9944	1.0046	(40)
HLP (average)												0.9986	
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												2.9937	(42)
Hot water usage for mixer showers	111.6213	109.9439	107.4995	102.8226	99.3712	95.5222	93.3345	95.7604	98.4196	102.5522	107.3295	111.1937	(42a)
Hot water usage for baths	33.8145	33.3123	32.6051	31.3012	30.3248	29.2422	28.6574	29.3596	30.1242	31.2827	32.6135	33.7002	(42b)
Hot water usage for other uses	47.6720	45.9385	44.2049	42.4714	40.7379	39.0044	39.0044	40.7379	42.4714	44.2049	45.9385	47.6720	(42c)
Average daily hot water use (litres/day)												177.6007	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	193.1078	189.1947	184.3096	176.5952	170.4339	163.7688	160.9962	165.8579	171.0152	178.0399	185.8815	192.5659	(44)
Energy conte	305.8356	269.4107	283.2769	241.7501	229.4368	201.3728	194.7110	205.3667	210.8789	241.5984	264.8223	301.5116	(45)
Energy content (annual)										Total = Sum(45)m =		2949.9717	
Distribution loss (46)m = 0.15 x (45)m	45.8753	40.4116	42.4915	36.2625	34.4155	30.2059	29.2066	30.8050	31.6318	36.2398	39.7233	45.2267	(46)
Water storage loss:													
Store volume												250.0000	(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	362.5780	320.6619	340.0193	296.6621	286.1792	256.2848	251.4534	262.1091	265.7909	298.3408	319.7343	358.2540	(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	362.5780	320.6619	340.0193	296.6621	286.1792	256.2848	251.4534	262.1091	265.7909	298.3408	319.7343	358.2540	(64)
										Total per year (kWh/year) = Sum(64)m =		3618.0677	(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	147.0843	130.5800	139.5835	124.3115	121.6817	110.8861	110.1353	113.6783	114.0468	125.7254	131.9830	145.6465	(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	179.6215	179.6215	179.6215	179.6215	179.6215	179.6215	179.6215	179.6215	179.6215	179.6215	179.6215	179.6215	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.0255	48.8732	39.7463	30.0905	22.4930	18.9896	20.5189	26.6712	35.7981	45.4539	53.0514	56.5548	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	544.7741	550.4272	536.1816	505.8547	467.5723	431.5922	407.5554	401.9023	416.1478	446.4748	484.7572	520.7372	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.9558	55.9558	55.9558	55.9558	55.9558	55.9558	55.9558	55.9558	55.9558	55.9558	55.9558	55.9558	(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)													
	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	-119.7477	(71)
Water heating gains (Table 5)													
	197.6939	194.3155	187.6122	172.6549	163.5506	154.0084	148.0313	152.7935	158.3984	168.9857	183.3097	195.7615	(72)
Total internal gains													
	913.3232	909.4455	879.3699	824.4297	769.4456	720.4199	691.9353	697.1967	726.1739	776.7441	836.9480	888.8832	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.1800	11.5821	0.6800	0.7000	0.7700	27.4316	(74)
East	4.6500	21.5869	0.6800	0.7000	0.7700	33.1119	(76)
South	16.1500	49.2853	0.6800	0.7000	0.7700	262.5611	(78)
West	21.0000	21.5869	0.6800	0.7000	0.7700	149.5376	(80)
North	5.3000	11.5821	0.7600	0.7000	0.7700	22.6311	(74)
East	3.1000	21.5869	0.7600	0.7000	0.7700	24.6716	(76)
South	1.8400	49.2853	0.7600	0.7000	0.7700	33.4334	(78)
North	10.8700	29.0000	0.6800	0.7000	1.0000	135.0445	(82)
East	13.5200	21.5869	0.6800	0.7000	0.7700	96.2738	(76)

Solar gains	784.6966	1304.9807	2029.2141	2933.0053	3445.8843	3754.4133	3569.1698	3172.5969	2540.9807	1649.2761	993.7806	644.4187	(83)
Total gains	1698.0198	2214.4262	2908.5840	3757.4350	4215.3299	4474.8332	4261.1051	3869.7936	3267.1546	2426.0202	1830.7286	1533.3019	(84)

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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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	23.4615	23.5209	23.5807	23.7617	23.7617	24.0074	23.9455	24.0074	24.0074	23.8226	23.8839	23.6407	
alpha	2.5641	2.5681	2.5720	2.5841	2.5841	2.6005	2.5964	2.6005	2.6005	2.5882	2.5923	2.5760	
util living area	0.8904	0.8177	0.6778	0.4946	0.3376	0.1987	0.1213	0.1428	0.3108	0.5979	0.8187	0.9089	(86)
Living	19.4332	19.8015	20.3112	20.6685	20.8199	20.8720	20.8804	20.8795	20.8470	20.6002	19.9936	19.3424	
Non living	18.6526	19.0047	19.4800	19.8000	19.9240	19.9697	19.9719	19.9739	19.9549	19.7551	19.2060	18.5706	
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	20.1985	19.8015	20.3112	20.6685	20.8199	20.8720	20.8804	20.8795	20.8470	20.6002	19.9936	19.5742	(87)
Th 2	20.0731	20.0753	20.0774	20.0838	20.0838	20.0923	20.0902	20.0923	20.0923	20.0859	20.0880	20.0795	(88)
util rest of house	0.8778	0.7993	0.6503	0.4612	0.3008	0.1612	0.0806	0.0984	0.2628	0.5561	0.7967	0.8980	(89)
MIT 2	19.3465	19.0047	19.4800	19.8000	19.9240	19.9697	19.9719	19.9739	19.9549	19.7551	19.2060	18.7817	(90)
Living area fraction									fLA = Living area / (4) =			0.2127	(91)
MIT	19.5277	19.1742	19.6568	19.9848	20.1146	20.1616	20.1651	20.1665	20.1447	19.9349	19.3736	18.9503	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5277	19.1742	19.6568	19.9848	20.1146	20.1616	20.1651	20.1665	20.1447	19.9349	19.3736	18.9503	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8695	0.7791	0.6368	0.4575	0.3021	0.1641	0.0840	0.1021	0.2656	0.5488	0.7771	0.8821	(94)
Useful gains	1476.4310	1725.2484	1852.3307	1719.0978	1273.3993	734.1289	357.7456	394.9862	867.6941	1331.3094	1422.7215	1352.6018	(95)
Ext temp.	5.2000	5.7000	7.7000	10.2000	13.3000	16.3000	18.3000	18.1000	15.5000	11.9000	8.2000	5.2000	(96)
Heat loss rate W	2808.9883	2634.9828	2332.3233	1894.1001	1319.1399	739.8664	358.2755	395.9329	889.8992	1551.3790	2151.8711	2675.3469	(97)
Space heating kWh	991.4226	611.3415	357.1145	126.0017	34.0310	0.0000	0.0000	0.0000	0.0000	163.7318	524.9877	984.1223	(98a)
Space heating requirement - total per year (kWh/year)												3792.7532	
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	991.4226	611.3415	357.1145	126.0017	34.0310	0.0000	0.0000	0.0000	0.0000	163.7318	524.9877	984.1223	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3792.7532	
Space heating per m2											(98c) / (4) =	19.5826	(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 %)	389.2087	(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													
	991.4226	611.3415	357.1145	126.0017	34.0310	0.0000	0.0000	0.0000	0.0000	163.7318	524.9877	984.1223	(98)
Space heating efficiency (main heating system 1)													
	389.2087	389.2087	389.2087	389.2087	389.2087	0.0000	0.0000	0.0000	0.0000	389.2087	389.2087	389.2087	(210)
Space heating fuel (main heating system)													
	254.7278	157.0729	91.7540	32.3738	8.7436	0.0000	0.0000	0.0000	0.0000	42.0679	134.8859	252.8521	(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													
	362.5780	320.6619	340.0193	296.6621	286.1792	256.2848	251.4534	262.1091	265.7909	298.3408	319.7343	358.2540	(64)
Efficiency of water heater												270.7457	(216)
(217)m	270.7457	270.7457	270.7457	270.7457	270.7457	270.7457	270.7457	270.7457	270.7457	270.7457	270.7457	270.7457	(217)
Fuel for water heating, kWh/month													
	133.9183	118.4365	125.5862	109.5722	105.7004	94.6589	92.8744	96.8100	98.1699	110.1922	118.0939	132.3212	(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	42.2061	38.1216	42.2061	40.8446	42.2061	40.8446	42.2061	42.2061	40.8446	42.2061	40.8446	42.2061	(231)
Lighting	48.1635	38.6386	34.7897	25.4885	19.6880	16.0853	17.9601	23.3452	30.3231	39.7855	44.9376	49.5021	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.0667	-23.8528	-43.0553	-60.0682	-71.6257	-73.3247	-71.7411	-63.9383	-49.2248	-32.7118	-18.3909	-12.1154	(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	974.4781 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	270.7457
Water heating fuel used	1336.3341 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8820)	
mechanical ventilation fans (SFP = 0.8820)	496.9423 (230a)
Total electricity for the above, kWh/year	496.9423 (231)
Electricity for lighting (calculated in Appendix L)	388.7071 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-535.1157 (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	2661.3459 (238)

10a. Fuel costs - using BEDF prices (524)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	974.4781	21.5100	209.6102	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1336.3341	21.5100	287.4455	(247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(247a)
Pumps, fans and electric keep-hot	496.9423	21.5100	106.8923	(249)
Energy for lighting	388.7071	21.5100	83.6109	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-535.1157	21.5100	-115.1034	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-115.1034	(252)
Total energy cost			572.4555	(255)

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

	Energy	Emission factor	Emissions

	kWh/year	kg CO2/kWh	kg CO2/year	
Space heating - main system 1	974.4781	0.1578	153.7782	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1336.3341	0.1410	188.4887	(264)
Space and water heating			342.2669	(265)
Pumps, fans and electric keep-hot	496.9423	0.1387	68.9320	(267)
Energy for lighting	388.7071	0.1443	56.1024	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-535.1157	0.1309	-70.0335	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-70.0335	(269)
Total CO2, kg/year			397.2679	(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	974.4781	1.5841	1543.6922	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1336.3341	1.5216	2033.3073	(278)
Space and water heating			3576.9995	(279)
Pumps, fans and electric keep-hot	496.9423	1.5128	751.7743	(281)
Energy for lighting	388.7071	1.5338	596.2119	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-535.1157	1.4835	-793.8289	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-793.8289	(283)
Total Primary energy kWh/year			4131.1568	(286)

Predicted Energy Assessment

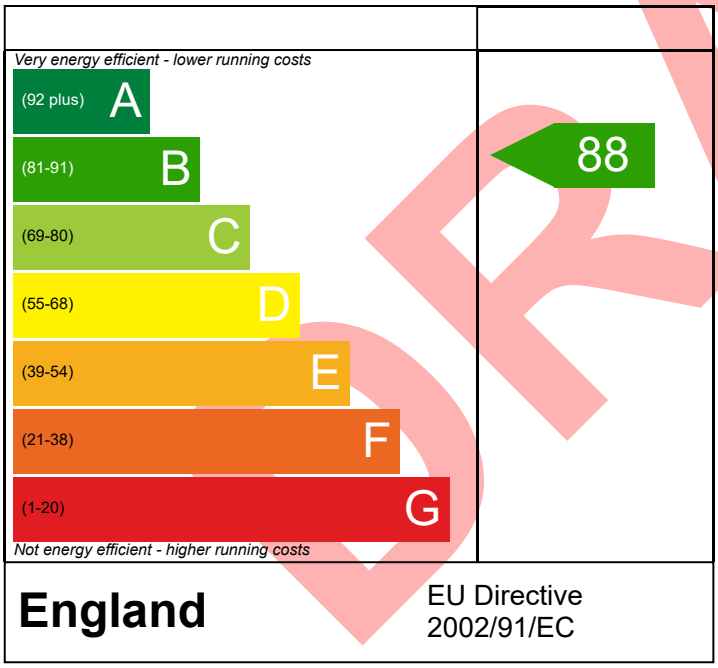
22b, Harley Road, London, NW3 3BN

Dwelling type:	House, Detached
Date of assessment:	07/09/2023
Produced by:	Kyle Jones
Total floor area:	193.68 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.

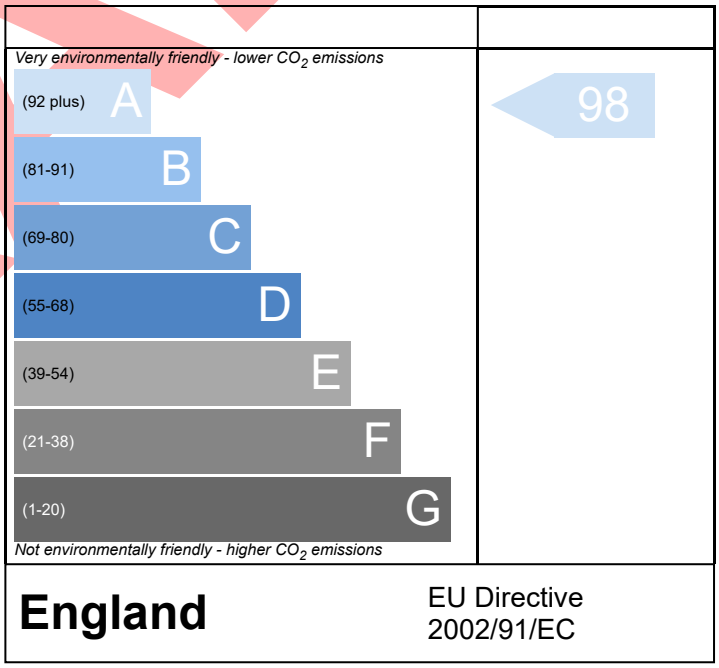
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



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.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.