

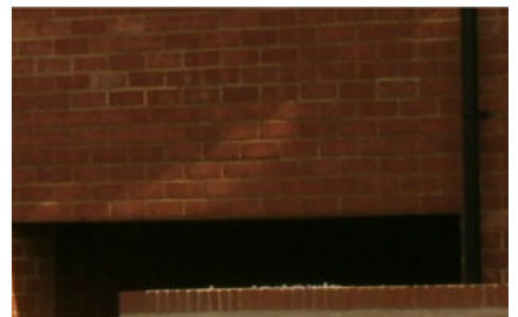


Energy Statement

Cowm Top Lane, Castleton

Clients: GLP Ltd and Barratt Homes

Author: Ruth Ferguson



Revision History

<i>Version</i>	<i>Date Issued</i>	<i>Issued by</i>	<i>QA Check</i>
1	18/12/2019	Michael Woodbridge	Tim James
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4	08/01/2021	Michael Woodbridge	Tim James
5	19/08/2022	Ruth Ferguson	Tim James
6	07/06/2024	Ruth Ferguson	Tim James

About Environmental Economics

Our team of experienced consultants specialise in construction and building energy. We have qualifications in sustainability, energy, engineering, building physics and construction as well as environmental, quality management and auditing.

Over the last decade, we have provided assessments and consultancy for some of the largest UK house builders, including Barratt Developments, David Wilson Homes, Bellway Homes, Abbey New Homes and Davidsons. We develop flexible, practical, cost-effective specifications for our clients through identifying solutions and delivering design advice. This includes the following disciplines:

- *Overheating Analysis (dynamic thermal modelling)*
- *Daylighting / Sunlight Simulations*
- *Energy Reports*
- *Compliance assessments and advice covering*
 - *Part L (SAP)*
 - *Part F (ventilation)*
 - *Part G (water)*
- *BREEAM*
- *SBEM (existing and new build)*
- *Minimum Energy Efficiency Standards (MEES)*
- *Thermal Bridging (Psi value calculations)*

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1. Project Overview

1.1. Introduction

- 1.1.1. This energy study was prepared by Environmental Economics Ltd. The report assesses measures to reduce the carbon emissions of the domestic housing on site.

1.2. Description of Site

- 1.2.1. The site consists of 445 plots. These include detached, semi-detached and terraced housing.
- 1.2.2. The site plan for the whole site is shown in Appendix A.
- 1.2.3. This report addresses a domestic development being undertaken by GLP Ltd and Barratt Homes, and does not include any further proposals for subsequent developments or non-residential parcels.

1.3. Client Brief

- 1.3.1. All newbuild development must comply with Building Regulations. Approved Document L 2021 (AD-L 2021) provides for a 31% reduction in Carbon emissions over the previous 2013 edition.
- 1.3.2. AD-L 2021 came into effect 15th June 2022, with a 12-month transitional arrangement. Sites which have been notified to local authorities prior to this date have 12 months transitional allowance on a plot-by-plot basis. That is to say, if a plot has commenced construction prior to 15th June 2023, it will be built under AD-L 2013. It is understood that Trows Farm, Castleton will be developed in accordance with AD-L 2021.

2. Design Response

2.1. Assessment Methodology

2.1.1. Environmental Economics have modelled some typical housing designs in order to validate the proposed specifications for this site. The Design SAP 10 software by Elmhurst has been used for this. The software provides a number of outputs, and based on the provided specification for this proposed development, we are able to assess the following areas for our calculations:

- *Building regulations compliance, including:*
 - *Carbon emissions (kg CO₂/m²/year)*
 - *Primary Energy Demand (kWh/m²/annum)*
 - *Fabric Energy Efficiency (kWh/m²/annum)*
- *Energy usage per year (kWh/annum)*
- *Energy costs per year (£/annum)*
- *More detailed breakdowns by end use (space heating, water heating, cooking, lighting, appliances)*

2.1.2. Each of these outputs can be used in different ways to analyse the performance of the dwelling. The total regulated carbon emissions for each property is based upon:

- *Space heating*
- *Water heating*
- *Electricity for pumps and fans*
- *Electricity for lighting*

2.1.3. SAP software is issued by independent software suppliers and checked and approved on behalf of government by the Building Research Establishment (BRE). As of 22nd November 2022, SAP 10 has now been fully approved.

2.1.4. The dwellings on this proposed development will be assessed using this methodology during the detailed design stage.

2.2. Design Philosophy

2.2.1. Upgrades have been made to a number of elements from a standard build specification in order to improve energy efficiency across the development. The site adopts the good design principles endorsed and promoted by The Zero Carbon Hub, the construction industries' key advisors and partners with the Governments Communities and Local Government Department. This guidance follows the general good principles of energy efficiency as the industry moves towards zero carbon. The principles are illustrated in figure 1 below.

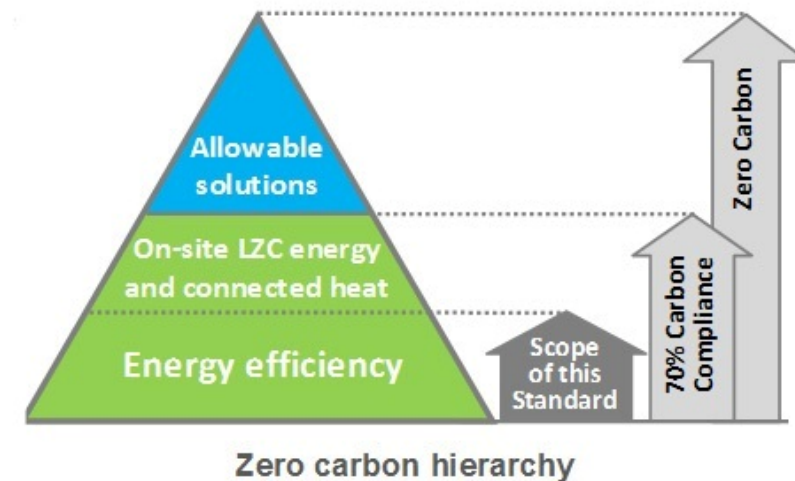


Figure 1

2.2.2. In order to reduce the residual carbon emissions a number of improvements were made to the standard material and product specification. These improvements include:

- *Upgraded heating and hot water controls*
- *Delayed start thermostat*
- *Design air permeability of 4m³/hr/m²*
- *Bespoke thermal bridging details*

2.3. Fabric Improvements Part L1A 2021

2.3.1. The building fabric for all dwellings within the proposed development will be improved in comparison to ADL 2013 specifications, and in relation to the ADL 2021 backstop notional specification. These fabric improvements reduce the space heating requirement upon a property. The improvements will be made through a combination of upgraded materials and increased insulation thicknesses. Enhanced glazing with a larger transmittance factor allowing for increased solar gains will also be used.

2.3.2. Proposed fabric designs and U-Values can be found in Table 1 below.

Table 1 – Part L 2021 Build Specification

<i>Element</i>	<i>Minimum Standard</i>	<i>Improved Specification</i>	
-	<i>W/m²k</i>	<i>Description</i>	<i>W/m²k</i>
Walls	0.26	Full-fill blown bead insulation in 100mm cavity	0.23
Roof	0.16	Loft Space – 500mm Mineral Wool	0.09
		Sloping Ceiling to have 100mm PUR between joists, and 55mm PUR Board underlaid	0.16
Floors	0.18	Beam & Block floor system	0.10 - 0.12
Doors	1.60	Double glazed Low-E, u-PVC frame	1.00 - 1.4
Glazing	1.60	Double glazed Low-E, u-PVC frame	1.30

2.3.3. Please note that this specification is not finalised and is subject to change up until detailed design stage.

2.3.4. As improvements are made to the thermal conductivity of main elements, thermal bridging and air permeability become increasingly significant in the overall fabric performance. Bespoke thermal bridging designs have been utilised, which achieve much lower heat loss levels in comparison with standard practice.

2.3.5. As a result of following these junction details and focusing on build quality, air permeability will also decrease. A target air pressure rating of 4m³/hr.m² has been set for all houses on site which is an improvement on the maximum allowable rating in the 2021 Building Regulations.

2.4. Building Services & Renewable Energy (LZCT)

- 2.4.1. The systems used in a property to supply hot water and heating, as well as to control it, are important to the overall energy demand of a property. AD-L 2021 includes requirements for efficiency and controls of such equipment, including space heating, water heating, ventilation and lighting.
- 2.4.2. The design of building services which provide space heating and domestic hot water, ventilation, and lighting, must be considered in a holistic way in order to avoid unintended consequences and to maximise the benefits from such systems.
- 2.4.3. After due consideration of the potential LZCT available (shown in Appendix B) the design team propose to adopt the following technologies which provide benefits / compliance with national and local policies as listed:
- ***Photovoltaic (PV) panels***
 - Low noise and visual pollution.
 - Efficient low-carbon source of renewable energy.
 - ***Decentralised Mechanical Extract Ventilation (dMEV)***
 - Quieter than standard extractor fans.
 - Technology that manages humidity that is significantly more energy efficient in comparison to standard extractor fans.
 - ***Waste Water Heat Recovery (WWHR)***
 - Passive technology, no maintenance required.
 - Recovers waste heat from shower, pre-heats incoming cold. This reduces the amount of hot water required from the hot water cylinder.
 - Typical systems recover ~60% waste heat.
 - ***Flue Gas Heat Recovery (FGHR)***
 - Recovers waste heat from the flue of a boiler.
 - Reduces energy demand by reducing the temperature increase required for the boiler to operate.
- 2.4.4. It is currently proposed that PV panels will be used to improve dwelling performance to the level required for Part L 2021. Part L 2021 building regulations represent a minimum 31% uplift over Part L 2013 regulations and will therefore meet the planning requirement of 10% reduction in carbon emissions.
- 2.4.5. For Part L 2021 it is proposed to provide heating and hot water via mains gas boilers.
- 2.4.6. For a mains gas fired system, the minimum boiler efficiency required is 92%. Compliant Ideal Logic boilers have been adopted which exceed this requirement.

2.4.7. Where installed, hot water cylinders can lose a significant amount of energy. To minimise this energy loss and corresponding carbon emissions, cylinders which have higher levels of insulation in comparison to typical hot water cylinders will be used.

2.4.8. Hot water distribution pipework will be fully insulated.

2.4.9. Lighting provision will be from LED low energy fittings achieving a minimum efficacy of 100 lamp lumens per circuit watt, an improvement of over 50% from AD-L 2013 performance levels.

2.4.10. Smart meters will be installed on all properties, providing:

- Real time information on energy use both in terms of consumption and cost
- Occupier can manage their energy, save money and reduce carbon emissions
- Smart meters will also allow for easier switching between suppliers
- Facilitate a more reactive, price driven, demand-response
- End estimated billing and eliminate the need for meter readers to visit premises

3. Conclusion

- 3.1.1. This energy statement has been produced to accompany the planning application for the proposed residential site of 445 dwellings at Cowm Top Lane, Castleton.
- 3.1.2. The proposed LZC Technologies for the Part L2021 plots are:
- Photovoltaic (PV) panels
 - Waste Water Heat Recovery Systems (WWHRS)
 - Flue Gas Heat Recovery System (FGHRS)
 - Decentralised Mechanical Extract Ventilation (dMEV).
- 3.1.3. The sample SAP calculations presented in Appendix C show the total carbon emissions from typical dwellings, including emissions from fabric and energy use, based on the modelling of representative housing designs using SAP 10 software. The enhanced fabric specifications including better insulation and improved thermal bridging details result in lower carbon emissions from the dwelling.
- 3.1.4. It is anticipated that all the plots of this development will be, at the very least, constructed to comply with the higher standards set out by Part L1A 2021, which is a minimum 31% reduction in carbon emissions in relation to Part L1A 2013 regulations. Therefore, as long as the proposed specification guidance is followed, this development will comply with the new Part L1A 2021 legislation.
- 3.1.5. It can therefore be seen that the proposed development will:
- *Achieve reduced carbon emissions of at least 31% below Part L 1A 2013.*
 - *Incorporate recognised LZC technologies.*
 - *Achieve significant reduction in energy demand from these technologies.*

PROPERTY: 10000 S. 10th St.
GENERAL: 10000 S. 10th St.

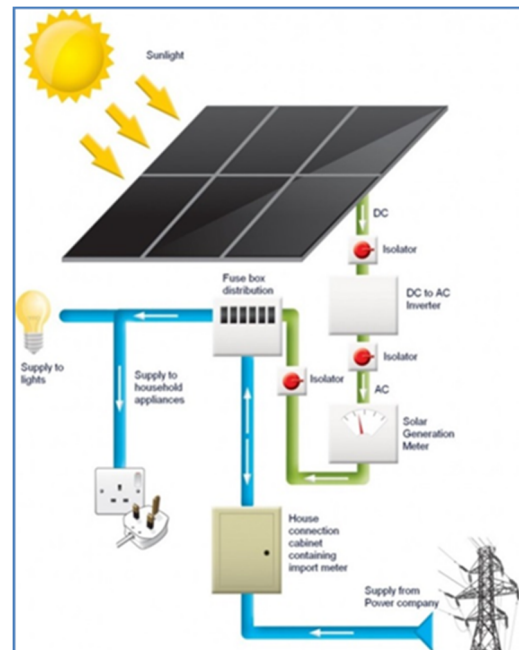
Block	Area (sq. ft.)	Area (acres)	Area (sq. ft.)	Area (acres)
Block 1	100,000	2.3	100,000	2.3
Block 2	100,000	2.3	100,000	2.3
Block 3	100,000	2.3	100,000	2.3
Block 4	100,000	2.3	100,000	2.3
Block 5	100,000	2.3	100,000	2.3
Block 6	100,000	2.3	100,000	2.3
Block 7	100,000	2.3	100,000	2.3
Block 8	100,000	2.3	100,000	2.3
Block 9	100,000	2.3	100,000	2.3
Block 10	100,000	2.3	100,000	2.3
Block 11	100,000	2.3	100,000	2.3
Block 12	100,000	2.3	100,000	2.3
Block 13	100,000	2.3	100,000	2.3
Block 14	100,000	2.3	100,000	2.3
Block 15	100,000	2.3	100,000	2.3
Block 16	100,000	2.3	100,000	2.3
Block 17	100,000	2.3	100,000	2.3
Block 18	100,000	2.3	100,000	2.3
Block 19	100,000	2.3	100,000	2.3
Block 20	100,000	2.3	100,000	2.3
Block 21	100,000	2.3	100,000	2.3
Block 22	100,000	2.3	100,000	2.3
Block 23	100,000	2.3	100,000	2.3
Block 24	100,000	2.3	100,000	2.3
Block 25	100,000	2.3	100,000	2.3
Block 26	100,000	2.3	100,000	2.3
Block 27	100,000	2.3	100,000	2.3
Block 28	100,000	2.3	100,000	2.3
Block 29	100,000	2.3	100,000	2.3
Block 30	100,000	2.3	100,000	2.3
Block 31	100,000	2.3	100,000	2.3
Block 32	100,000	2.3	100,000	2.3
Block 33	100,000	2.3	100,000	2.3
Block 34	100,000	2.3	100,000	2.3
Block 35	100,000	2.3	100,000	2.3
Block 36	100,000	2.3	100,000	2.3
Block 37	100,000	2.3	100,000	2.3
Block 38	100,000	2.3	100,000	2.3
Block 39	100,000	2.3	100,000	2.3
Block 40	100,000	2.3	100,000	2.3
Block 41	100,000	2.3	100,000	2.3
Block 42	100,000	2.3	100,000	2.3
Block 43	100,000	2.3	100,000	2.3
Block 44	100,000	2.3	100,000	2.3
Block 45	100,000	2.3	100,000	2.3
Block 46	100,000	2.3	100,000	2.3
Block 47	100,000	2.3	100,000	2.3
Block 48	100,000	2.3	100,000	2.3
Block 49	100,000	2.3	100,000	2.3
Block 50	100,000	2.3	100,000	2.3
Block 51	100,0			

Appendix B – Low and Zero Carbon Technologies

Photovoltaic (PV) Cells

The efficiency of PV cells has improved rapidly over the last 15 years. This has made a previously uneconomical technology an increasingly viable solution to rising energy costs and demand. The cells can be produced in a variety of formats but are typically manufactured as a panel or a roof tile for domestic housing applications.

The PV system typically produces direct current (DC) which is then sent through an inverter to supply the house with electricity. If a greater amount of electricity is produced than used by the household, this extra can be exported to the national grid.



A PV cell is assessed on its peak power rating. This is tested by exposing the cell to the equivalent of full solar radiation and measuring the power output. The peak power is input into the Design SAP software as well as the physical attributes of the installation such as pitch, orientation and over-shading. A total energy saving per year can then be calculated through SAP for the PV installation. This is then offset against the electricity energy demand for the house.

Solar Hot Water (SHW)

SHW systems generate energy which is used to heat stored water (in a special solar hot water cylinder) which offsets the energy required for the boiler, thereby reducing fuel use and reducing carbon emissions. Therefore, SHW systems are ideally utilised when the design of a dwelling already calls for a hot water cylinder, and not when a combination boiler is specified.



There are two main SHW systems: evacuated tubes and flat plate collectors. Evacuated tubes are more efficient at transferring solar irradiation to the fluid although flat plate collectors are considered to be better aesthetically and to install.

The final energy contribution to the household, calculated through SAP, is based on several factors:

- *Pitch, orientation, and over-shading.*
- *Heat absorption efficiency for the collector.*
- *Average hot water usage of the dwelling*

Most of the energy savings will be made in the hot water demand for the dwelling however, adding a SHW system will impact upon other energy demands.

Air Source Heat Pumps (ASHP)

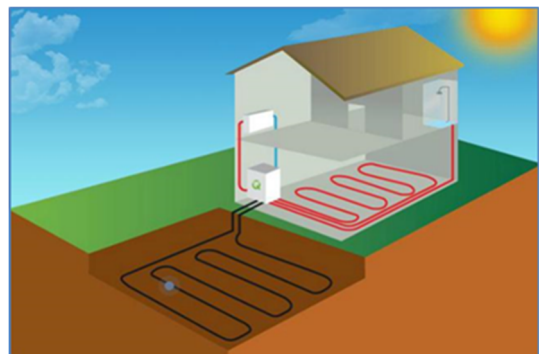
ASHP provide heating and hot water to a home through thermal energy gathered from air outside the dwelling. Systems can be designed to work in conjunction with a boiler system but in the case of energy efficient new builds it is possible for an ASHP unit to provide 100% of the heating and hot water demand.



The thermal performance of the unit depends on the outside temperature as well as the unit's Coefficient of Performance. This is the ratio of thermal energy produced to energy used. A typical value for this would be around 3.5, meaning that for every 1kW of electricity consumed the unit would provide 3.5kW of thermal energy to the household. This efficiency leads to large carbon and energy savings for both space and water heating.

Ground Source Heat Pumps (GSHP)

GSHP provide heating and hot water to a dwelling through geothermal effects. A GSHP system would offset the energy demand from the main space heating. There is, however, an additional electricity demand for the pump and control system. This would reduce energy savings from the installation.



GSHP are expensive to install and rely on having appropriate ground conditions and suitable space around the dwelling for the pipe looping. Energy savings are dependent upon the type of system being replaced and the way the system is operated by the homeowner.

Biomass Heating Systems

Biomass heating systems burn fuels, considered carbon neutral, to heat the water required for a dwelling. There are a large variety of systems available, and choice depends on the type of fuel to be burned and the level of automation.



The system would offset the energy demand from the hot water and main space heating. However, biomass systems typically require a large amount of maintenance and monitoring.

The savings from such a system, in terms of CO₂ and money, depends upon what it is replacing. The savings are greatest when replacing an electrical hot water system but are considerably less for replacing mains gas.

Wind Turbines

Wind turbines provide electricity directly to a dwelling. They can be added to a property in two ways: pole mounted or building mounted. The pole mounted systems are free standing and therefore require enough space around them to allow for the construction and maintenance of the structure, as well as to allow for efficient operation. The building mounted systems have a lower power output but do not require additional structures, as can be seen in the figure.

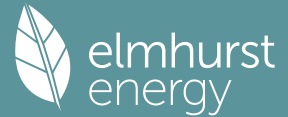
The energy produced from a wind turbine is heavily dependent upon the surrounding landscape. The energy saved will be offset against the electricity usage of the dwelling.



Appendix C – Sample SAP Calculations

Sample SAP reports can be found on the following pages

Full SAP Calculation Printout



Property Reference	H469X-H7 Holden				Issued on Date	07/06/2024
Assessment Reference	H469X-H7 Holden Final Issue B&B		Prop Type Ref	H469X-H7		
Property	Holden, DS00					
SAP Rating	93 A	DER	9.19	TER	9.54	
Environmental	91 B	% DER < TER				3.67
CO ₂ Emissions (t/year)	1.09	DFEE	40.51	TFEE	40.86	
Compliance Check	See BREL	% DFEE < TFEE				0.86
% DPER < TPER	6.70	DPER	46.57	TPER	49.92	
Assessor Details	Ms. Ruth Ferguson				Assessor ID	AE69-0001
Client						

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	73.8400 (1b)	x 2.3000 (2b)	= 169.8320 (1b) - (3b)
First floor	69.1500 (1c)	x 2.5600 (2c)	= 177.0240 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.9900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 346.8560 (5)

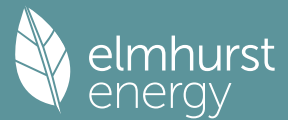
2. Ventilation rate

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	1 * 10 =	10.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans	Air changes per hour	
Pressure test	10.0000 / (5) =	0.0288 (8)
Pressure Test Method	Yes	
Measured/design AP50	Blower Door	4.0000 (17)
Infiltration rate		0.2288 (18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1945 (21)
Wind speed	Jan 5.1000 Feb 5.0000 Mar 4.9000 Apr 4.4000 May 4.3000 Jun 3.8000 Jul 3.8000 Aug 3.7000 Sep 4.0000 Oct 4.3000 Nov 4.5000 Dec 4.7000	(22)
Wind factor	1.2750 1.2500 1.2250 1.1000 1.0750 0.9500 0.9500 0.9250 1.0000 1.0750 1.1250 1.1750	(22a)
Adj infilt rate	0.2480 0.2431 0.2383 0.2140 0.2091 0.1848 0.1848 0.1799 0.1945 0.2091 0.2188 0.2285	(22b)
Mechanical extract ventilation - decentralised		
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)
Effective ac	0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Type 3 Front Door			2.3700	1.4000	3.3180		(26a)
Type 6 Rear Door			2.0000	1.4000	2.8000		(26a)
French door (Uw = 1.30)			10.9900	1.2357	13.5808		(27)
Window (Uw = 1.30)			15.8400	1.2357	19.5741		(27)
225mm TE Platinum GF B&B			73.8400	0.1100	8.1224	135.0000	9968.4000 (28a)
100mm Ecobead	171.5600	31.2000	140.3600	0.2300	32.2828	60.0000	8421.5999 (29a)
500mm MW @ 0.044	69.1500		69.1500	0.0900	6.2235	10.0000	691.5000 (30)
Lightpod Roof	4.1500		4.1500	0.1700	0.7055	9.0000	37.3500 (30)
Hexagonal Bay	0.5300		0.5300	0.1700	0.0901	9.0000	4.7700 (30)
Total net area of external elements Aum(A, m ²)			319.2300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	86.6972		(33)
GF Solid			75.5000			75.0000	5662.5000 (32c)
GF Timber			42.9100			7.7000	330.4070 (32c)
FF Timber			147.1100			7.7000	1132.7470 (32c)
FF Floor			69.1500			18.0000	1244.7000 (32d)

Full SAP Calculation Printout



GF Ceiling	69.1500	9.0000	622.3500 (32e)
Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =		
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	28116.3238 (34)		
List of Thermal Bridges	196.6314 (35)		
K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	5.5600	0.0260	0.1446
E3 Sill	11.4800	0.0310	0.3559
E4 Jamb	49.9500	0.0360	1.7982
E5 Ground floor (normal)	36.8100	0.0590	2.1718
E6 Intermediate floor within a dwelling	34.0100	0.0060	0.2041
E2 Other lintels (including other steel lintels)	5.8200	0.0400	0.2328
E4 Jamb	4.6500	0.0470	0.2186
E4 Jamb	4.2000	0.0670	0.2814
E4 Jamb	3.0000	0.0830	0.2490
E10 Eaves (insulation at ceiling level)	12.1000	0.1030	1.2463
E10 Eaves (insulation at ceiling level)	18.1300	0.0740	1.3416
E24 Eaves (insulation at ceiling level - inverted)	5.1100	0.1500	0.7665
E12 Gable (insulation at ceiling level)	3.7800	0.0570	0.2155
E14 Flat roof	7.9000	0.1600	1.2640
E16 Corner (normal)	24.3500	0.0520	1.2662
E17 Corner (inverted - internal area greater than external area)	4.8700	-0.0940	-0.4578
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.2985 (36)		
Point Thermal bridges	(36a) = 0.0000		
Total fabric heat loss	(33) + (36) + (36a) = 97.9958 (37)		
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)			
(38)m	Jan	Feb	Mar
Heat transfer coeff	57.2312	57.2312	57.2312
Average = Sum(39)m / 12 =	155.2270	155.2270	155.2270
HLP	Jan	Feb	Mar
HLP (average)	1.0856	1.0856	1.0856
Days in mont	31	28	31

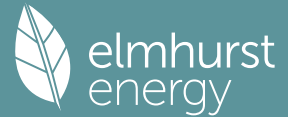
4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9226 (42)											
Hot water usage for mixer showers	73.2218	72.1214	70.5179	67.4500	65.1859	62.6610	61.2259	62.8172	64.5616	67.2726	70.4064	72.9412 (42a)
Hot water usage for baths	31.6110	31.1415	30.4804	29.2614	28.3487	27.3366	26.7899	27.4464	28.1612	29.2442	30.4882	31.5041 (42b)
Hot water usage for other uses	44.5601	42.9397	41.3193	39.6990	38.0786	36.4582	36.4582	38.0786	39.6990	41.3193	42.9397	44.5601 (42c)
Average daily hot water use (litres/day)	137.3255 (43)											
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	149.3928	146.2026	142.3176	136.4104	131.6132	126.4558	124.4740	128.3422	132.4218	137.8361	143.8343	149.0054 (44)
Energy content (annual)	236.6017	208.1905	218.7369	186.7390	177.1766	155.4922	150.5406	158.9145	163.2893	187.0422	204.9184	233.3064 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m = 2280.9483											
Water storage loss:	35.4903	31.2286	32.8105	28.0108	26.5765	23.3238	22.5811	23.8372	24.4934	28.0563	30.7378	34.9960 (46)
Store volume	180.0000 (47)											
a) If manufacturer declared loss factor is known (kWh/day):	1.3400 (48)											
Temperature factor from Table 2b	0.5400 (49)											
Enter (49) or (54) in (55)	0.7236 (55)											
Total storage loss	22.4316	20.2608	22.4316	21.7080	22.4316	21.7080	22.4316	22.4316	21.7080	22.4316	21.7080	22.4316 (56)
If cylinder contains dedicated solar storage	22.4316	20.2608	22.4316	21.7080	22.4316	21.7080	22.4316	22.4316	21.7080	22.4316	21.7080	22.4316 (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	282.2957	249.4625	264.4309	230.9590	222.8706	199.7122	196.2346	204.6085	207.5093	232.7362	249.1384	279.0004 (62)
WWHRS	-32.6012	-28.8328	-30.1920	-25.0002	-23.2993	-19.9374	-18.6881	-19.8729	-20.6280	-24.3181	-27.5495	-31.9975 (63a)
PV diverter	-10.8404	-26.4236	-62.9062	-110.2098	-159.2976	-165.4543	-161.3395	-127.9888	-82.6844	-40.7085	-15.1679	-8.2151 (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	238.8541	194.2061	171.3327	95.7490	40.2737	14.3205	16.2069	56.7467	104.1969	167.7096	206.4211	238.7879 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m = 1544.8053 (64)											
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	115.2253	102.2410	109.2852	97.4667	95.4664	87.0772	86.6099	89.3943	89.6697	98.7467	103.5114	114.1296 (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	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	160.1305	177.2873	160.1305	165.4681	160.1305	165.4681	160.1305	160.1305	165.4681	160.1305	165.4681	160.1305 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	312.7867	316.0325	307.8533	290.4408	268.4606	247.8024	234.0014	230.7556	238.9348	256.3473	278.3275	298.9857 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029 (71)
Water heating gains (Table 5)	154.8727	152.1443	146.8887	135.3704	128.3151	120.9405	116.4112	120.1536	124.5412	132.7241	143.7658	153.4000 (72)
Total internal gains	697.6284	715.3026	684.7111	661.1179	626.7448	601.0496	577.3816	577.8783	595.7828	619.0405	657.4000	682.3548 (73)

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6. Solar gains

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

Northeast				1.9600	11.2829	0.7300	0.7000	0.7700	7.8313 (75)			
Southwest				1.9600	36.7938	0.7300	0.7000	0.7700	25.5379 (79)			
Northwest				7.0700	11.2829	0.7300	0.7000	0.7700	28.2485 (81)			
Northeast				1.3200	11.2829	0.7300	0.7000	0.7700	5.2741 (75)			
East				0.8400	19.6403	0.7300	0.7000	0.7700	5.8423 (76)			
Southeast				6.6800	36.7938	0.7300	0.7000	0.7700	87.0373 (77)			
South				0.8400	46.7521	0.7300	0.7000	0.7700	13.9070 (78)			
Southwest				0.6600	36.7938	0.7300	0.7000	0.7700	8.5995 (79)			
Northwest				5.5000	11.2829	0.7300	0.7000	0.7700	21.9755 (81)			

Solar gains	204.2535	369.5192	562.5000	791.5899	972.4654	1003.0348	951.3953	810.8027	640.9946	423.7862	248.5934	172.2397 (83)
Total gains	901.8819	1084.8218	1247.2110	1452.7078	1599.2102	1604.0844	1528.7770	1388.6809	1236.7773	1042.8267	905.9934	854.5944 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	50.3140	50.3140	50.3140	50.3140	50.3140	50.3140	50.3140	50.3140	50.3140	50.3140	50.3140	50.3140
alpha	4.3543	4.3543	4.3543	4.3543	4.3543	4.3543	4.3543	4.3543	4.3543	4.3543	4.3543	4.3543
util living area	0.9934	0.9849	0.9644	0.9009	0.7694	0.5876	0.4393	0.5000	0.7505	0.9416	0.9866	0.9948 (86)
MIT	19.4482	19.6912	20.0413	20.4791	20.8050	20.9535	20.9895	20.9820	20.8693	20.4214	19.8439	19.3921 (87)
Th 2	20.0126	20.0126	20.0126	20.0126	20.0126	20.0126	20.0126	20.0126	20.0126	20.0126	20.0126	20.0126 (88)
util rest of house	0.9917	0.9810	0.9551	0.8758	0.7172	0.5084	0.3443	0.3991	0.6766	0.9211	0.9825	0.9934 (89)
MIT 2	18.1994	18.5081	18.9487	19.4812	19.8444	19.9836	20.0086	20.0050	19.9176	19.4251	18.7046	18.1279 (90)
Living area fraction	18.3841	18.6830	19.1102	19.6287	19.9864	20.1270	20.1536	20.1494	20.0583	19.5724	18.8731	18.3148 (92)
MIT	18.3841	18.6830	19.1102	19.6287	19.9864	20.1270	20.1536	20.1494	20.0583	19.5724	18.8731	18.3148 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.2341	18.5330	18.9602	19.4787	19.8364	19.9770	20.0036	19.9994	19.9083	19.4224	18.7231	18.1648 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9870	0.9727	0.9419	0.8594	0.7069	0.5054	0.3434	0.3977	0.6679	0.9051	0.9746	0.9894 (94)
Useful gains	890.1137	1055.1792	1174.7315	1248.4797	1130.5520	810.6441	524.9360	552.3426	825.9873	943.8909	882.9479	845.5398 (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	2162.9413	2116.2123	1934.1650	1642.1026	1262.9909	834.6545	528.3323	558.7297	901.6014	1369.4714	1804.2149	2167.7113 (97)
Space heating kWh	946.9837	713.0143	565.0185	283.4085	98.5345	0.0000	0.0000	0.0000	0.0000	316.6319	663.3122	983.6956 (98a)
Space heating requirement - total per year (kWh/year)												4570.5993
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	946.9837	713.0143	565.0185	283.4085	98.5345	0.0000	0.0000	0.0000	0.0000	316.6319	663.3122	983.6956 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4570.5993
Space heating per m2										(98c) / (4) =		31.9645 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												88.9000 (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	946.9837	713.0143	565.0185	283.4085	98.5345	0.0000	0.0000	0.0000	0.0000	316.6319	663.3122	983.6956 (98)
Space heating efficiency (main heating system 1)	88.9000	88.9000	88.9000	88.9000	88.9000	0.0000	0.0000	0.0000	0.0000	88.9000	88.9000	88.9000 (210)
Space heating fuel (main heating system)	1065.2236	802.0408	635.5664	318.7947	110.8375	0.0000	0.0000	0.0000	0.0000	356.1664	746.1330	1106.5193 (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	238.8541	194.2061	171.3327	95.7490	40.2737	14.3205	16.2069	56.7467	104.1969	167.7096	206.4211	238.7879 (64)
Efficiency of water heater (217)m	86.9278	86.8069	86.6295	86.4412	86.0866	79.9000	79.9000	79.9000	79.9000	85.5628	86.5852	79.9000 (216)
Fuel for water heating, kWh/month	274.7731	223.7221	197.7764	110.7678	46.7828	17.9231	20.2840	71.0222	130.4092	196.0077	238.4022	274.5126 (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	12.8485	11.6051	12.8485	12.4340	12.8485	12.4340	12.8485	12.8485	12.4340	12.8485	12.4340	12.8485 (231)
Lighting	32.0141	25.6829	23.1246	16.9421	13.0865	10.6918	11.9380	15.5174	20.1556	26.4453	29.8699	32.9039 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-35.6211	-55.8401	-89.6594	-109.4775	-122.9481	-116.2132	-114.1768	-104.9457	-88.5321	-67.2093	-40.6590	-29.8853 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												

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(233b)m	-3.0112	-7.3399	-17.4739	-30.6138	-44.2493	-45.9595	-44.8165	-35.5525	-22.9679	-11.3079	-4.2133	-2.2820	(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												5141.2815	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.9000	
Water heating fuel used												1802.3831	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.9420, total flow = 45.0000, SFP = 0.1543)													
mechanical ventilation fans (SFP = 0.1543)												65.2801	(230a)
central heating pump												41.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												151.2801	(231)
Electricity for lighting (calculated in Appendix L)												258.3722	(232)

Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1244.9556	(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												-311.7400	(236)
Energy used												77.0400	(237)
Total delivered energy for all uses												5873.6614	(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	5141.2815	0.2100	1079.6691	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1802.3831	0.2100	378.5005	(264)
Space and water heating			1458.1696	(265)
Pumps, fans and electric keep-hot	151.2801	0.1387	20.9844	(267)
Energy for lighting	258.3722	0.1443	37.2911	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-975.1678	0.1330	-129.6683	
PV Unit electricity exported	-269.7878	0.1223	-32.9846	
Total			-162.6529	(269)
Appendix Q item 'PV Diverter - Part 1' - energy saved	-311.7400	0.2100	-65.4654	(270)
Appendix Q item 'PV Diverter - Part 1' - energy used	77.0400	0.1360	10.4774	(271)
Appendix Q item 'PV Diverter - Part 2' - energy saved	-0.0000	0.0000	-0.0000	(270)
Appendix Q item 'PV Diverter - Part 2' - energy used	15.8700	0.0000	15.8700	(271)
Total CO2, kg/year			1314.6742	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			9.1900	(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	5141.2815	1.1300	5809.6481	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1802.3831	1.1300	2036.6929	(278)
Space and water heating			7846.3410	(279)
Pumps, fans and electric keep-hot	151.2801	1.5128	228.8566	(281)
Energy for lighting	258.3722	1.5338	396.2999	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-975.1678	1.4914	-1454.3182	
PV Unit electricity exported	-269.7878	0.4486	-121.0285	
Total			-1575.3467	(283)
Appendix Q item 'PV Diverter - Part 1' - energy saved	-311.7400	1.1300	-352.2662	(284)
Appendix Q item 'PV Diverter - Part 1' - energy used	77.0400	1.5010	115.6370	(285)
Total Primary energy kWh/year			6659.5217	(286)
Dwelling Primary energy Rate (DPER)			46.5700	(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	73.8400 (1b)	x	2.3000 (2b)	=	169.8320 (1b) - (3b)	
First floor	69.1500 (1c)	x	2.5600 (2c)	=	177.0240 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.9900				(4)	
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	346.8560 (5)	

2. Ventilation rate

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		m3 per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
		Air changes per hour
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1153 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3653 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3105 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Effective ac	0.3959	0.3882	0.3804	0.3416	0.3338	0.2950	0.2950	0.2872	0.3105	0.3338	0.3493	0.3649	(22b)
	0.5784	0.5753	0.5723	0.5583	0.5557	0.5435	0.5435	0.5413	0.5482	0.5557	0.5610	0.5666	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.3700	1.0000	4.3700			(26a)
TER Opening Type (Uw = 1.20)			26.8300	1.1450	30.7214			(27)
225mm TE Platinum GF B&B			73.8400	0.1300	9.5992			(28a)
100mm Ecobead	171.5600	31.2000	140.3600	0.1800	25.2648			(29a)
500mm MW @ 0.044	69.1500		69.1500	0.1100	7.6065			(30)
Lightpod Roof	4.1500		4.1500	0.1100	0.4565			(30)
Hexagonal Bay	0.5300		0.5300	0.1100	0.0583			(30)
Total net area of external elements Aum(A, m2)			319.2300					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 78.0767			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 196.6314 (35)

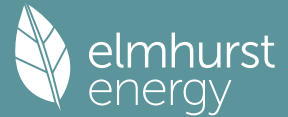
List of Thermal Bridges													
K1 Element							Length	Psi-value	Total				
E2 Other lintels (including other steel lintels)							5.5600	0.0500	0.2780				
E3 Sill							11.4800	0.0500	0.5740				
E4 Jamb							49.9500	0.0500	2.4975				
E5 Ground floor (normal)							36.8100	0.1600	5.8896				
E6 Intermediate floor within a dwelling							34.0100	0.0000	0.0000				
E2 Other lintels (including other steel lintels)							5.8200	0.0500	0.2910				
E4 Jamb							4.6500	0.0500	0.2325				
E4 Jamb							4.2000	0.0500	0.2100				
E4 Jamb							3.0000	0.0500	0.1500				
E10 Eaves (insulation at ceiling level)							12.1000	0.0600	0.7260				
E10 Eaves (insulation at ceiling level)							18.1300	0.0600	1.0878				
E24 Eaves (insulation at ceiling level - inverted)							5.1100	0.2400	1.2264				
E12 Gable (insulation at ceiling level)							3.7800	0.0600	0.2268				
E14 Flat roof							7.9000	0.0800	0.6320				
E16 Corner (normal)							24.3500	0.0900	2.1915				
E17 Corner (inverted - internal area greater than external area)							4.8700	-0.0900	-0.4383				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)									15.7748				(36)
Point Thermal bridges									(36a) = 0.0000				
Total fabric heat loss									(33) + (36) + (36a) = 93.8515				(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	66.2023	65.8539	65.5125	63.9086	63.6086	62.2117	62.2117	61.9530	62.7497	63.6086	64.2156	64.8502	(38)
Average = Sum(39)m / 12 =	160.0537	159.7054	159.3639	157.7601	157.4600	156.0632	156.0632	155.8045	156.6012	157.4600	158.0671	158.7017	(39)
												157.7587	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1193	1.1169	1.1145	1.1033	1.1012	1.0914	1.0914	1.0896	1.0952	1.1012	1.1054	1.1099	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9226 (42)
Hot water usage for mixer showers													
	73.2218	72.1214	70.5179	67.4500	65.1859	62.6610	61.2259	62.8172	64.5616	67.2726	70.4064	72.9412	(42a)
Hot water usage for baths													
	31.6110	31.1415	30.4804	29.2614	28.3487	27.3366	26.7899	27.4464	28.1612	29.2442	30.4882	31.5041	(42b)
Hot water usage for other uses													
	44.5601	42.9397	41.3193	39.6990	38.0786	36.4582	36.4582	38.0786	39.6990	41.3193	42.9397	44.5601	(42c)
Average daily hot water use (litres/day)													137.3255 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	149.3928	146.2026	142.3176	136.4104	131.6132	126.4558	124.4740	128.3422	132.4218	137.8361	143.8343	149.0054	(44)
Energy content (annual)	236.6017	208.1905	218.7369	186.7390	177.1766	155.4922	150.5406	158.9145	163.2893	187.0422	204.9184	233.3064	(45)
Distribution loss (46)m = 0.15 x (45)m													Total = Sum(45)m = 2280.9483
	35.4903	31.2286	32.8105	28.0108	26.5765	23.3238	22.5811	23.8372	24.4934	28.0563	30.7378	34.9960	(46)
Water storage loss:													
Store volume													180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.5520 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.8381 (55)

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Total storage loss	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (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	285.8444	252.6678	267.9796	234.3932	226.4193	203.1464	199.7832	208.1571	210.9435	236.2849	252.5726	282.5491 (62)
WWHRS	-33.4739	-29.6046	-31.0003	-25.6694	-23.9230	-20.4711	-19.1884	-20.4049	-21.1802	-24.9691	-28.2869	-32.8540 (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	252.3704	223.0632	236.9793	208.7237	202.4963	182.6753	180.5949	187.7522	189.7633	211.3158	224.2856	249.6951 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											2549.7153 (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	118.0642	104.8052	112.1242	100.2141	98.3054	89.8245	89.4489	92.2332	92.4170	101.5857	106.2587	116.9685 (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	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	160.1305	177.2873	160.1305	165.4681	160.1305	165.4681	160.1305	160.1305	165.4681	160.1305	165.4681	160.1305 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	312.7867	316.0325	307.8533	290.4408	268.4606	247.8024	234.0014	230.7556	238.9348	256.3473	278.3275	298.9857 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129 (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)	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029 (71)
Water heating gains (Table 5)	158.6884	155.9601	150.7045	139.1862	132.1309	124.7563	120.2270	123.9694	128.3570	136.5399	147.5816	157.2158 (72)
Total internal gains	701.4442	719.1184	688.5268	664.9337	630.5605	604.8654	581.1974	581.6940	599.5986	622.8563	661.2158	686.1705 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W				
Northeast					3.2800	11.2829	0.6300	0.7000			0.7700	11.3101 (75)				
East					0.8400	19.6403	0.6300	0.7000			0.7700	5.0419 (76)				
Southeast					6.6800	36.7938	0.6300	0.7000			0.7700	75.1144 (77)				
South					0.8400	46.7521	0.6300	0.7000			0.7700	12.0020 (78)				
Southwest					2.6200	36.7938	0.6300	0.7000			0.7700	29.4610 (79)				
Northwest					12.5700	11.2829	0.6300	0.7000			0.7700	43.3440 (81)				
Solar gains					176.2735	318.9001	485.4452	683.1529	839.2510	865.6328	821.0672	699.7338	553.1871	365.7333	214.5395	148.6452 (83)
Total gains					877.7177	1038.0185	1173.9720	1348.0866	1469.8115	1470.4982	1402.2646	1281.4278	1152.7856	988.5895	875.7553	834.8157 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	48.7967	48.9031	49.0079	49.5061	49.6005	50.0444	50.0444	50.1275	49.8725	49.6005	49.4100	49.2124
alpha	4.2531	4.2602	4.2672	4.3004	4.3067	4.3363	4.3363	4.3418	4.3248	4.3067	4.2940	4.2808
util living area	0.9941	0.9874	0.9719	0.9218	0.8101	0.6326	0.4781	0.5386	0.7850	0.9516	0.9883	0.9952 (86)
MIT	19.3653	19.5952	19.9367	20.3929	20.7504	20.9373	20.9852	20.9758	20.8397	20.3647	19.7872	19.3300 (87)
Th 2	19.9851	19.9871	19.9890	19.9981	19.9999	20.0078	20.0078	20.0093	20.0048	19.9999	19.9964	19.9928 (88)
util rest of house	0.9925	0.9841	0.9642	0.9003	0.7611	0.5507	0.3757	0.4319	0.7136	0.9338	0.9847	0.9940 (89)
MIT 2	18.0751	18.3690	18.8019	19.3701	19.7796	19.9678	20.0020	19.9988	19.8852	19.3484	18.6218	18.0353 (90)
Living area fraction	18.2658	18.5503	18.9697	19.5213	19.9231	20.1112	20.1474	20.1433	20.0263	19.4986	18.7941	18.2267 (91)
Temperature adjustment	18.2658	18.5503	18.9697	19.5213	19.9231	20.1112	20.1474	20.1433	20.0263	19.4986	18.7941	0.0000 (92)
adjusted MIT	18.2658	18.5503	18.9697	19.5213	19.9231	20.1112	20.1474	20.1433	20.0263	19.4986	18.7941	18.2267 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	867.6409	1014.5012	1119.7420	1196.9489	1112.4407	823.0854	547.6184	572.6409	824.6430	911.6955	856.7501	826.9361 (94)
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	2235.2862	2180.0236	1987.2209	1675.6196	1294.8165	860.0891	553.6155	583.2173	928.0706	1401.1785	1848.4534	2226.0630 (97)
Space heating kWh	1017.5281	783.2310	645.4043	344.6429	135.6876	0.0000	0.0000	0.0000	0.0000	364.1754	714.0263	1040.9504 (98a)
Space heating requirement - total per year (kWh/year)												5045.6461
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	1017.5281	783.2310	645.4043	344.6429	135.6876	0.0000	0.0000	0.0000	0.0000	364.1754	714.0263	1040.9504 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5045.6461
Space heating per m2												(98c) / (4) = 35.2867 (99)

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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	1017.5281	783.2310	645.4043	344.6429	135.6876	0.0000	0.0000	0.0000	0.0000	364.1754	714.0263	1040.9504 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	1102.4140	848.5710	699.2463	373.3943	147.0072	0.0000	0.0000	0.0000	0.0000	394.5562	773.5930	1127.7903 (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	252.3704	223.0632	236.9793	208.7237	202.4963	182.6753	180.5949	187.7522	189.7633	211.3158	224.2856	249.6951 (64)
Efficiency of water heater (217)m	86.8533	86.6341	86.1894	85.1766	83.1826	79.8000	79.8000	79.8000	79.8000	85.2688	86.4689	79.8000 (216)
Fuel for water heating, kWh/month	290.5709	257.4772	274.9519	245.0483	243.4359	228.9165	226.3093	235.2785	237.7986	247.8232	259.3829	287.3235 (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	33.2719	26.6920	24.0332	17.6077	13.6007	11.1119	12.4070	16.1271	20.9475	27.4843	31.0435	34.1967 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-64.1472	-88.0225	-123.1533	-134.5990	-141.8687	-131.1423	-129.3717	-123.6138	-113.1373	-98.6438	-69.5964	-55.7334 (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	-43.9691	-91.4858	-180.0626	-267.9789	-352.0725	-353.0511	-349.0293	-296.6673	-218.8905	-130.1624	-58.4685	-34.8594 (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												5466.5722 (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												3034.3167 (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)												268.5237 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-3649.7268 (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												5205.6858 (238)

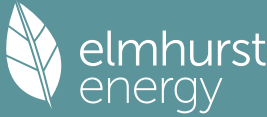
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5466.5722	0.2100	1147.9802 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3034.3167	0.2100	637.2065 (264)
Space and water heating			1785.1867 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	268.5237	0.1443	38.7563 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1273.0294	0.1352	-172.1104
PV Unit electricity exported	-2376.6974	0.1262	-299.8423
Total			-471.9527 (269)
Total CO2, kg/year			1363.9195 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.5400 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	5466.5722	1.1300	6177.2265 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3034.3167	1.1300	3428.7779 (278)
Space and water heating			9606.0045 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	268.5237	1.5338	411.8706 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1273.0294	1.4997	-1909.1635
PV Unit electricity exported	-2376.6974	0.4631	-1100.6542
Total			-3009.8177 (283)

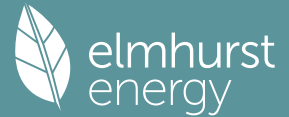
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Total Primary energy kWh/year
Target Primary Energy Rate (TPER)

7138.1581 (286)
49.9200 (287)

Full SAP Calculation Printout



Property Reference	H469X-H7 Holden				Issued on Date	07/06/2024
Assessment Reference	H469X-H7 Holden Final Issue B&B		Prop Type Ref	H469X-H7		
Property	Holden, DS00					
SAP Rating	93 A	DER	9.19	TER	9.54	
Environmental	91 B	% DER < TER				3.67
CO ₂ Emissions (t/year)	1.09	DFEE	40.51	TFEE	40.86	
Compliance Check	See BREL	% DFEE < TFEE				0.86
% DPER < TPER	6.70	DPER	46.57	TPER	49.92	
Assessor Details	Ms. Ruth Ferguson				Assessor ID	AE69-0001
Client						

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	73.8400 (1b)	x 2.3000 (2b)	= 169.8320 (1b) - (3b)
First floor	69.1500 (1c)	x 2.5600 (2c)	= 177.0240 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.9900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 346.8560 (5)

2. Ventilation rate

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1153 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	4.0000	(17)
Infiltration rate	0.3153	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2680 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
	0.3417	0.3350	0.3283	0.2948	0.2881	0.2546	0.2546	0.2479	0.2680	0.2881	0.3015	0.3149 (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	0.5584	0.5561	0.5539	0.5435	0.5415	0.5324	0.5324	0.5307	0.5359	0.5415	0.5455	0.5496 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Type 3 Front Door			2.3700	1.4000	3.3180		(26a)
Type 6 Rear Door			2.0000	1.4000	2.8000		(26a)
French door (Uw = 1.30)			10.9900	1.2357	13.5808		(27)
Window (Uw = 1.30)			15.8400	1.2357	19.5741		(27)
225mm TE Platinum GF B&B			73.8400	0.1100	8.1224	135.0000	9968.4000 (28a)
100mm Ecobead	171.5600	31.2000	140.3600	0.2300	32.2828	60.0000	8421.5999 (29a)
500mm MW @ 0.044	69.1500		69.1500	0.0900	6.2235	10.0000	691.5000 (30)
Lightpod Roof	4.1500		4.1500	0.1700	0.7055	9.0000	37.3500 (30)
Hexagonal Bay	0.5300		0.5300	0.1700	0.0901	9.0000	4.7700 (30)
Total net area of external elements Aum(A, m ²)			319.2300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	86.6972		(33)
GF Solid			75.5000			75.0000	5662.5000 (32c)
GF Timber			42.9100			7.7000	330.4070 (32c)
FF Timber			147.1100			7.7000	1132.7470 (32c)
FF Floor			69.1500			18.0000	1244.7000 (32d)
GF Ceiling			69.1500			9.0000	622.3500 (32e)

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Heat capacity $C_m = \text{Sum}(A \times k)$
Thermal mass parameter (TMP) = C_m / TFA in $\text{kJ/m}^2\text{K}$
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.5600	0.0260	0.1446
E3 Sill	11.4800	0.0310	0.3559
E4 Jamb	49.9500	0.0360	1.7982
E5 Ground floor (normal)	36.8100	0.0590	2.1718
E6 Intermediate floor within a dwelling	34.0100	0.0060	0.2041
E2 Other lintels (including other steel lintels)	5.8200	0.0400	0.2328
E4 Jamb	4.6500	0.0470	0.2186
E4 Jamb	4.2000	0.0670	0.2814
E4 Jamb	3.0000	0.0830	0.2490
E10 Eaves (insulation at ceiling level)	12.1000	0.1030	1.2463
E10 Eaves (insulation at ceiling level)	18.1300	0.0740	1.3416
E24 Eaves (insulation at ceiling level - inverted)	5.1100	0.1500	0.7665
E12 Gable (insulation at ceiling level)	3.7800	0.0570	0.2155
E14 Flat roof	7.9000	0.1600	1.2640
E16 Corner (normal)	24.3500	0.0520	1.2662
E17 Corner (inverted - internal area greater than external area)	4.8700	-0.0940	-0.4578

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Point Thermal bridges
Total fabric heat loss

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$
(38)m
Heat transfer coeff
Average = $\text{Sum}(39)\text{m} / 12 =$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	63.9147	63.6551	63.4007	62.2059	61.9824	60.9417	60.9417	60.7490	61.3425	61.9824	62.4346	62.9074
Heat transfer coeff	161.9104	161.6509	161.3965	160.2017	159.9781	158.9375	158.9375	158.7447	159.3383	159.9781	160.4304	160.9032
Average = $\text{Sum}(39)\text{m} / 12 =$												

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1323	1.1305	1.1287	1.1204	1.1188	1.1115	1.1115	1.1102	1.1143	1.1188	1.1220	1.1253
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9226 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	31.6110	31.1415	30.4804	29.2614	28.3487	27.3366	26.7899	27.4464	28.1612	29.2442	30.4882	31.5041	31.5041 (42b)
Hot water usage for other uses	44.5601	42.9397	41.3193	39.6990	38.0786	36.4582	36.4582	38.0786	39.6990	41.3193	42.9397	44.5601	44.5601 (42c)
Average daily hot water use (litres/day)													69.8175 (43)
Daily hot water use	76.1710	74.0812	71.7997	68.9604	66.4273	63.7948	63.2481	65.5250	67.8602	70.5635	73.4279	76.0642	76.0642 (44)
Energy content (annual)	120.6363	105.4906	110.3535	94.4033	89.4239	78.4432	76.4932	81.1336	83.6784	95.7540	104.6115	119.0981	119.0981 (45)
Distribution loss (46)m = $0.15 \times (45)\text{m}$	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	102.5409	89.6670	93.8005	80.2428	76.0103	66.6767	65.0192	68.9636	71.1266	81.3909	88.9198	101.2334	101.2334 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	102.5409	89.6670	93.8005	80.2428	76.0103	66.6767	65.0192	68.9636	71.1266	81.3909	88.9198	101.2334	101.2334 (64)
12Total per year (kWh/year)													985.5917 (64)
Electric shower(s)	58.6384	52.2473	57.0521	54.4441	55.4657	52.9089	54.6725	55.4657	54.4441	57.0521	55.9793	58.6384	58.6384 (64a)
Heat gains from water heating, kWh/month	40.2948	35.4786	37.7131	33.6717	32.8690	29.8964	29.9229	31.1073	31.3927	34.6107	36.2248	39.9680	39.9680 (65)
Total Energy used by instantaneous electric shower(s) (kWh/year) = $\text{Sum}(64a)\text{m} =$													667.0087 (64a)

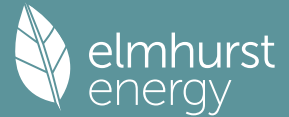
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	160.1305	177.2873	160.1305	165.4681	160.1305	165.4681	160.1305	160.1305	165.4681	160.1305	165.4681	160.1305	160.1305 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	312.7867	316.0325	307.8533	290.4408	268.4606	247.8024	234.0014	230.7556	238.9348	256.3473	278.3275	298.9857	298.9857 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129 (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	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029 (71)
Water heating gains (Table 5)	54.1597	52.7955	50.6897	46.7663	44.1788	41.5228	40.2190	41.8109	43.6009	46.5198	50.3122	53.7204	53.7204 (72)
Total internal gains	593.9155	612.9539	585.5120	569.5138	539.6084	521.6319	501.1894	499.5356	514.8425	529.8362	560.9464	579.6751	579.6751 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
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Northeast	1.9600	11.2829	0.7300	0.7000	0.7700	7.8313 (75)
Southwest	1.9600	36.7938	0.7300	0.7000	0.7700	25.5379 (79)
Northwest	7.0700	11.2829	0.7300	0.7000	0.7700	28.2485 (81)
Northeast	1.3200	11.2829	0.7300	0.7000	0.7700	5.2741 (75)
East	0.8400	19.6403	0.7300	0.7000	0.7700	5.8423 (76)
Southeast	6.6800	36.7938	0.7300	0.7000	0.7700	87.0373 (77)
South	0.8400	46.7521	0.7300	0.7000	0.7700	13.9070 (78)
Southwest	0.6600	36.7938	0.7300	0.7000	0.7700	8.5995 (79)
Northwest	5.5000	11.2829	0.7300	0.7000	0.7700	21.9755 (81)

Solar gains	204.2535	369.5192	562.5000	791.5899	972.4654	1003.0348	951.3953	810.8027	640.9946	423.7862	248.5934	172.2397 (83)
Total gains	798.1689	982.4730	1148.0120	1361.1037	1512.0739	1524.6667	1452.5847	1310.3383	1155.8370	953.6224	809.5398	751.9148 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	48.2371	48.3145	48.3907	48.7516	48.8197	49.1394	49.1394	49.1990	49.0158	48.8197	48.6821	48.5391
alpha	4.2158	4.2210	4.2260	4.2501	4.2546	4.2760	4.2760	4.2799	4.2677	4.2546	4.2455	4.2359
util living area	0.9959	0.9897	0.9743	0.9215	0.8031	0.6225	0.4702	0.5361	0.7894	0.9578	0.9913	0.9968 (86)
MIT	19.2716	19.5235	19.8929	20.3789	20.7517	20.9381	20.9852	20.9748	20.8300	20.3185	19.7046	19.2284 (87)
Th 2	19.9745	19.9760	19.9774	19.9842	19.9855	19.9914	19.9914	19.9925	19.9891	19.9855	19.9829	19.9802 (88)
util rest of house	0.9948	0.9870	0.9671	0.8998	0.7529	0.5400	0.3677	0.4282	0.7177	0.9417	0.9885	0.9959 (89)
MIT 2	18.3956	18.6469	19.0125	19.4840	19.8157	19.9609	19.9870	19.9841	19.8902	19.4376	18.8336	18.3569 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.5251	18.7765	19.1427	19.6163	19.9541	20.1054	20.1345	20.1306	20.0292	19.5678	18.9624	18.4857 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.5251	18.7765	19.1427	19.6163	19.9541	20.1054	20.1345	20.1306	20.0292	19.5678	18.9624	18.4857 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9925	0.9825	0.9595	0.8904	0.7512	0.5499	0.3826	0.4435	0.7209	0.9332	0.9846	0.9941 (94)
Useful gains	792.1604	965.3113	1101.5340	1211.8616	1135.8828	838.3549	555.8018	581.1983	833.2343	889.9185	797.0503	747.4514 (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	2303.1978	2243.1523	2040.4811	1716.7716	1320.4698	875.0129	561.7711	592.2062	944.7410	1434.6525	1903.0844	2298.6174 (97)
Space heating kWh	1124.2118	858.7091	698.5766	363.5352	137.3327	0.0000	0.0000	0.0000	0.0000	405.2821	796.3445	1154.0675 (98a)
Space heating requirement - total per year (kWh/year)	5538.0596											
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	1124.2118	858.7091	698.5766	363.5352	137.3327	0.0000	0.0000	0.0000	0.0000	405.2821	796.3445	1154.0675 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	5538.0596											
Space heating per m2	(98c) / (4) = 38.7304 (99)											

8c. Space cooling requirement

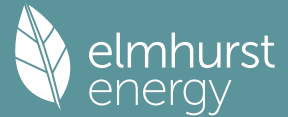
Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1494.0122	1176.1372	1206.4601	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8612	0.9161	0.8806	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1286.6046	1077.4462	1062.4622	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1711.6757	1630.5439	1467.5017	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	306.0512	411.5047	301.3494	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction	fc = cooled area / (4) =											
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	76.5128	102.8762	75.3373	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement	254.7263 (107)											
Energy for space heating	38.7304 (99)											
Energy for space cooling	1.7814 (108)											
Total	40.5118 (109)											
Fabric Energy Efficiency (DFEE)	40.5 (109)											

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	73.8400 (1b)	x	2.3000 (2b)	= 169.8320 (1b) - (3b)
First floor	69.1500 (1c)	x	2.5600 (2c)	= 177.0240 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.9900			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)		= 346.8560 (5)

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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) =		0.1153 (8)	
Pressure test												Yes			
Pressure Test Method												Blower Door			
Measured/design AP50												5.0000		(17)	
Infiltration rate												0.3653		(18)	
Number of sides sheltered												2		(19)	
Shelter factor												(20) = 1 - [0.075 x (19)] =		0.8500 (20)	
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) =		0.3105 (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	0.3959	0.3882	0.3804	0.3416	0.3338	0.2950	0.2950	0.2872	0.3105	0.3338	0.3493	0.3649	(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	0.5784	0.5753	0.5723	0.5583	0.5557	0.5435	0.5435	0.5413	0.5482	0.5557	0.5610	0.5666	(25)		

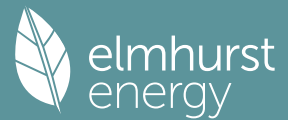
3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Semi-glazed door			4.3700	1.0000	4.3700			(26a)				
TER Opening Type (Uw = 1.20)			26.8300	1.1450	30.7214			(27)				
225mm TE Platinum GF B&B			73.8400	0.1300	9.5992			(28a)				
100mm Ecobead	171.5600	31.2000	140.3600	0.1800	25.2648			(29a)				
500mm MW @ 0.044	69.1500		69.1500	0.1100	7.6065			(30)				
Lightpod Roof	4.1500		4.1500	0.1100	0.4565			(30)				
Hexagonal Bay	0.5300		0.5300	0.1100	0.0583			(30)				
Total net area of external elements Aum(A, m2)			319.2300					(31)				
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		78.0767			(33)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								196.6314 (35)				
List of Thermal Bridges												
K1 Element				Length	Psi-value		Total					
E2 Other lintels (including other steel lintels)				5.5600	0.0500		0.2780					
E3 Sill				11.4800	0.0500		0.5740					
E4 Jamb				49.9500	0.0500		2.4975					
E5 Ground floor (normal)				36.8100	0.1600		5.8896					
E6 Intermediate floor within a dwelling				34.0100	0.0000		0.0000					
E2 Other lintels (including other steel lintels)				5.8200	0.0500		0.2910					
E4 Jamb				4.6500	0.0500		0.2325					
E4 Jamb				4.2000	0.0500		0.2100					
E4 Jamb				3.0000	0.0500		0.1500					
E10 Eaves (insulation at ceiling level)				12.1000	0.0600		0.7260					
E10 Eaves (insulation at ceiling level)				18.1300	0.0600		1.0878					
E24 Eaves (insulation at ceiling level - inverted)				5.1100	0.2400		1.2264					
E12 Gable (insulation at ceiling level)				3.7800	0.0600		0.2268					
E14 Flat roof				7.9000	0.0800		0.6320					
E16 Corner (normal)				24.3500	0.0900		2.1915					
E17 Corner (inverted - internal area greater than external area)				4.8700	-0.0900		-0.4383					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								15.7748 (36)				
Point Thermal bridges							(36a) =	0.0000				
Total fabric heat loss							(33) + (36) + (36a) =	93.8515 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 66.2023	Feb 65.8539	Mar 65.5125	Apr 63.9086	May 63.6086	Jun 62.2117	Jul 62.2117	Aug 61.9530	Sep 62.7497	Oct 63.6086	Nov 64.2156	Dec 64.8502 (38)
Heat transfer coeff	160.0537	159.7054	159.3639	157.7601	157.4600	156.0632	156.0632	155.8045	156.6012	157.4600	158.0671	158.7017 (39)
Average = Sum(39)m / 12 =	157.7587											
HLP	Jan 1.1193	Feb 1.1169	Mar 1.1145	Apr 1.1033	May 1.1012	Jun 1.0914	Jul 1.0914	Aug 1.0896	Sep 1.0952	Oct 1.1012	Nov 1.1054	Dec 1.1099 (40)
HLP (average)	1.1033											
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9226 (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	31.6110	31.1415	30.4804	29.2614	28.3487	27.3366	26.7899	27.4464	28.1612	29.2442	30.4882	31.5041 (42b)
Hot water usage for other uses	44.5601	42.9397	41.3193	39.6990	38.0786	36.4582	36.4582	38.0786	39.6990	41.3193	42.9397	44.5601 (42c)
Average daily hot water use (litres/day)												69.8175 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	76.1710	74.0812	71.7997	68.9604	66.4273	63.7948	63.2481	65.5250	67.8602	70.5635	73.4279	76.0642 (44)
Energy content (annual)	120.6363	105.4906	110.3535	94.4033	89.4239	78.4432	76.4932	81.1336	83.6784	95.7540	104.6115	119.0981 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m =											1159.5197

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Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	102.5409	89.6670	93.8005	80.2428	76.0103	66.6767	65.0192	68.9636	71.1266	81.3909	88.9198	101.2334 (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	102.5409	89.6670	93.8005	80.2428	76.0103	66.6767	65.0192	68.9636	71.1266	81.3909	88.9198	101.2334 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											985.5917 (64)
Electric shower(s)	58.6384	52.2473	57.0521	54.4441	55.4657	52.9089	54.6725	55.4657	54.4441	57.0521	55.9793	58.6384 (64a)
Heat gains from water heating, kWh/month	40.2948	35.4786	37.7131	33.6717	32.8690	29.8964	29.9229	31.1073	31.3927	34.6107	36.2248	39.9680 (65)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												

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	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	160.1305	177.2873	160.1305	165.4681	160.1305	165.4681	160.1305	160.1305	165.4681	160.1305	165.4681	160.1305 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	312.7867	316.0325	307.8533	290.4408	268.4606	247.8024	234.0014	230.7556	238.9348	256.3473	278.3275	298.9857 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129 (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)	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029 (71)
Water heating gains (Table 5)	54.1597	52.7955	50.6897	46.7663	44.1788	41.5228	40.2190	41.8109	43.6009	46.5198	50.3122	53.7204 (72)
Total internal gains	593.9155	612.9539	585.5120	569.5138	539.6084	521.6319	501.1894	499.5356	514.8425	529.8362	560.9464	579.6751 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				3.2800	11.2829	0.6300	0.7000	0.7700	11.3101 (75)			
East				0.8400	19.6403	0.6300	0.7000	0.7700	5.0419 (76)			
Southeast				6.6800	36.7938	0.6300	0.7000	0.7700	75.1144 (77)			
South				0.8400	46.7521	0.6300	0.7000	0.7700	12.0020 (78)			
Southwest				2.6200	36.7938	0.6300	0.7000	0.7700	29.4610 (79)			
Northwest				12.5700	11.2829	0.6300	0.7000	0.7700	43.3440 (81)			
Solar gains	176.2735	318.9001	485.4452	683.1529	839.2510	865.6328	821.0672	699.7338	553.1871	365.7333	214.5395	148.6452 (83)
Total gains	770.1890	931.8540	1070.9572	1252.6667	1378.8594	1387.2647	1322.2566	1199.2694	1068.0296	895.5695	775.4859	728.3203 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	48.7967	48.9031	49.0079	49.5061	49.6005	50.0444	50.0444	50.1275	49.8725	49.6005	49.4100	49.2124
alpha	4.2531	4.2602	4.2672	4.3004	4.3067	4.3363	4.3363	4.3418	4.3248	4.3067	4.2940	4.2808
util living area	0.9964	0.9915	0.9795	0.9371	0.8351	0.6613	0.5043	0.5701	0.8169	0.9649	0.9926	0.9972 (86)
MIT	19.2699	19.5035	19.8531	20.3302	20.7148	20.9256	20.9819	20.9699	20.8101	20.2949	19.7000	19.2349 (87)
Th 2	19.9851	19.9871	19.9890	19.9981	19.9999	20.0078	20.0078	20.0093	20.0048	19.9999	19.9964	19.9928 (88)
util rest of house	0.9954	0.9892	0.9737	0.9188	0.7892	0.5787	0.3976	0.4595	0.7495	0.9512	0.9902	0.9964 (89)
MIT 2	18.4017	18.6355	18.9829	19.4515	19.8005	19.9702	20.0022	19.9990	19.8914	19.4272	18.8391	18.3726 (90)
Living area fraction	18.5301	18.7639	19.1115	19.5814	19.9356	20.1114	20.1470	20.1425	20.0272	19.5555	18.9664	0.1478 (91)
MIT	18.5301	18.7639	19.1115	19.5814	19.9356	20.1114	20.1470	20.1425	20.0272	19.5555	18.9664	18.5001 (92)
Temperature adjustment	18.5301	18.7639	19.1115	19.5814	19.9356	20.1114	20.1470	20.1425	20.0272	19.5555	18.9664	0.0000
adjusted MIT	18.5301	18.7639	19.1115	19.5814	19.9356	20.1114	20.1470	20.1425	20.0272	19.5555	18.9664	18.5001 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9934	0.9853	0.9670	0.9095	0.7859	0.5879	0.4130	0.4751	0.7512	0.9432	0.9867	0.9948 (94)
Ext temp.	765.1060	918.1922	1035.5827	1139.3313	1083.5772	815.5249	546.1138	569.7290	802.3537	844.7440	765.1385	724.4982 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	2277.5794	2214.1319	2009.8233	1685.1047	1296.7852	860.1334	553.5615	583.0978	928.2076	1410.1255	1875.6870	2269.4493 (97)
Space heating requirement - total per year (kWh/year)	1125.2802	870.8715	724.8350	392.9569	158.6268	0.0000	0.0000	0.0000	0.0000	420.6438	799.5949	1149.4436 (98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	1125.2802	870.8715	724.8350	392.9569	158.6268	0.0000	0.0000	0.0000	0.0000	420.6438	799.5949	1149.4436 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (99)
Space heating per m2	(98c) / (4) =											39.4591 (99)

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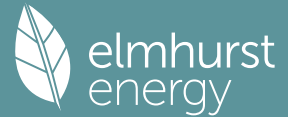


8c. Space cooling requirement

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	1466.9938	1154.8674	1184.1141	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8345	0.8976	0.8588	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1224.2401	1036.5627	1016.8698	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1551.0759	1478.2123	1337.6809	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	235.3218	328.5873	238.6835	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	58.8304	82.1468	59.6709	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												200.6481 (107)
Energy for space heating												39.4591 (99)
Energy for space cooling												1.4032 (108)
Total												40.8623 (109)
Fabric Energy Efficiency (TFEE)												40.9 (109)

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Property Reference	H469X-H7 Holden				Issued on Date	07/06/2024
Assessment Reference	H469X-H7 Holden Final Issue B&B		Prop Type Ref	H469X-H7		
Property	Holden, DS00					
SAP Rating	93 A	DER	9.19	TER	9.54	
Environmental	91 B	% DER < TER				3.67
CO ₂ Emissions (t/year)	1.09	DFEE	40.51	TFEE	40.86	
Compliance Check	See BREL	% DFEE < TFEE				0.86
% DPER < TPER	6.70	DPER	46.57	TPER	49.92	
Assessor Details	Ms. Ruth Ferguson				Assessor ID	AE69-0001
Client						

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	73.8400 (1b)	x 2.3000 (2b)	= 169.8320 (1b) - (3b)
First floor	69.1500 (1c)	x 2.5600 (2c)	= 177.0240 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.9900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 346.8560 (5)

2. Ventilation rate

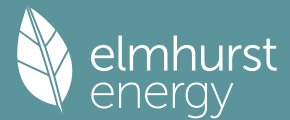
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	1 * 10 = 10.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	10.0000 / (5) = 0.0288 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.2288 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1945 (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	0.2480	0.2431	0.2383	0.2140	0.2091	0.1848	0.1848	0.1799	0.1945	0.2091	0.2188	0.2285 (22b)
Mechanical extract ventilation - decentralised												
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)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Type 3 Front Door			2.3700	1.4000	3.3180		(26a)
Type 6 Rear Door			2.0000	1.4000	2.8000		(26a)
French door (Uw = 1.30)			10.9900	1.2357	13.5808		(27)
Window (Uw = 1.30)			15.8400	1.2357	19.5741		(27)
225mm TE Platinum GF B&B			73.8400	0.1100	8.1224	135.0000	9968.4000 (28a)
100mm Ecobead	171.5600	31.2000	140.3600	0.2300	32.2828	60.0000	8421.5999 (29a)
500mm MW @ 0.044	69.1500		69.1500	0.0900	6.2235	10.0000	691.5000 (30)
Lightpod Roof	4.1500		4.1500	0.1700	0.7055	9.0000	37.3500 (30)
Hexagonal Bay	0.5300		0.5300	0.1700	0.0901	9.0000	4.7700 (30)
Total net area of external elements Aum(A, m ²)			319.2300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	86.6972		(33)
GF Solid			75.5000			75.0000	5662.5000 (32c)
GF Timber			42.9100			7.7000	330.4070 (32c)
FF Timber			147.1100			7.7000	1132.7470 (32c)
FF Floor			69.1500			18.0000	1244.7000 (32d)

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GF Ceiling	69.1500	9.0000	622.3500 (32e)
Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =		
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	28116.3238 (34)		
List of Thermal Bridges	196.6314 (35)		
K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	5.5600	0.0260	0.1446
E3 Sill	11.4800	0.0310	0.3559
E4 Jamb	49.9500	0.0360	1.7982
E5 Ground floor (normal)	36.8100	0.0590	2.1718
E6 Intermediate floor within a dwelling	34.0100	0.0060	0.2041
E2 Other lintels (including other steel lintels)	5.8200	0.0400	0.2328
E4 Jamb	4.6500	0.0470	0.2186
E4 Jamb	4.2000	0.0670	0.2814
E4 Jamb	3.0000	0.0830	0.2490
E10 Eaves (insulation at ceiling level)	12.1000	0.1030	1.2463
E10 Eaves (insulation at ceiling level)	18.1300	0.0740	1.3416
E24 Eaves (insulation at ceiling level - inverted)	5.1100	0.1500	0.7665
E12 Gable (insulation at ceiling level)	3.7800	0.0570	0.2155
E14 Flat roof	7.9000	0.1600	1.2640
E16 Corner (normal)	24.3500	0.0520	1.2662
E17 Corner (inverted - internal area greater than external area)	4.8700	-0.0940	-0.4578
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.2985 (36)		
Point Thermal bridges	(36a) = 0.0000		
Total fabric heat loss	(33) + (36) + (36a) = 97.9958 (37)		
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)			
(38)m	Jan	Feb	Mar
Heat transfer coeff	57.2312	57.2312	57.2312
Average = Sum(39)m / 12 =	155.2270	155.2270	155.2270
HLP	Jan	Feb	Mar
HLP (average)	1.0856	1.0856	1.0856
Days in mont	31	28	31

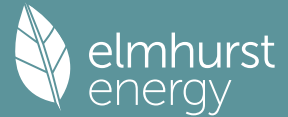
4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9226 (42)											
Hot water usage for mixer showers	73.2218	72.1214	70.5179	67.4500	65.1859	62.6610	61.2259	62.8172	64.5616	67.2726	70.4064	72.9412 (42a)
Hot water usage for baths	31.6110	31.1415	30.4804	29.2614	28.3487	27.3366	26.7899	27.4464	28.1612	29.2442	30.4882	31.5041 (42b)
Hot water usage for other uses	44.5601	42.9397	41.3193	39.6990	38.0786	36.4582	36.4582	38.0786	39.6990	41.3193	42.9397	44.5601 (42c)
Average daily hot water use (litres/day)	137.3255 (43)											
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	149.3928	146.2026	142.3176	136.4104	131.6132	126.4558	124.4740	128.3422	132.4218	137.8361	143.8343	149.0054 (44)
Energy content (annual)	236.6017	208.1905	218.7369	186.7390	177.1766	155.4922	150.5406	158.9145	163.2893	187.0422	204.9184	233.3064 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m = 2280.9483											
Water storage loss:	35.4903	31.2286	32.8105	28.0108	26.5765	23.3238	22.5811	23.8372	24.4934	28.0563	30.7378	34.9960 (46)
Store volume	180.0000 (47)											
a) If manufacturer declared loss factor is known (kWh/day):	1.3400 (48)											
Temperature factor from Table 2b	0.5400 (49)											
Enter (49) or (54) in (55)	0.7236 (55)											
Total storage loss	22.4316	20.2608	22.4316	21.7080	22.4316	21.7080	22.4316	22.4316	21.7080	22.4316	21.7080	22.4316 (56)
If cylinder contains dedicated solar storage	22.4316	20.2608	22.4316	21.7080	22.4316	21.7080	22.4316	22.4316	21.7080	22.4316	21.7080	22.4316 (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	282.2957	249.4625	264.4309	230.9590	222.8706	199.7122	196.2346	204.6085	207.5093	232.7362	249.1384	279.0004 (62)
WWHRS	-32.6012	-28.8328	-30.1920	-25.0002	-23.2993	-19.9374	-18.6881	-19.8729	-20.6280	-24.3181	-27.5495	-31.9975 (63a)
PV diverter	-10.8404	-26.4236	-62.9062	-110.2098	-159.2976	-165.4543	-161.3395	-127.9888	-82.6844	-40.7085	-15.1679	-8.2151 (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	238.8541	194.2061	171.3327	95.7490	40.2737	14.3205	16.2069	56.7467	104.1969	167.7096	206.4211	238.7879 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m = 1544.8053 (64)											
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	115.2253	102.2410	109.2852	97.4667	95.4664	87.0772	86.6099	89.3943	89.6697	98.7467	103.5114	114.1296 (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	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	160.1305	177.2873	160.1305	165.4681	160.1305	165.4681	160.1305	160.1305	165.4681	160.1305	165.4681	160.1305 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	312.7867	316.0325	307.8533	290.4408	268.4606	247.8024	234.0014	230.7556	238.9348	256.3473	278.3275	298.9857 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029 (71)
Water heating gains (Table 5)	154.8727	152.1443	146.8887	135.3704	128.3151	120.9405	116.4112	120.1536	124.5412	132.7241	143.7658	153.4000 (72)
Total internal gains	697.6284	715.3026	684.7111	661.1179	626.7448	601.0496	577.3816	577.8783	595.7828	619.0405	657.4000	682.3548 (73)

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6. Solar gains

[Jan]				Area m2	Solar flux Table 6a		g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W			
					W/m2										
Northeast				1.9600	11.2829	0.7300	0.7000	0.7700	7.8313 (75)						
Southwest				1.9600	36.7938	0.7300	0.7000	0.7700	25.5379 (79)						
Northwest				7.0700	11.2829	0.7300	0.7000	0.7700	28.2485 (81)						
Northeast				1.3200	11.2829	0.7300	0.7000	0.7700	5.2741 (75)						
East				0.8400	19.6403	0.7300	0.7000	0.7700	5.8423 (76)						
Southeast				6.6800	36.7938	0.7300	0.7000	0.7700	87.0373 (77)						
South				0.8400	46.7521	0.7300	0.7000	0.7700	13.9070 (78)						
Southwest				0.6600	36.7938	0.7300	0.7000	0.7700	8.5995 (79)						
Northwest				5.5000	11.2829	0.7300	0.7000	0.7700	21.9755 (81)						
Solar gains				204.2535	369.5192	562.5000	791.5899	972.4654	1003.0348	951.3953	810.8027	640.9946	423.7862	248.5934	172.2397 (83)
Total gains				901.8819	1084.8218	1247.2110	1452.7078	1599.2102	1604.0844	1528.7770	1388.6809	1236.7773	1042.8267	905.9934	854.5944 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	50.3140	50.3140	50.3140	50.3140	50.3140	50.3140	50.3140	50.3140	50.3140	50.3140	50.3140	50.3140
alpha	4.3543	4.3543	4.3543	4.3543	4.3543	4.3543	4.3543	4.3543	4.3543	4.3543	4.3543	4.3543
util living area	0.9934	0.9849	0.9644	0.9009	0.7694	0.5876	0.4393	0.5000	0.7505	0.9416	0.9866	0.9948 (86)
MIT	19.4482	19.6912	20.0413	20.4791	20.8050	20.9535	20.9895	20.9820	20.8693	20.4214	19.8439	19.3921 (87)
Th 2	20.0126	20.0126	20.0126	20.0126	20.0126	20.0126	20.0126	20.0126	20.0126	20.0126	20.0126	20.0126 (88)
util rest of house	0.9917	0.9810	0.9551	0.8758	0.7172	0.5084	0.3443	0.3991	0.6766	0.9211	0.9825	0.9934 (89)
MIT 2	18.1994	18.5081	18.9487	19.4812	19.8444	19.9836	20.0086	20.0050	19.9176	19.4251	18.7046	18.1279 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.3841	18.6830	19.1102	19.6287	19.9864	20.1270	20.1536	20.1494	20.0583	19.5724	18.8731	18.3148 (92)
Temperature adjustment												
adjusted MIT	18.2341	18.5330	18.9602	19.4787	19.8364	19.9770	20.0036	19.9994	19.9083	19.4224	18.7231	18.1648 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9870	0.9727	0.9419	0.8594	0.7069	0.5054	0.3434	0.3977	0.6679	0.9051	0.9746	0.9894 (94)
Useful gains	890.1137	1055.1792	1174.7315	1248.4797	1130.5520	810.6441	524.9360	552.3426	825.9873	943.8909	882.9479	845.5398 (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	2162.9413	2116.2123	1934.1650	1642.1026	1262.9909	834.6545	528.3323	558.7297	901.6014	1369.4714	1804.2149	2167.7113 (97)
Space heating kWh	946.9837	713.0143	565.0185	283.4085	98.5345	0.0000	0.0000	0.0000	0.0000	316.6319	663.3122	983.6956 (98a)
Space heating requirement - total per year (kWh/year)												4570.5993
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	946.9837	713.0143	565.0185	283.4085	98.5345	0.0000	0.0000	0.0000	0.0000	316.6319	663.3122	983.6956 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4570.5993
Space heating per m2												(98c) / (4) = 31.9645 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												88.9000 (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	946.9837	713.0143	565.0185	283.4085	98.5345	0.0000	0.0000	0.0000	0.0000	316.6319	663.3122	983.6956 (98)
Space heating efficiency (main heating system 1)	88.9000	88.9000	88.9000	88.9000	88.9000	0.0000	0.0000	0.0000	0.0000	88.9000	88.9000	88.9000 (210)
Space heating fuel (main heating system)	1065.2236	802.0408	635.5664	318.7947	110.8375	0.0000	0.0000	0.0000	0.0000	356.1664	746.1330	1106.5193 (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	238.8541	194.2061	171.3327	95.7490	40.2737	14.3205	16.2069	56.7467	104.1969	167.7096	206.4211	238.7879 (64)
Efficiency of water heater (217)m	86.9278	86.8069	86.6295	86.4412	86.0866	79.9000	79.9000	79.9000	79.9000	85.5628	86.5852	79.9000 (216)
Fuel for water heating, kWh/month	274.7731	223.7221	197.7764	110.7678	46.7828	17.9231	20.2840	71.0222	130.4092	196.0077	238.4022	274.5126 (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	12.8485	11.6051	12.8485	12.4340	12.8485	12.4340	12.8485	12.8485	12.4340	12.8485	12.4340	12.8485 (231)
Lighting	32.0141	25.6829	23.1246	16.9421	13.0865	10.6918	11.9380	15.5174	20.1556	26.4453	29.8699	32.9039 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-35.6211	-55.8401	-89.6594	-109.4775	-122.9481	-116.2132	-114.1768	-104.9457	-88.5321	-67.2093	-40.6590	-29.8853 (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)												

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(233b)m	-3.0112	-7.3399	-17.4739	-30.6138	-44.2493	-45.9595	-44.8165	-35.5525	-22.9679	-11.3079	-4.2133	-2.2820	(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												5141.2815	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.9000	
Water heating fuel used												1802.3831	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.9420, total flow = 45.0000, SFP = 0.1543)													
mechanical ventilation fans (SFP = 0.1543)												65.2801	(230a)
central heating pump												41.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												151.2801	(231)
Electricity for lighting (calculated in Appendix L)												258.3722	(232)

Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1244.9556	(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												-311.7400	(236)
Energy used												77.0400	(237)
Total delivered energy for all uses												5873.6614	(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	5141.2815	0.2100	1079.6691	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1802.3831	0.2100	378.5005	(264)
Space and water heating			1458.1696	(265)
Pumps, fans and electric keep-hot	151.2801	0.1387	20.9844	(267)
Energy for lighting	258.3722	0.1443	37.2911	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-975.1678	0.1330	-129.6683	
PV Unit electricity exported	-269.7878	0.1223	-32.9846	
Total			-162.6529	(269)
Appendix Q item 'PV Diverter - Part 1' - energy saved	-311.7400	0.2100	-65.4654	(270)
Appendix Q item 'PV Diverter - Part 1' - energy used	77.0400	0.1360	10.4774	(271)
Appendix Q item 'PV Diverter - Part 2' - energy saved	-0.0000	0.0000	-0.0000	(270)
Appendix Q item 'PV Diverter - Part 2' - energy used	15.8700	0.0000	15.8700	(271)
Total CO2, kg/year			1314.6742	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			9.1900	(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	5141.2815	1.1300	5809.6481	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1802.3831	1.1300	2036.6929	(278)
Space and water heating			7846.3410	(279)
Pumps, fans and electric keep-hot	151.2801	1.5128	228.8566	(281)
Energy for lighting	258.3722	1.5338	396.2999	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-975.1678	1.4914	-1454.3182	
PV Unit electricity exported	-269.7878	0.4486	-121.0285	
Total			-1575.3467	(283)
Appendix Q item 'PV Diverter - Part 1' - energy saved	-311.7400	1.1300	-352.2662	(284)
Appendix Q item 'PV Diverter - Part 1' - energy used	77.0400	1.5010	115.6370	(285)
Total Primary energy kWh/year			6659.5217	(286)
Dwelling Primary energy Rate (DPER)			46.5700	(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	73.8400 (1b)	x 2.3000 (2b)	= 169.8320 (1b) - (3b)	
First floor	69.1500 (1c)	x 2.5600 (2c)	= 177.0240 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n)	142.9900		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)... (3n)	= 346.8560 (5)	

2. Ventilation rate

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		m3 per hour	
Number of open chimneys		0 * 80 =	0.0000 (6a)
Number of open flues		0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000 (6d)
Number of flues attached to other heater		0 * 35 =	0.0000 (6e)
Number of blocked chimneys		0 * 20 =	0.0000 (6f)
Number of intermittent extract fans		4 * 10 =	40.0000 (7a)
Number of passive vents		0 * 10 =	0.0000 (7b)
Number of flueless gas fires		0 * 40 =	0.0000 (7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1153 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			5.0000 (17)
Infiltration rate			0.3653 (18)
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3105 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750
Effective ac	0.3959	0.3882	0.3804	0.3416	0.3338	0.2950	0.2950	0.2872	0.3105	0.3338	0.3493	0.3649
	0.5784	0.5753	0.5723	0.5583	0.5557	0.5435	0.5435	0.5413	0.5482	0.5557	0.5610	0.5666

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Semi-glazed door			4.3700	1.0000	4.3700		(26a)
TER Opening Type (Uw = 1.20)			26.8300	1.1450	30.7214		(27)
225mm TE Platinum GF B&B			73.8400	0.1300	9.5992		(28a)
100mm Ecobead	171.5600	31.2000	140.3600	0.1800	25.2648		(29a)
500mm MW @ 0.044	69.1500		69.1500	0.1100	7.6065		(30)
Lightpod Roof	4.1500		4.1500	0.1100	0.4565		(30)
Hexagonal Bay	0.5300		0.5300	0.1100	0.0583		(30)
Total net area of external elements Aum(A, m2)			319.2300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 78.0767		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 196.6314 (35)

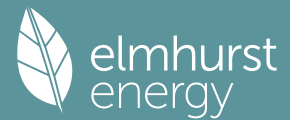
List of Thermal Bridges	Length	Psi-value	Total
K1 Element	5.5600	0.0500	0.2780
E2 Other lintels (including other steel lintels)	11.4800	0.0500	0.5740
E3 Sill	49.9500	0.0500	2.4975
E4 Jamb	36.8100	0.1600	5.8896
E5 Ground floor (normal)	34.0100	0.0000	0.0000
E6 Intermediate floor within a dwelling	5.8200	0.0500	0.2910
E2 Other lintels (including other steel lintels)	4.6500	0.0500	0.2325
E4 Jamb	4.2000	0.0500	0.2100
E4 Jamb	3.0000	0.0500	0.1500
E10 Eaves (insulation at ceiling level)	12.1000	0.0600	0.7260
E10 Eaves (insulation at ceiling level)	18.1300	0.0600	1.0878
E24 Eaves (insulation at ceiling level - inverted)	5.1100	0.2400	1.2264
E12 Gable (insulation at ceiling level)	3.7800	0.0600	0.2268
E14 Flat roof	7.9000	0.0800	0.6320
E16 Corner (normal)	24.3500	0.0900	2.1915
E17 Corner (inverted - internal area greater than external area)	4.8700	-0.0900	-0.4383
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			15.7748 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 93.8515 (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	66.2023	65.8539	65.5125	63.9086	63.6086	62.2117	62.2117	61.9530	62.7497	63.6086	64.2156	64.8502
Heat transfer coeff	160.0537	159.7054	159.3639	157.7601	157.4600	156.0632	156.0632	155.8045	156.6012	157.4600	158.0671	158.7017
Average = Sum(39)m / 12 =												157.7587
HLP	1.1193	1.1169	1.1145	1.1033	1.1012	1.0914	1.0914	1.0896	1.0952	1.1012	1.1054	1.1099
HLP (average)												1.1033
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9226 (42)
Hot water usage for mixer showers													
73.2218	72.1214	70.5179	67.4500	65.1859	62.6610	61.2259	62.8172	64.5616	67.2726	70.4064	72.9412	72.9412	(42a)
Hot water usage for baths													
31.6110	31.1415	30.4804	29.2614	28.3487	27.3366	26.7899	27.4464	28.1612	29.2442	30.4882	31.5041	31.5041	(42b)
Hot water usage for other uses													
44.5601	42.9397	41.3193	39.6990	38.0786	36.4582	36.4582	38.0786	39.6990	41.3193	42.9397	44.5601	44.5601	(42c)
Average daily hot water use (litres/day)													137.3255 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
149.3928	146.2026	142.3176	136.4104	131.6132	126.4558	124.4740	128.3422	132.4218	137.8361	143.8343	149.0054	149.0054	(44)
Energy conte	236.6017	208.1905	218.7369	186.7390	177.1766	155.4922	150.5406	158.9145	163.2893	187.0422	204.9184	233.3064	(45)
Energy content (annual)													Total = Sum(45)m = 2280.9483
Distribution loss (46)m = 0.15 x (45)m													
35.4903	31.2286	32.8105	28.0108	26.5765	23.3238	22.5811	23.8372	24.4934	28.0563	30.7378	34.9960	34.9960	(46)
Water storage loss:													
Store volume													180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.5520 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.8381 (55)

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Total storage loss	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (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	285.8444	252.6678	267.9796	234.3932	226.4193	203.1464	199.7832	208.1571	210.9435	236.2849	252.5726	282.5491 (62)
WWHRS	-33.4739	-29.6046	-31.0003	-25.6694	-23.9230	-20.4711	-19.1884	-20.4049	-21.1802	-24.9691	-28.2869	-32.8540 (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	252.3704	223.0632	236.9793	208.7237	202.4963	182.6753	180.5949	187.7522	189.7633	211.3158	224.2856	249.6951 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											2549.7153 (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	118.0642	104.8052	112.1242	100.2141	98.3054	89.8245	89.4489	92.2332	92.4170	101.5857	106.2587	116.9685 (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	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	160.1305	177.2873	160.1305	165.4681	160.1305	165.4681	160.1305	160.1305	165.4681	160.1305	165.4681	160.1305 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	312.7867	316.0325	307.8533	290.4408	268.4606	247.8024	234.0014	230.7556	238.9348	256.3473	278.3275	298.9857 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129 (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)	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029 (71)
Water heating gains (Table 5)	158.6884	155.9601	150.7045	139.1862	132.1309	124.7563	120.2270	123.9694	128.3570	136.5399	147.5816	157.2158 (72)
Total internal gains	701.4442	719.1184	688.5268	664.9337	630.5605	604.8654	581.1974	581.6940	599.5986	622.8563	661.2158	686.1705 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W				
Northeast					3.2800	11.2829	0.6300	0.7000			0.7700	11.3101 (75)				
East					0.8400	19.6403	0.6300	0.7000			0.7700	5.0419 (76)				
Southeast					6.6800	36.7938	0.6300	0.7000			0.7700	75.1144 (77)				
South					0.8400	46.7521	0.6300	0.7000			0.7700	12.0020 (78)				
Southwest					2.6200	36.7938	0.6300	0.7000			0.7700	29.4610 (79)				
Northwest					12.5700	11.2829	0.6300	0.7000			0.7700	43.3440 (81)				
Solar gains					176.2735	318.9001	485.4452	683.1529	839.2510	865.6328	821.0672	699.7338	553.1871	365.7333	214.5395	148.6452 (83)
Total gains					877.7177	1038.0185	1173.9720	1348.0866	1469.8115	1470.4982	1402.2646	1281.4278	1152.7856	988.5895	875.7553	834.8157 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	48.7967	48.9031	49.0079	49.5061	49.6005	50.0444	50.0444	50.1275	49.8725	49.6005	49.4100	49.2124
alpha	4.2531	4.2602	4.2672	4.3004	4.3067	4.3363	4.3363	4.3418	4.3248	4.3067	4.2940	4.2808
util living area	0.9941	0.9874	0.9719	0.9218	0.8101	0.6326	0.4781	0.5386	0.7850	0.9516	0.9883	0.9952 (86)
MIT	19.3653	19.5952	19.9367	20.3929	20.7504	20.9373	20.9852	20.9758	20.8397	20.3647	19.7872	19.3300 (87)
Th 2	19.9851	19.9871	19.9890	19.9981	19.9999	20.0078	20.0078	20.0093	20.0048	19.9999	19.9964	19.9928 (88)
util rest of house	0.9925	0.9841	0.9642	0.9003	0.7611	0.5507	0.3757	0.4319	0.7136	0.9338	0.9847	0.9940 (89)
MIT 2	18.0751	18.3690	18.8019	19.3701	19.7796	19.9678	20.0020	19.9988	19.8852	19.3484	18.6218	18.0353 (90)
Living area fraction	18.2658	18.5503	18.9697	19.5213	19.9231	20.1112	20.1474	20.1433	20.0263	19.4986	18.7941	18.2267 (91)
Temperature adjustment	18.2658	18.5503	18.9697	19.5213	19.9231	20.1112	20.1474	20.1433	20.0263	19.4986	18.7941	18.2267 (92)
adjusted MIT	18.2658	18.5503	18.9697	19.5213	19.9231	20.1112	20.1474	20.1433	20.0263	19.4986	18.7941	18.2267 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	867.6409	1014.5012	1119.7420	1196.9489	1112.4407	823.0854	547.6184	572.6409	824.6430	911.6955	856.7501	826.9361 (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	2235.2862	2180.0236	1987.2209	1675.6196	1294.8165	860.0891	553.6155	583.2173	928.0706	1401.1785	1848.4534	2226.0630 (97)
Space heating kWh	1017.5281	783.2310	645.4043	344.6429	135.6876	0.0000	0.0000	0.0000	0.0000	364.1754	714.0263	1040.9504 (98a)
Space heating requirement - total per year (kWh/year)												5045.6461
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	1017.5281	783.2310	645.4043	344.6429	135.6876	0.0000	0.0000	0.0000	0.0000	364.1754	714.0263	1040.9504 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5045.6461
Space heating per m2												(98c) / (4) = 35.2867 (99)

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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	1017.5281	783.2310	645.4043	344.6429	135.6876	0.0000	0.0000	0.0000	0.0000	364.1754	714.0263	1040.9504 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	1102.4140	848.5710	699.2463	373.3943	147.0072	0.0000	0.0000	0.0000	0.0000	394.5562	773.5930	1127.7903 (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	252.3704	223.0632	236.9793	208.7237	202.4963	182.6753	180.5949	187.7522	189.7633	211.3158	224.2856	249.6951 (64)
Efficiency of water heater (217)m	86.8533	86.6341	86.1894	85.1766	83.1826	79.8000	79.8000	79.8000	79.8000	85.2688	86.4689	79.8000 (216)
Fuel for water heating, kWh/month	290.5709	257.4772	274.9519	245.0483	243.4359	228.9165	226.3093	235.2785	237.7986	247.8232	259.3829	287.3235 (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	33.2719	26.6920	24.0332	17.6077	13.6007	11.1119	12.4070	16.1271	20.9475	27.4843	31.0435	34.1967 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-64.1472	-88.0225	-123.1533	-134.5990	-141.8687	-131.1423	-129.3717	-123.6138	-113.1373	-98.6438	-69.5964	-55.7334 (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	-43.9691	-91.4858	-180.0626	-267.9789	-352.0725	-353.0511	-349.0293	-296.6673	-218.8905	-130.1624	-58.4685	-34.8594 (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												5466.5722 (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												3034.3167 (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)												268.5237 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-3649.7268 (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												5205.6858 (238)

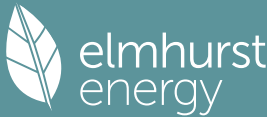
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5466.5722	0.2100	1147.9802 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3034.3167	0.2100	637.2065 (264)
Space and water heating			1785.1867 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	268.5237	0.1443	38.7563 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1273.0294	0.1352	-172.1104
PV Unit electricity exported	-2376.6974	0.1262	-299.8423
Total			-471.9527 (269)
Total CO2, kg/year			1363.9195 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.5400 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	5466.5722	1.1300	6177.2265 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3034.3167	1.1300	3428.7779 (278)
Space and water heating			9606.0045 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	268.5237	1.5338	411.8706 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1273.0294	1.4997	-1909.1635
PV Unit electricity exported	-2376.6974	0.4631	-1100.6542
Total			-3009.8177 (283)

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Total Primary energy kWh/year
Target Primary Energy Rate (TPER)

7138.1581 (286)
49.9200 (287)

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Property Reference	Type 50 B50FX0HE			Issued on Date	07/06/2024
Assessment Reference	Type 50 EOT H Final Issue B&B	Prop Type Ref	DS00 EOT Hipped		
Property	Type 50 B50FX0HE , EOT Hipped, Affordable Range, Part L2021 Masonry				
SAP Rating	89 B	DER	12.25	TER	13.14
Environmental	91 B	% DER < TER			6.77
CO ₂ Emissions (t/year)	0.78	DFEE	38.80	TFEE	38.89
Compliance Check	See BREL	% DFEE < TFEE			0.23
% DPER < TPER	5.32	DPER	65.21	TPER	68.87
Assessor Details	Ms. Ruth Ferguson			Assessor ID	AE69-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	34.1600 (1b)	x 2.3100 (2b)	= 78.9096 (1b) - (3b)
First floor	34.1600 (1c)	x 2.5600 (2c)	= 87.4496 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 166.3592 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.2000 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1700 (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	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998 (22b)
Mechanical extract ventilation - decentralised												
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)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (Uw = 1.30)			11.2100	1.2357	13.8527		(27)
Opening Type 2			2.1400	1.2000	2.5680		(26)
Opening Type 5			2.1400	1.4000	2.9960		(26a)
225mm TE Platinum GF B&B			34.1600	0.1000	3.4160	135.0000	4611.6000 (28a)
100mm Ecobead	80.5500	15.4900	65.0600	0.2400	15.6144	60.0000	3903.6002 (29a)
500mm mineral wool @ 0.04	34.1600		34.1600	0.0800	2.7328	10.0000	341.6000 (30)
Total net area of external elements Aum(A, m ²)			148.8700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.1799		(33)
E-WM-20/22			39.5900	0.0000	0.0000	110.0000	4354.9000 (32)
Timber Partitions			122.1400			7.0000	854.9800 (32c)
Internal Floor 1			34.1600			18.0000	614.8800 (32d)
Internal Ceiling 1			34.1600			18.0000	614.8800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15296.4402 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							223.8940 (35)

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List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	6.3300	0.0260	0.1646
E2 Other lintels (including other steel lintels)	4.2900	0.0400	0.1716
E3 Sill	8.5800	0.0310	0.2660
E4 Jamb	23.4000	0.0360	0.8424
E5 Ground floor (normal)	16.5400	0.0590	0.9759
E6 Intermediate floor within a dwelling	16.5400	0.0060	0.0992
E10 Eaves (insulation at ceiling level)	8.4100	0.1160	0.9756
E10 Eaves (insulation at ceiling level)	8.1300	0.0960	0.7805
E16 Corner (normal)	9.7400	0.0520	0.5065
E18 Party wall between dwellings	9.7400	0.0530	0.5162
P1 Party wall - Ground floor	8.1300	0.0890	0.7236
P2 Party wall - Intermediate floor within a dwelling	8.1300	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.1300	0.0770	0.6260
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			6.6480 (36)
Point Thermal bridges			0.0000 (36a) =
Total fabric heat loss		(33) + (36) + (36a) =	47.8278 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	27.4493	27.4493	27.4493	27.4493	27.4493	27.4493	27.4493	27.4493	27.4493	27.4493	27.4493	27.4493	(38)
Average = Sum(39)m / 12 =	75.2771	75.2771	75.2771	75.2771	75.2771	75.2771	75.2771	75.2771	75.2771	75.2771	75.2771	75.2771	(39)
													(39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1018	1.1018	1.1018	1.1018	1.1018	1.1018	1.1018	1.1018	1.1018	1.1018	1.1018	1.1018	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.2047 (42)
Hot water usage for mixer showers													
	61.1845	60.2650	58.9251	56.3615	54.4697	52.3599	51.1607	52.4904	53.9480	56.2133	58.8320	60.9501	(42a)
Hot water usage for baths													
	26.4346	26.0420	25.4891	24.4698	23.7065	22.8601	22.4030	22.9519	23.5497	24.4553	25.4957	26.3452	(42b)
Hot water usage for other uses													
	37.2079	35.8549	34.5019	33.1488	31.7958	30.4428	30.4428	31.7958	33.1488	34.5019	35.8549	37.2079	(42c)
Average daily hot water use (litres/day)													114.7444 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	124.8269	122.1618	118.9161	113.9801	109.9720	105.6628	104.0064	107.2382	110.6465	115.1705	120.1825	124.5031	(44)
Energy conte	197.6953	173.9568	182.7696	156.0331	148.0434	129.9248	125.7868	132.7832	136.4383	156.2852	171.2220	194.9418	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m													
	29.6543	26.0935	27.4154	23.4050	22.2065	19.4887	18.8680	19.9175	20.4657	23.4428	25.6833	29.2413	(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	5.4549	4.9178	5.4250	5.2084	5.3556	5.1561	5.3111	5.3251	5.1692	5.3721	5.2387	5.4494	(61)
Total heat required for water heating calculated for each month													
	203.1502	178.8746	188.1947	161.2415	153.3990	135.0809	131.0979	138.1083	141.6074	161.6573	176.4607	200.3912	(62)
WWHRS	-54.4835	-48.1856	-50.4572	-41.7806	-38.9380	-33.3195	-31.2317	-33.2118	-34.4737	-40.6406	-46.0409	-53.4745	(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													
	148.6667	130.6890	137.7374	119.4609	114.4610	101.7614	99.8661	104.8965	107.1338	121.0167	130.4198	146.9167	(64)
12Total per year (kWh/year)													
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
													(64a)
Heat gains from water heating, kWh/month													
	67.0974	59.0701	62.1272	53.1831	50.5633	44.4890	43.1519	45.4817	46.6580	53.3079	58.2410	66.1805	(65)

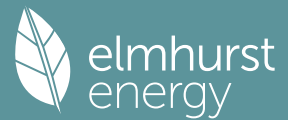
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	101.2443	112.0919	101.2443	104.6191	101.2443	104.6191	101.2443	101.2443	104.6191	101.2443	104.6191	101.2443	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	193.3447	195.3510	190.2952	179.5319	165.9452	153.1755	144.6447	142.6384	147.6942	158.4575	172.0442	184.8138	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.0233	34.0233	34.0233	34.0233	34.0233	34.0233	34.0233	34.0233	34.0233	34.0233	34.0233	34.0233	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-88.1863	-88.1863	-88.1863	-88.1863	-88.1863	-88.1863	-88.1863	-88.1863	-88.1863	-88.1863	-88.1863	-88.1863	(71)
Water heating gains (Table 5)													
	90.1847	87.9019	83.5042	73.8654	67.9615	61.7903	57.9998	61.1313	64.8028	71.6504	80.8903	88.9523	(72)
Total internal gains													
	443.8436	454.4147	434.1136	417.0863	394.2208	375.6548	359.9587	361.0839	373.1860	390.4220	416.6235	434.0803	(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	1.3200	10.6334	0.7300	0.7000	0.7700	4.9705 (74)
East	4.6700	19.6403	0.7300	0.7000	0.7700	32.4802 (76)
West	5.2200	19.6403	0.7300	0.7000	0.7700	36.3055 (80)

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Solar gains	73.7561	144.0582	237.7409	349.1168	431.0072	442.8489	420.9218	359.2752	277.1366	170.9731	91.8993	60.7096 (83)
Total gains	517.5997	598.4729	671.8545	766.2031	825.2280	818.5037	780.8805	720.3591	650.3226	561.3951	508.5228	494.7899 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	56.4449	56.4449	56.4449	56.4449	56.4449	56.4449	56.4449	56.4449	56.4449	56.4449	56.4449	56.4449
alpha	4.7630	4.7630	4.7630	4.7630	4.7630	4.7630	4.7630	4.7630	4.7630	4.7630	4.7630	4.7630
util living area	0.9914	0.9821	0.9594	0.8895	0.7524	0.5682	0.4200	0.4730	0.7228	0.9319	0.9832	0.9930 (86)
MIT	19.7153	19.9222	20.2283	20.6041	20.8632	20.9712	20.9944	20.9904	20.9148	20.5516	20.0566	19.6647 (87)
Th 2	19.9993	19.9993	19.9993	19.9993	19.9993	19.9993	19.9993	19.9993	19.9993	19.9993	19.9993	19.9993 (88)
util rest of house	0.9889	0.9771	0.9480	0.8602	0.6959	0.4875	0.3266	0.3739	0.6433	0.9068	0.9776	0.9910 (89)
MIT 2	18.5149	18.7766	19.1590	19.6085	19.8875	19.9829	19.9975	19.9958	19.9423	19.5596	18.9493	18.4505 (90)
Living area fraction									fLA = Living area / (4) =			0.4319 (91)
MIT	19.0334	19.2714	19.6208	20.0385	20.3090	20.4098	20.4281	20.4254	20.3623	19.9881	19.4276	18.9750 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.8834	19.1214	19.4708	19.8885	20.1590	20.2598	20.2781	20.2754	20.2123	19.8381	19.2776	18.8250 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9851	0.9714	0.9405	0.8565	0.7055	0.5091	0.3529	0.4017	0.6614	0.9019	0.9722	0.9877 (94)
Useful gains	509.8812	581.3338	631.9023	656.2823	582.2238	416.7233	275.5918	289.3719	430.1382	506.3366	494.3709	488.6915 (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	1097.7967	1070.5473	976.4069	827.1830	636.7664	426.0526	276.8755	291.7274	460.1193	695.4151	916.6926	1100.9254 (97)
Space heating kWh	437.4091	328.7515	256.3114	123.0485	40.5797	0.0000	0.0000	0.0000	0.0000	140.6745	304.0716	455.5020 (98a)
Space heating requirement - total per year (kWh/year)												2086.3484
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	437.4091	328.7515	256.3114	123.0485	40.5797	0.0000	0.0000	0.0000	0.0000	140.6745	304.0716	455.5020 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2086.3484
Space heating per m2										(98c) / (4) =		30.5379 (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 %)												89.0000 (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	437.4091	328.7515	256.3114	123.0485	40.5797	0.0000	0.0000	0.0000	0.0000	140.6745	304.0716	455.5020 (98)
Space heating efficiency (main heating system 1)	89.0000	89.0000	89.0000	89.0000	89.0000	0.0000	0.0000	0.0000	0.0000	89.0000	89.0000	89.0000 (210)
Space heating fuel (main heating system)	491.4709	369.3837	287.9904	138.2567	45.5952	0.0000	0.0000	0.0000	0.0000	158.0612	341.6535	511.8000 (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	148.6667	130.6890	137.7374	119.4609	114.4610	101.7614	99.8661	104.8965	107.1338	121.0167	130.4198	146.9167 (64)
Efficiency of water heater (217)m	88.5625	88.5097	88.3983	88.1544	87.7386	87.3000	87.3000	87.3000	87.3000	88.2057	88.4828	87.3000 (216)
Fuel for water heating, kWh/month	167.8664	147.6549	155.8146	135.5133	130.4568	116.5652	114.3942	120.1564	122.7191	137.1983	147.3957	165.8589 (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	10.3896	9.3842	10.3896	10.0545	10.3896	10.0545	10.3896	10.3896	10.0545	10.3896	10.0545	10.3896 (231)
Lighting	19.8129	15.8946	14.3114	10.4851	8.0990	6.6170	7.3882	9.6034	12.4739	16.3665	18.4859	20.3636 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-10.1823	-16.9151	-29.0362	-38.1981	-45.5450	-44.1177	-43.2893	-38.3649	-30.4323	-21.2150	-11.9179	-8.4495 (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												2344.2117 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												87.3000
Water heating fuel used												1661.5936 (219)
Space cooling fuel												0.0000 (221)

Electricity for pumps and fans:
(MEVDcentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)

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mechanical ventilation fans (SFP = 0.1790)	36.3295 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	122.3295 (231)
Electricity for lighting (calculated in Appendix L)	159.9015 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-337.6633 (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	3950.3728 (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	2344.2117	0.2100	492.2844 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1661.5936	0.2100	348.9346 (264)
Space and water heating			841.2191 (265)
Pumps, fans and electric keep-hot	122.3295	0.1387	16.9686 (267)
Energy for lighting	159.9015	0.1443	23.0787 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-337.6633	0.1317	-44.4539
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-44.4539 (269)
Total CO2, kg/year			836.8125 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			12.2500 (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	2344.2117	1.1300	2648.9592 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1661.5936	1.1300	1877.6007 (278)
Space and water heating			4526.5599 (279)
Pumps, fans and electric keep-hot	122.3295	1.5128	185.0601 (281)
Energy for lighting	159.9015	1.5338	245.2622 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-337.6633	1.4864	-501.9011
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-501.9011 (283)
Total Primary energy kWh/year			4454.9811 (286)
Dwelling Primary energy Rate (DPER)			65.2100 (287)

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

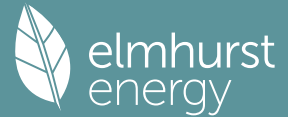
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	34.1600 (1b)	x 2.3100 (2b)	= 78.9096 (1b) - (3b)
First floor	34.1600 (1c)	x 2.5600 (2c)	= 87.4496 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	166.3592 (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	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1202 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3702 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3147 (21)

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Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
Effective ac	0.4012	0.3934	0.3855	0.3462	0.3383	0.2990	0.2990	0.2911	0.3147	0.3383	0.3540	0.3698	(22b)
	0.5805	0.5774	0.5743	0.5599	0.5572	0.5447	0.5447	0.5424	0.5495	0.5572	0.5627	0.5684	(25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1400	1.0000	2.1400		(26)
TER Semi-glazed door			2.1400	1.0000	2.1400		(26a)
TER Opening Type (Uw = 1.20)			11.2100	1.1450	12.8359		(27)
225mm TE Platinum GF B&B			34.1600	0.1300	4.4408		(28a)
100mm Ecobead	80.5500	15.4900	65.0600	0.1800	11.7108		(29a)
500mm mineral wool @ 0.04	34.1600		34.1600	0.1100	3.7576		(30)
Total net area of external elements Aum(A, m ²)			148.8700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	37.0251		(31)
E-WM-20/22			39.5900	0.0000	0.0000		(32)

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

223.8940 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	6.3300	0.0500	0.3165
E2 Other lintels (including other steel lintels)	4.2900	0.0500	0.2145
E3 Sill	8.5800	0.0500	0.4290
E4 Jamb	23.4000	0.0500	1.1700
E5 Ground floor (normal)	16.5400	0.1600	2.6464
E6 Intermediate floor within a dwelling	16.5400	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	8.4100	0.0600	0.5046
E10 Eaves (insulation at ceiling level)	8.1300	0.0600	0.4878
E16 Corner (normal)	9.7400	0.0900	0.8766
E18 Party wall between dwellings	9.7400	0.0600	0.5844
P1 Party wall - Ground floor	8.1300	0.0800	0.6504
P2 Party wall - Intermediate floor within a dwelling	8.1300	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.1300	0.1200	0.9756

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

8.8558 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 45.8809 (37)

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

(38)m	Jan 31.8682	Feb 31.6966	Mar 31.5284	Apr 30.7384	May 30.5906	Jun 29.9025	Jul 29.9025	Aug 29.7751	Sep 30.1675	Oct 30.5906	Nov 30.8896	Dec 31.2022	(38)
Heat transfer coeff	77.7490	77.5774	77.4092	76.6193	76.4714	75.7834	75.7834	75.6560	76.0484	76.4714	76.7705	77.0831	(39)
Average = Sum(39)m / 12 =												76.6185	

HLP	Jan 1.1380	Feb 1.1355	Mar 1.1330	Apr 1.1215	May 1.1193	Jun 1.1092	Jul 1.1092	Aug 1.1074	Sep 1.1131	Oct 1.1193	Nov 1.1237	Dec 1.1283	(40)
HLP (average)												1.1215	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

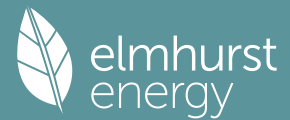
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.2047 (42)
Hot water usage for mixer showers	61.1845	60.2650	58.9251	56.3615	54.4697	52.3599	51.1607	52.4904	53.9480	56.2133	58.8320	60.9501	(42a)
Hot water usage for baths	26.4346	26.0420	25.4891	24.4698	23.7065	22.8601	22.4030	22.9519	23.5497	24.4553	25.4957	26.3452	(42b)
Hot water usage for other uses	37.2079	35.8549	34.5019	33.1488	31.7958	30.4428	30.4428	31.7958	33.1488	34.5019	35.8549	37.2079	(42c)
Average daily hot water use (litres/day)													114.7444 (43)
Daily hot water use	Jan 124.8269	Feb 122.1618	Mar 118.9161	Apr 113.9801	May 109.9720	Jun 105.6628	Jul 104.0064	Aug 107.2382	Sep 110.6465	Oct 115.1705	Nov 120.1825	Dec 124.5031	(44)
Energy conte	197.6953	173.9568	182.7696	156.0331	148.0434	129.9248	125.7868	132.7832	136.4383	156.2852	171.2220	194.9418	(45)
Energy content (annual)										Total = Sum(45)m =		1905.8804	
Distribution loss (46)m = 0.15 x (45)m	29.6543	26.0935	27.4154	23.4050	22.2065	19.4887	18.8680	19.9175	20.4657	23.4428	25.6833	29.2413	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	248.6542	219.9842	233.7285	205.3482	199.0023	179.2398	176.7457	183.7422	185.7533	207.2441	220.5371	245.9007	(62)
WWHRS	-27.9710	-24.7378	-25.9040	-21.4495	-19.9902	-17.1057	-16.0339	-17.0504	-17.6983	-20.8643	-23.6367	-27.4530	(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	220.6833	195.2465	207.8246	183.8987	179.0121	162.1341	160.7118	166.6917	168.0551	186.3799	196.9004	218.4477	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2245.9857	(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)
												0.0000	(64a)
Heat gains from water heating, kWh/month	78.4734	69.3475	73.5106	64.2098	61.9642	55.5287	54.5638	56.8902	57.6945	64.7046	69.2601	77.5579	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	Jan 110.2328	Feb 110.2328	Mar 110.2328	Apr 110.2328	May 110.2328	Jun 110.2328	Jul 110.2328	Aug 110.2328	Sep 110.2328	Oct 110.2328	Nov 110.2328	Dec 110.2328	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	101.2443	112.0919	101.2443	104.6191	101.2443	104.6191	101.2443	101.2443	104.6191	101.2443	104.6191	101.2443	(67)

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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	193.3447	195.3510	190.2952	179.5319	165.9452	153.1755	144.6447	142.6384	147.6942	158.4575	172.0442	184.8138 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.0233	34.0233	34.0233	34.0233	34.0233	34.0233	34.0233	34.0233	34.0233	34.0233	34.0233	34.0233 (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)	-88.1863	-88.1863	-88.1863	-88.1863	-88.1863	-88.1863	-88.1863	-88.1863	-88.1863	-88.1863	-88.1863	-88.1863 (71)
Water heating gains (Table 5)	103.4750	103.1957	98.8046	89.1802	83.2852	77.1233	73.3385	76.4653	80.1312	86.9685	96.1946	104.2445 (72)
Total internal gains	459.1339	469.7085	449.4140	432.4011	409.5445	390.9878	375.2973	376.4178	388.5144	405.7402	431.9278	449.3725 (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					1.3200	10.6334	0.6300	0.7000			0.7700			4.2896 (74)
East					4.6700	19.6403	0.6300	0.7000			0.7700			28.0308 (76)
West					5.2200	19.6403	0.6300	0.7000			0.7700			31.3321 (80)
Solar gains	63.6526	124.3242	205.1737	301.2926	371.9651	382.1847	363.2613	310.0594	239.1726	147.5521	79.3104	52.3932	(83)	
Total gains	522.7865	594.0327	654.5876	733.6937	781.5096	773.1725	738.5586	686.4773	627.6871	553.2923	511.2382	501.7657	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)											
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	54.6503	54.7712	54.8902	55.4562	55.5634	56.0678	56.0678	56.1623	55.8724	55.5634	55.3470	55.1225
alpha	4.6434	4.6514	4.6593	4.6971	4.7042	4.7379	4.7379	4.7442	4.7248	4.7042	4.6898	4.6748
util living area	0.9912	0.9832	0.9645	0.9056	0.7837	0.5997	0.4457	0.4968	0.7443	0.9368	0.9832	0.9927 (86)
MIT	19.6625	19.8595	20.1573	20.5482	20.8301	20.9633	20.9926	20.9880	20.9008	20.5234	20.0296	19.6312 (87)
Th 2	19.9699	19.9719	19.9739	19.9833	19.9851	19.9933	19.9933	19.9948	19.9901	19.9851	19.9815	19.9778 (88)
util rest of house	0.9887	0.9784	0.9542	0.8789	0.7288	0.5162	0.3467	0.3932	0.6651	0.9129	0.9776	0.9906 (89)
MIT 2	18.4269	18.6778	19.0527	19.5323	19.8437	19.9719	19.9908	19.9903	19.9228	19.5157	18.9025	18.3927 (90)
Living area fraction	18.9606	19.1882	19.5298	19.9711	20.2698	20.4001	20.4235	20.4212	20.3452	19.9510	19.3893	18.9277 (92)
MIT	18.9606	19.1882	19.5298	19.9711	20.2698	20.4001	20.4235	20.4212	20.3452	19.9510	19.3893	18.9277 (92)
Temperature adjustment	18.9606	19.1882	19.5298	19.9711	20.2698	20.4001	20.4235	20.4212	20.3452	19.9510	19.3893	18.9277 (93)
adjusted MIT	18.9606	19.1882	19.5298	19.9711	20.2698	20.4001	20.4235	20.4212	20.3452	19.9510	19.3893	18.9277 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9853	0.9737	0.9487	0.8785	0.7452	0.5509	0.3895	0.4379	0.6948	0.9119	0.9733	0.9876 (94)
Ext temp.	515.1076	578.4263	621.0324	644.5779	582.4186	425.9610	287.6580	300.6299	436.1246	504.5564	497.5873	495.5466 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	1139.8451	1108.4447	1008.6291	848.2615	655.3437	439.5536	289.7595	304.2298	474.9407	715.0807	943.4563	1135.2550 (97)
Space heating requirement - total per year (kWh/year)	464.8047	356.1723	288.3719	146.6522	54.2563	0.0000	0.0000	0.0000	0.0000	156.6301	321.0257	475.9431 (98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98c)
Space heating kWh	464.8047	356.1723	288.3719	146.6522	54.2563	0.0000	0.0000	0.0000	0.0000	156.6301	321.0257	475.9431 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	464.8047	356.1723	288.3719	146.6522	54.2563	0.0000	0.0000	0.0000	0.0000	156.6301	321.0257	475.9431 (98c)
Space heating per m2	(98c) / (4) = 33.1361 (99)											

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)											
Fraction of space heat from main system(s)	1.0000 (202)											
Efficiency of main space heating system 1 (in %)	92.4000 (206)											
Efficiency of main space heating system 2 (in %)	0.0000 (207)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating efficiency (main heating system 1)	464.8047	356.1723	288.3719	146.6522	54.2563	0.0000	0.0000	0.0000	0.0000	156.6301	321.0257	475.9431 (98)
Space heating fuel (main heating system)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000 (210)
Space heating efficiency (main heating system 2)	503.0354	385.4679	312.0908	158.7145	58.7189	0.0000	0.0000	0.0000	0.0000	169.5131	347.4304	515.0899 (211)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating	220.6833	195.2465	207.8246	183.8987	179.0121	162.1341	160.7118	166.6917	168.0551	186.3799	196.9004	218.4477 (64)
Efficiency of water heater (217)m	85.9370	85.6520	85.0834	83.9009	82.1484	80.3000	80.3000	80.3000	80.3000	84.0111	85.4220	80.3000 (216)
Fuel for water heating, kWh/month	256.7966	227.9533	244.2597	219.1855	217.9132	201.9104	200.1392	207.5862	209.2840	221.8515	230.5031	254.0019 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	21.0366	16.8763	15.1953	11.1327	8.5992	7.0256	7.8445	10.1966	13.2443	17.3773	19.6276	21.6212 (232)

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Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-32.1346	-45.3926	-65.3827	-73.6850	-79.6188	-74.3945	-73.4937	-69.3119	-61.9399	-52.0017	-35.3670	-27.7734	(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	-17.8824	-37.6519	-74.8916	-112.5563	-148.8892	-149.6040	-147.8251	-125.1193	-91.6634	-53.8491	-23.8786	-14.1368	(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												2450.0610	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												2691.3846	(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)												169.7772	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1688.4436	(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												3708.7792	(238)

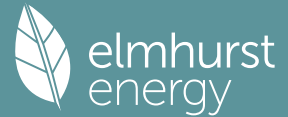
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2450.0610	0.2100	514.5128	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2691.3846	0.2100	565.1908	(264)
Space and water heating			1079.7036	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	169.7772	0.1443	24.5041	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-690.4958	0.1345	-92.8954	
PV Unit electricity exported	-997.9477	0.1259	-125.6213	
Total			-218.5167	(269)
Total CO2, kg/year			897.6203	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.1400	(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	2450.0610	1.1300	2768.5689	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2691.3846	1.1300	3041.2646	(278)
Space and water heating			5809.8335	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	169.7772	1.5338	260.4099	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-690.4958	1.4972	-1033.8195	
PV Unit electricity exported	-997.9477	0.4621	-461.1160	
Total			-1494.9355	(283)
Total Primary energy kWh/year			4705.4087	(286)
Target Primary Energy Rate (TPER)			68.8700	(287)

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Property Reference	Type 50 B50FX0HE			Issued on Date	07/06/2024
Assessment Reference	Type 50 EOT H Final Issue B&B	Prop Type Ref	DS00 EOT Hipped		
Property	Type 50 B50FX0HE , EOT Hipped, Affordable Range, Part L2021 Masonry				
SAP Rating	89 B	DER	12.25	TER	13.14
Environmental	91 B	% DER < TER			6.77
CO ₂ Emissions (t/year)	0.78	DFEE	38.80	TFEE	38.89
Compliance Check	See BREL	% DFEE < TFEE			0.23
% DPER < TPER	5.32	DPER	65.21	TPER	68.87
Assessor Details	Ms. Ruth Ferguson			Assessor ID	AE69-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	34.1600 (1b)	x 2.3100 (2b)	= 78.9096 (1b) - (3b)
First floor	34.1600 (1c)	x 2.5600 (2c)	= 87.4496 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 166.3592 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1202 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.3202 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2722 (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	0.3470	0.3402	0.3334	0.2994	0.2926	0.2586	0.2586	0.2518	0.2722	0.2926	0.3062	0.3198 (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	0.5602	0.5579	0.5556	0.5448	0.5428	0.5334	0.5334	0.5317	0.5370	0.5428	0.5469	0.5511 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (Uw = 1.30)			11.2100	1.2357	13.8527		(27)
Opening Type 2			2.1400	1.2000	2.5680		(26)
Opening Type 5			2.1400	1.4000	2.9960		(26a)
225mm TE Platinum GF B&B			34.1600	0.1000	3.4160	135.0000	4611.6000 (28a)
100mm Ecobead	80.5500	15.4900	65.0600	0.2400	15.6144	60.0000	3903.6002 (29a)
500mm mineral wool @ 0.04	34.1600		34.1600	0.0800	2.7328	10.0000	341.6000 (30)
Total net area of external elements Aum(A, m ²)			148.8700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.1799		(33)
E-WM-20/22			39.5900	0.0000	0.0000	110.0000	4354.9000 (32)
Timber Partitions			122.1400			7.0000	854.9800 (32c)
Internal Floor 1			34.1600			18.0000	614.8800 (32d)
Internal Ceiling 1			34.1600			18.0000	614.8800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15296.4402 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							223.8940 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	

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E2 Other lintels (including other steel lintels)	6.3300	0.0260	0.1646
E2 Other lintels (including other steel lintels)	4.2900	0.0400	0.1716
E3 Sill	8.5800	0.0310	0.2660
E4 Jamb	23.4000	0.0360	0.8424
E5 Ground floor (normal)	16.5400	0.0590	0.9759
E6 Intermediate floor within a dwelling	16.5400	0.0060	0.0992
E10 Eaves (insulation at ceiling level)	8.4100	0.1160	0.9756
E10 Eaves (insulation at ceiling level)	8.1300	0.0960	0.7805
E16 Corner (normal)	9.7400	0.0520	0.5065
E18 Party wall between dwellings	9.7400	0.0530	0.5162
P1 Party wall - Ground floor	8.1300	0.0890	0.7236
P2 Party wall - Intermediate floor within a dwelling	8.1300	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.1300	0.0770	0.6260
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			6.6480 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	47.8278 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	30.7552	30.6268	30.5010	29.9100	29.7994	29.2846	29.2846	29.1893	29.4829	29.7994	30.0231	30.2569	(38)
Average = Sum(39)m / 12 =	78.5830	78.4546	78.3288	77.7378	77.6272	77.1125	77.1125	77.0171	77.3107	77.6272	77.8509	78.0848	(39)
												77.7373	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1502	1.1483	1.1465	1.1378	1.1362	1.1287	1.1287	1.1273	1.1316	1.1362	1.1395	1.1429	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	
												1.1378	
												31	

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.2047 (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	26.4346	26.0420	25.4891	24.4698	23.7065	22.8601	22.4030	22.9519	23.5497	24.4553	25.4957	26.3452 (42b)
Hot water usage for other uses	37.2079	35.8549	34.5019	33.1488	31.7958	30.4428	30.4428	31.7958	33.1488	34.5019	35.8549	37.2079 (42c)
Average daily hot water use (litres/day)												58.3344 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	63.6424	61.8968	59.9910	57.6186	55.5023	53.3029	52.8458	54.7478	56.6985	58.9572	61.3505	63.5531 (44)
Energy content (annual)	100.7941	88.1403	92.2039	78.8770	74.7168	65.5422	63.9124	67.7892	69.9150	80.0043	87.4051	99.5088 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	85.6750	74.9192	78.3733	67.0454	63.5093	55.7109	54.3255	57.6208	59.4277	68.0037	74.2943	84.5824 (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	85.6750	74.9192	78.3733	67.0454	63.5093	55.7109	54.3255	57.6208	59.4277	68.0037	74.2943	84.5824 (64)
12Total per year (kWh/year)												823.4876 (64)
Electric shower(s)	48.9986	43.6581	47.6730	45.4938	46.3474	44.2110	45.6847	46.3474	45.4938	47.6730	46.7766	48.9986 (64a)
Heat gains from water heating, kWh/month	33.6684	29.6443	31.5116	28.1348	27.4642	24.9805	25.0025	25.9921	26.2304	28.9192	30.2677	33.3953 (65)
												557.3559 (64a)

5. Internal gains (see Table 5 and 5a)												
Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	110.2328	110.2328	110.2328	110.2328	110.2328	110.2328	110.2328	110.2328	110.2328	110.2328	110.2328	110.2328 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	101.2443	112.0919	101.2443	104.6191	101.2443	104.6191	101.2443	101.2443	104.6191	101.2443	104.6191	101.2443 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	193.3447	195.3510	190.2952	179.5319	165.9452	153.1755	144.6447	142.6384	147.6942	158.4575	172.0442	184.8138 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.0233	34.0233	34.0233	34.0233	34.0233	34.0233	34.0233	34.0233	34.0233	34.0233	34.0233	34.0233 (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)	-88.1863	-88.1863	-88.1863	-88.1863	-88.1863	-88.1863	-88.1863	-88.1863	-88.1863	-88.1863	-88.1863	-88.1863 (71)
Water heating gains (Table 5)	45.2532	44.1136	42.3543	39.0761	36.9142	34.6951	33.6056	34.9356	36.4311	38.8699	42.0385	44.8861 (72)
Total internal gains	395.9121	407.6264	389.9636	379.2970	360.1736	348.5596	335.5644	334.8881	344.8143	354.6415	374.7717	387.0141 (73)

6. Solar gains												
[Jan]		Area	Solar flux	g	FF	Access	Gains					
		m2	Table 6a	Specific data	Specific data	factor	W					
			W/m2	or Table 6b	or Table 6c	Table 6d						
North		1.3200	10.6334	0.7300	0.7000	0.7700	4.9705 (74)					
East		4.6700	19.6403	0.7300	0.7000	0.7700	32.4802 (76)					
West		5.2200	19.6403	0.7300	0.7000	0.7700	36.3055 (80)					
Solar gains	73.7561	144.0582	237.7409	349.1168	431.0072	442.8489	420.9218	359.2752	277.1366	170.9731	91.8993	60.7096 (83)

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Total gains 469.6682 551.6846 627.7045 728.4138 791.1808 791.4085 756.4862 694.1633 621.9508 525.6146 466.6711 447.7237 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	54.0703	54.1588	54.2458	54.6582	54.7361	55.1015	55.1015	55.1697	54.9602	54.7361	54.5788	54.4154
alpha	4.6047	4.6106	4.6164	4.6439	4.6491	4.6734	4.6734	4.6780	4.6640	4.6491	4.6386	4.6277
util living area	0.9943	0.9875	0.9700	0.9099	0.7833	0.5959	0.4426	0.4994	0.7550	0.9479	0.9884	0.9954 (86)
MIT	19.5544	19.7711	20.0982	20.5237	20.8248	20.9623	20.9923	20.9869	20.8904	20.4700	19.9360	19.5166 (87)
Th 2	19.9600	19.9615	19.9630	19.9700	19.9714	19.9775	19.9775	19.9786	19.9751	19.9714	19.9687	19.9659 (88)
util rest of house	0.9926	0.9839	0.9610	0.8839	0.7279	0.5115	0.3427	0.3938	0.6756	0.9271	0.9843	0.9941 (89)
MIT 2	18.6528	18.8686	19.1906	19.5985	19.8579	19.9605	19.9755	19.9748	19.9167	19.5595	19.0390	18.6198 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	19.0422	19.2584	19.5827	19.9981	20.2755	20.3932	20.4147	20.4120	20.3373	19.9528	19.4264	19.0072 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.0422	19.2584	19.5827	19.9981	20.2755	20.3932	20.4147	20.4120	20.3373	19.9528	19.4264	19.0072 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9906	0.9807	0.9569	0.8847	0.7454	0.5468	0.3860	0.4395	0.7057	0.9267	0.9816	0.9924 (94)
Useful gains	465.2701	541.0180	600.6692	644.4173	589.7646	432.7446	291.9737	305.0615	438.8991	487.0838	458.0624	444.3066 (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	1158.4872	1126.4847	1024.7486	862.7428	665.6928	446.7294	294.1597	308.9893	482.2082	726.0299	959.6244	1156.2143 (97)
Space heating kWh	515.7535	393.4336	315.5151	157.1943	56.4906	0.0000	0.0000	0.0000	0.0000	177.7758	361.1247	529.6593 (98a)
Space heating requirement - total per year (kWh/year)	2506.9470											
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	515.7535	393.4336	315.5151	157.1943	56.4906	0.0000	0.0000	0.0000	0.0000	177.7758	361.1247	529.6593 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	2506.9470											
Space heating per m2	(98c) / (4) = 36.6942 (99)											

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan 4.3000	Feb 4.9000	Mar 6.5000	Apr 8.9000	May 11.7000	Jun 14.6000	Jul 16.6000	Aug 16.4000	Sep 14.1000	Oct 10.6000	Nov 7.1000	Dec 4.2000
Heat loss rate W												
	0.0000	0.0000	0.0000	0.0000	0.0000	724.8571	570.6322	585.3302	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8947	0.9420	0.9173	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	648.5533	537.5509	536.9193	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	884.3151	845.5773	774.7284	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000										
			0.0000	0.0000	0.0000	169.7485	229.1716	176.9299	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	42.4371	57.2929	44.2325	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												143.9625 (107)
Energy for space heating												36.6942 (99)
Energy for space cooling												2.1072 (108)
Total												38.8014 (109)
Fabric Energy Efficiency (DFEE)												38.8 (109)

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

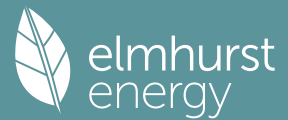
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	34.1600 (1b)	x 2.3100 (2b)	= 78.9096 (1b) - (3b)
First floor	34.1600 (1c)	x 2.5600 (2c)	= 87.4496 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 166.3592 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)

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Number of intermittent extract fans	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		20.0000 / (5) = 0.1202 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3702	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3147 (21)
Wind speed	Jan 5.1000 Feb 5.0000 Mar 4.9000 Apr 4.4000 May 4.3000 Jun 3.8000 Jul 3.8000 Aug 3.7000 Sep 4.0000 Oct 4.3000 Nov 4.5000 Dec 4.7000	(22)
Wind factor	Jan 1.2750 Feb 1.2500 Mar 1.2250 Apr 1.1000 May 1.0750 Jun 0.9500 Jul 0.9500 Aug 0.9250 Sep 1.0000 Oct 1.0750 Nov 1.1250 Dec 1.1750	(22a)
Adj infilt rate	0.4012 0.3934 0.3855 0.3462 0.3383 0.2990 0.2990 0.2911 0.3147 0.3383 0.3540 0.3698	(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	0.5805 0.5774 0.5743 0.5599 0.5572 0.5447 0.5447 0.5424 0.5495 0.5572 0.5627 0.5684	(25)

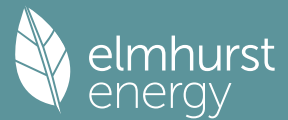
3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			2.1400	1.0000	2.1400		(26)
TER Semi-glazed door			2.1400	1.0000	2.1400		(26a)
TER Opening Type (Uw = 1.20)			11.2100	1.1450	12.8359		(27)
225mm TE Platinum GF B&B			34.1600	0.1300	4.4408		(28a)
100mm Ecobead	80.5500	15.4900	65.0600	0.1800	11.7108		(29a)
500mm mineral wool @ 0.04	34.1600		34.1600	0.1100	3.7576		(30)
Total net area of external elements Aum(A, m2)			148.8700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	37.0251		(33)
E-WM-20/22			39.5900	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							223.8940 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				6.3300	0.0500	0.3165	
E2 Other lintels (including other steel lintels)				4.2900	0.0500	0.2145	
E3 Sill				8.5800	0.0500	0.4290	
E4 Jamb				23.4000	0.0500	1.1700	
E5 Ground floor (normal)				16.5400	0.1600	2.6464	
E6 Intermediate floor within a dwelling				16.5400	0.0000	0.0000	
E10 Eaves (insulation at ceiling level)				8.4100	0.0600	0.5046	
E10 Eaves (insulation at ceiling level)				8.1300	0.0600	0.4878	
E16 Corner (normal)				9.7400	0.0900	0.8766	
E18 Party wall between dwellings				9.7400	0.0600	0.5844	
P1 Party wall - Ground floor				8.1300	0.0800	0.6504	
P2 Party wall - Intermediate floor within a dwelling				8.1300	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)				8.1300	0.1200	0.9756	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.8558 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	45.8809 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	Jan 31.8682 Feb 31.6966 Mar 31.5284 Apr 30.7384 May 30.5906 Jun 29.9025 Jul 29.9025 Aug 29.7751 Sep 30.1675 Oct 30.5906 Nov 30.8896 Dec 31.2022	(38)					
Heat transfer coeff	77.7490 77.5774 77.4092 76.6193 76.4714 75.7834 75.7834 75.6560 76.0484 76.4714 76.7705 77.0831	(39)					
Average = Sum(39)m / 12 =							76.6185
HLP	Jan 1.1380 Feb 1.1355 Mar 1.1330 Apr 1.1215 May 1.1193 Jun 1.1092 Jul 1.1092 Aug 1.1074 Sep 1.1131 Oct 1.1193 Nov 1.1237 Dec 1.1283	(40)					
HLP (average)							1.1215
Days in mont	31 28 31 30 31 30 31 31 30 31 30 31						

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2047 (42)
Hot water usage for mixer showers												0.0000 (42a)
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000												
Hot water usage for baths	26.4346 26.0420 25.4891 24.4698 23.7065 22.8601 22.4030 22.9519 23.5497 24.4553 25.4957 26.3452	(42b)										
Hot water usage for other uses	37.2079 35.8549 34.5019 33.1488 31.7958 30.4428 30.4428 31.7958 33.1488 34.5019 35.8549 37.2079	(42c)										
Average daily hot water use (litres/day)												58.3344 (43)
Daily hot water use	Jan 63.6424 Feb 61.8968 Mar 59.9910 Apr 57.6186 May 55.5023 Jun 53.3029 Jul 52.8458 Aug 54.7478 Sep 56.6985 Oct 58.9572 Nov 61.3505 Dec 63.5531	(44)										
Energy conte	100.7941 88.1403 92.2039 78.8770 74.7168 65.5422 63.9124 67.7892 69.9150 80.0043 87.4051 99.5088	(45)										
Energy content (annual)												968.8089
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	85.6750 74.9192 78.3733 67.0454 63.5093 55.7109 54.3255 57.6208 59.4277 68.0037 74.2943 84.5824	(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	85.6750 74.9192 78.3733 67.0454 63.5093 55.7109 54.3255 57.6208 59.4277 68.0037 74.2943 84.5824	(64)										

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12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											823.4876 (64)
Electric shower(s)	823 (64)											
48.9986	43.6581	47.6730	45.4938	46.3474	44.2110	45.6847	46.3474	45.4938	47.6730	46.7766	48.9986 (64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												557.3559 (64a)
Heat gains from water heating, kWh/month	33.6684	29.6443	31.5116	28.1348	27.4642	24.9805	25.0025	25.9921	26.2304	28.9192	30.2677	33.3953 (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	110.2328	110.2328	110.2328	110.2328	110.2328	110.2328	110.2328	110.2328	110.2328	110.2328	110.2328	110.2328	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	101.2443	112.0919	101.2443	104.6191	101.2443	104.6191	101.2443	101.2443	104.6191	101.2443	104.6191	101.2443	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	193.3447	195.3510	190.2952	179.5319	165.9452	153.1755	144.6447	142.6384	147.6942	158.4575	172.0442	184.8138	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.0233	34.0233	34.0233	34.0233	34.0233	34.0233	34.0233	34.0233	34.0233	34.0233	34.0233	34.0233	(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)	-88.1863	-88.1863	-88.1863	-88.1863	-88.1863	-88.1863	-88.1863	-88.1863	-88.1863	-88.1863	-88.1863	-88.1863	(71)
Water heating gains (Table 5)	45.2532	44.1136	42.3543	39.0761	36.9142	34.6951	33.6056	34.9356	36.4311	38.8699	42.0385	44.8861	(72)
Total internal gains	395.9121	407.6264	389.9636	379.2970	360.1736	348.5596	335.5644	334.8881	344.8143	354.6415	374.7717	387.0141	(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				1.3200	10.6334	0.6300	0.7000	0.7700	4.2896 (74)			
East				4.6700	19.6403	0.6300	0.7000	0.7700	28.0308 (76)			
West				5.2200	19.6403	0.6300	0.7000	0.7700	31.3321 (80)			
Solar gains	63.6526	124.3242	205.1737	301.2926	371.9651	382.1847	363.2613	310.0594	239.1726	147.5521	79.3104	52.3932 (83)
Total gains	459.5646	531.9506	595.1373	680.5896	732.1387	730.7443	698.8257	644.9476	583.9869	502.1937	454.0821	439.4073 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	54.6503	54.7712	54.8902	55.4562	55.5634	56.0678	56.0678	56.1623	55.8724	55.5634	55.3470	55.1225
alpha	4.6434	4.6514	4.6593	4.6971	4.7042	4.7379	4.7379	4.7442	4.7248	4.7042	4.6898	4.6748
util living area	0.9948	0.9891	0.9749	0.9248	0.8125	0.6283	0.4696	0.5259	0.7785	0.9543	0.9895	0.9958 (86)
MIT	19.5579	19.7602	20.0695	20.4880	20.7999	20.9554	20.9908	20.9848	20.8792	20.4561	19.9379	19.5272 (87)
Th 2	19.9699	19.9719	19.9739	19.9833	19.9851	19.9933	19.9933	19.9948	19.9901	19.9851	19.9815	19.9778 (88)
util rest of house	0.9932	0.9859	0.9672	0.9020	0.7603	0.5430	0.3659	0.4176	0.7017	0.9356	0.9858	0.9945 (89)
MIT 2	18.6638	18.8660	19.1719	19.5787	19.8527	19.9728	19.9908	19.9903	19.9244	19.5587	19.0509	18.6394 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	19.0500	19.2522	19.5596	19.9714	20.2618	20.3972	20.4228	20.4198	20.3368	19.9463	19.4340	19.0229 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.0500	19.2522	19.5596	19.9714	20.2618	20.3972	20.4228	20.4198	20.3368	19.9463	19.4340	19.0229 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	455.5982	522.8646	573.3177	613.7047	567.9143	422.7101	287.0700	299.5208	426.4078	469.4282	446.4371	436.2899	(94)
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	1146.7985	1113.4087	1010.9335	848.2858	654.7357	439.3324	289.7026	304.1238	474.2988	714.7261	946.8892	1142.5939	(97)
Space heating kWh	514.2530	396.8456	325.5861	168.8984	64.5951	0.0000	0.0000	0.0000	0.0000	182.5017	360.3255	525.4902	(98a)
Space heating requirement - total per year (kWh/year)												2538.4957	
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	514.2530	396.8456	325.5861	168.8984	64.5951	0.0000	0.0000	0.0000	0.0000	182.5017	360.3255	525.4902	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2538.4957	
Space heating per m ²												37.1560	(99)

8c. Space cooling requirement

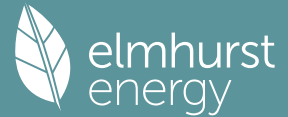
Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	712.3638	560.7970	574.9853	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8756	0.9302	0.9034	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	623.7765	521.6408	519.4146	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	813.4089	778.1818	717.2034	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	136.5353	190.8665	147.1549	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction												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)

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Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	34.1338	47.7166	36.7887	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												118.6392 (107)
Energy for space heating												37.1560 (99)
Energy for space cooling												1.7365 (108)
Total												38.8925 (109)
Fabric Energy Efficiency (TFEE)												38.9 (109)

Full SAP Calculation Printout



Property Reference	Type 50 B50FX0HE			Issued on Date	07/06/2024
Assessment Reference	Type 50 EOT H Final Issue B&B	Prop Type Ref	DS00 EOT Hipped		
Property	Type 50 B50FX0HE , EOT Hipped, Affordable Range, Part L2021 Masonry				
SAP Rating	89 B	DER	12.25	TER	13.14
Environmental	91 B	% DER < TER			6.77
CO ₂ Emissions (t/year)	0.78	DFEE	38.80	TFEE	38.89
Compliance Check	See BREL	% DFEE < TFEE			0.23
% DPER < TPER	5.32	DPER	65.21	TPER	68.87
Assessor Details	Ms. Ruth Ferguson			Assessor ID	AE69-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	34.1600 (1b)	x 2.3100 (2b)	= 78.9096 (1b) - (3b)
First floor	34.1600 (1c)	x 2.5600 (2c)	= 87.4496 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 166.3592 (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											4.0000 (17)	
Infiltration rate											0.2000 (18)	
Number of sides sheltered											2 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] = 0.8500 (20)	
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) = 0.1700 (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	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998 (22b)
Mechanical extract ventilation - decentralised												
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)	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

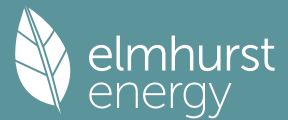
3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (Uw = 1.30)			11.2100	1.2357	13.8527		(27)
Opening Type 2			2.1400	1.2000	2.5680		(26)
Opening Type 5			2.1400	1.4000	2.9960		(26a)
225mm TE Platinum GF B&B			34.1600	0.1000	3.4160	135.0000	4611.6000 (28a)
100mm Ecobead	80.5500	15.4900	65.0600	0.2400	15.6144	60.0000	3903.6002 (29a)
500mm mineral wool @ 0.04	34.1600		34.1600	0.0800	2.7328	10.0000	341.6000 (30)
Total net area of external elements Aum(A, m ²)			148.8700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.1799		(33)
E-WM-20/22			39.5900	0.0000	0.0000	110.0000	4354.9000 (32)
Timber Partitions			122.1400			7.0000	854.9800 (32c)
Internal Floor 1			34.1600			18.0000	614.8800 (32d)
Internal Ceiling 1			34.1600			18.0000	614.8800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15296.4402 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							223.8940 (35)

elmhurst
energy

6. Solar gains						
[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.3200	10.6334	0.7300	0.7000	0.7700	4.9705 (74)
East	4.6700	19.6403	0.7300	0.7000	0.7700	32.4802 (76)
West	5.2200	19.6403	0.7300	0.7000	0.7700	36.3055 (80)

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Solar gains	73.7561	144.0582	237.7409	349.1168	431.0072	442.8489	420.9218	359.2752	277.1366	170.9731	91.8993	60.7096 (83)
Total gains	517.5997	598.4729	671.8545	766.2031	825.2280	818.5037	780.8805	720.3591	650.3226	561.3951	508.5228	494.7899 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	56.4449	56.4449	56.4449	56.4449	56.4449	56.4449	56.4449	56.4449	56.4449	56.4449	56.4449	56.4449
alpha	4.7630	4.7630	4.7630	4.7630	4.7630	4.7630	4.7630	4.7630	4.7630	4.7630	4.7630	4.7630
util living area	0.9914	0.9821	0.9594	0.8895	0.7524	0.5682	0.4200	0.4730	0.7228	0.9319	0.9832	0.9930 (86)
MIT	19.7153	19.9222	20.2283	20.6041	20.8632	20.9712	20.9944	20.9904	20.9148	20.5516	20.0566	19.6647 (87)
Th 2	19.9993	19.9993	19.9993	19.9993	19.9993	19.9993	19.9993	19.9993	19.9993	19.9993	19.9993	19.9993 (88)
util rest of house	0.9889	0.9771	0.9480	0.8602	0.6959	0.4875	0.3266	0.3739	0.6433	0.9068	0.9776	0.9910 (89)
MIT 2	18.5149	18.7766	19.1590	19.6085	19.8875	19.9829	19.9975	19.9958	19.9423	19.5596	18.9493	18.4505 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	19.0334	19.2714	19.6208	20.0385	20.3090	20.4098	20.4281	20.4254	20.3623	19.9881	19.4276	18.9750 (92)
Temperature adjustment												
adjusted MIT	18.8834	19.1214	19.4708	19.8885	20.1590	20.2598	20.2781	20.2754	20.2123	19.8381	19.2776	18.8250 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9851	0.9714	0.9405	0.8565	0.7055	0.5091	0.3529	0.4017	0.6614	0.9019	0.9722	0.9877 (94)
Useful gains	509.8812	581.3338	631.9023	656.2823	582.2238	416.7233	275.5918	289.3719	430.1382	506.3366	494.3709	488.6915 (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	1097.7967	1070.5473	976.4069	827.1830	636.7664	426.0526	276.8755	291.7274	460.1193	695.4151	916.6926	1100.9254 (97)
Space heating kWh	437.4091	328.7515	256.3114	123.0485	40.5797	0.0000	0.0000	0.0000	0.0000	140.6745	304.0716	455.5020 (98a)
Space heating requirement - total per year (kWh/year)												2086.3484
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	437.4091	328.7515	256.3114	123.0485	40.5797	0.0000	0.0000	0.0000	0.0000	140.6745	304.0716	455.5020 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2086.3484
Space heating per m2												(98c) / (4) = 30.5379 (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 %)													89.0000 (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	437.4091	328.7515	256.3114	123.0485	40.5797	0.0000	0.0000	0.0000	0.0000	140.6745	304.0716	455.5020 (98)	
Space heating efficiency (main heating system 1)	89.0000	89.0000	89.0000	89.0000	89.0000	0.0000	0.0000	0.0000	0.0000	89.0000	89.0000	89.0000 (210)	
Space heating fuel (main heating system)	491.4709	369.3837	287.9904	138.2567	45.5952	0.0000	0.0000	0.0000	0.0000	158.0612	341.6535	511.8000 (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	148.6667	130.6890	137.7374	119.4609	114.4610	101.7614	99.8661	104.8965	107.1338	121.0167	130.4198	146.9167 (64)	
Efficiency of water heater (217)m	88.5625	88.5097	88.3983	88.1544	87.7386	87.3000	87.3000	87.3000	87.3000	88.2057	88.4828	88.5793 (217)	
Fuel for water heating, kWh/month	167.8664	147.6549	155.8146	135.5133	130.4568	116.5652	114.3942	120.1564	122.7191	137.1983	147.3957	165.8589 (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	10.3896	9.3842	10.3896	10.0545	10.3896	10.0545	10.3896	10.3896	10.0545	10.3896	10.0545	10.3896 (231)	
Lighting	19.8129	15.8946	14.3114	10.4851	8.0990	6.6170	7.3882	9.6034	12.4739	16.3665	18.4859	20.3636 (232)	
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-10.1823	-16.9151	-29.0362	-38.1981	-45.5450	-44.1177	-43.2893	-38.3649	-30.4323	-21.2150	-11.9179	-8.4495 (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												2344.2117 (211)	
Space heating fuel - main system 2												0.0000 (213)	
Space heating fuel - secondary												0.0000 (215)	
Efficiency of water heater												87.3000	
Water heating fuel used												1661.5936 (219)	
Space cooling fuel												0.0000 (221)	

Electricity for pumps and fans:
(MEVDcentralised, Database: total watage = 5.1910, total flow = 29.0000, SFP = 0.1790)

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mechanical ventilation fans (SFP = 0.1790)	36.3295 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	122.3295 (231)
Electricity for lighting (calculated in Appendix L)	159.9015 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-337.6633 (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	3950.3728 (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	2344.2117	0.2100	492.2844 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1661.5936	0.2100	348.9346 (264)
Space and water heating			841.2191 (265)
Pumps, fans and electric keep-hot	122.3295	0.1387	16.9686 (267)
Energy for lighting	159.9015	0.1443	23.0787 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-337.6633	0.1317	-44.4539
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-44.4539 (269)
Total CO2, kg/year			836.8125 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			12.2500 (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	2344.2117	1.1300	2648.9592 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1661.5936	1.1300	1877.6007 (278)
Space and water heating			4526.5599 (279)
Pumps, fans and electric keep-hot	122.3295	1.5128	185.0601 (281)
Energy for lighting	159.9015	1.5338	245.2622 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-337.6633	1.4864	-501.9011
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-501.9011 (283)
Total Primary energy kWh/year			4454.9811 (286)
Dwelling Primary energy Rate (DPER)			65.2100 (287)

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

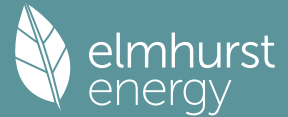
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	34.1600 (1b)	x 2.3100 (2b)	= 78.9096 (1b) - (3b)
First floor	34.1600 (1c)	x 2.5600 (2c)	= 87.4496 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	166.3592 (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	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1202 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3702 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3147 (21)

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Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4012	0.3934	0.3855	0.3462	0.3383	0.2990	0.2990	0.2911	0.3147	0.3383	0.3540	0.3698 (22b)
	0.5805	0.5774	0.5743	0.5599	0.5572	0.5447	0.5447	0.5424	0.5495	0.5572	0.5627	0.5684 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			2.1400	1.0000	2.1400		(26)
TER Semi-glazed door			2.1400	1.0000	2.1400		(26a)
TER Opening Type (Uw = 1.20)			11.2100	1.1450	12.8359		(27)
225mm TE Platinum GF B&B			34.1600	0.1300	4.4408		(28a)
100mm Ecobead	80.5500	15.4900	65.0600	0.1800	11.7108		(29a)
500mm mineral wool @ 0.04	34.1600		34.1600	0.1100	3.7576		(30)
Total net area of external elements Aum(A, m2)			148.8700				(31)
Fabric heat loss, W/K = Sum (A x U)							(32)
E-WM-20/22			39.5900	0.0000	0.0000		(32)

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

223.8940 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	6.3300	0.0500	0.3165
E2 Other lintels (including other steel lintels)	4.2900	0.0500	0.2145
E3 Sill	8.5800	0.0500	0.4290
E4 Jamb	23.4000	0.0500	1.1700
E5 Ground floor (normal)	16.5400	0.1600	2.6464
E6 Intermediate floor within a dwelling	16.5400	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	8.4100	0.0600	0.5046
E10 Eaves (insulation at ceiling level)	8.1300	0.0600	0.4878
E16 Corner (normal)	9.7400	0.0900	0.8766
E18 Party wall between dwellings	9.7400	0.0600	0.5844
P1 Party wall - Ground floor	8.1300	0.0800	0.6504
P2 Party wall - Intermediate floor within a dwelling	8.1300	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.1300	0.1200	0.9756

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

8.8558 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 45.8809 (37)

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

(38)m	Jan 31.8682	Feb 31.6966	Mar 31.5284	Apr 30.7384	May 30.5906	Jun 29.9025	Jul 29.9025	Aug 29.7751	Sep 30.1675	Oct 30.5906	Nov 30.8896	Dec 31.2022 (38)
Heat transfer coeff	77.7490	77.5774	77.4092	76.6193	76.4714	75.7834	75.7834	75.6560	76.0484	76.4714	76.7705	77.0831 (39)
Average = Sum(39)m / 12 =												76.6185

HLP	Jan 1.1380	Feb 1.1355	Mar 1.1330	Apr 1.1215	May 1.1193	Jun 1.1092	Jul 1.1092	Aug 1.1074	Sep 1.1131	Oct 1.1193	Nov 1.1237	Dec 1.1283 (40)
HLP (average)												1.1215
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

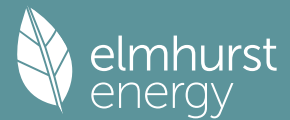
4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2047 (42)
Hot water usage for mixer showers	61.1845	60.2650	58.9251	56.3615	54.4697	52.3599	51.1607	52.4904	53.9480	56.2133	58.8320	60.9501 (42a)
Hot water usage for baths	26.4346	26.0420	25.4891	24.4698	23.7065	22.8601	22.4030	22.9519	23.5497	24.4553	25.4957	26.3452 (42b)
Hot water usage for other uses	37.2079	35.8549	34.5019	33.1488	31.7958	30.4428	30.4428	31.7958	33.1488	34.5019	35.8549	37.2079 (42c)
Average daily hot water use (litres/day)												114.7444 (43)
Daily hot water use	Jan 124.8269	Feb 122.1618	Mar 118.9161	Apr 113.9801	May 109.9720	Jun 105.6628	Jul 104.0064	Aug 107.2382	Sep 110.6465	Oct 115.1705	Nov 120.1825	Dec 124.5031 (44)
Energy conte	197.6953	173.9568	182.7696	156.0331	148.0434	129.9248	125.7868	132.7832	136.4383	156.2852	171.2220	194.9418 (45)
Energy content (annual)										Total = Sum(45)m =		1905.8804
Distribution loss (46)m = 0.15 x (45)m	29.6543	26.0935	27.4154	23.4050	22.2065	19.4887	18.8680	19.9175	20.4657	23.4428	25.6833	29.2413 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	248.6542	219.9842	233.7285	205.3482	199.0023	179.2398	176.7457	183.7422	185.7533	207.2441	220.5371	245.9007 (62)
WWHRS	-27.9710	-24.7378	-25.9040	-21.4495	-19.9902	-17.1057	-16.0339	-17.0504	-17.6983	-20.8643	-23.6367	-27.4530 (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	220.6833	195.2465	207.8246	183.8987	179.0121	162.1341	160.7118	166.6917	168.0551	186.3799	196.9004	218.4477 (64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2245.9857 (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)
												0.0000 (64a)
Heat gains from water heating, kWh/month	78.4734	69.3475	73.5106	64.2098	61.9642	55.5287	54.5638	56.8902	57.6945	64.7046	69.2601	77.5579 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan 110.2328	Feb 110.2328	Mar 110.2328	Apr 110.2328	May 110.2328	Jun 110.2328	Jul 110.2328	Aug 110.2328	Sep 110.2328	Oct 110.2328	Nov 110.2328	Dec 110.2328 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	101.2443	112.0919	101.2443	104.6191	101.2443	104.6191	101.2443	101.2443	104.6191	101.2443	104.6191	101.2443 (67)

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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	193.3447	195.3510	190.2952	179.5319	165.9452	153.1755	144.6447	142.6384	147.6942	158.4575	172.0442	184.8138 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.0233	34.0233	34.0233	34.0233	34.0233	34.0233	34.0233	34.0233	34.0233	34.0233	34.0233	34.0233 (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)	-88.1863	-88.1863	-88.1863	-88.1863	-88.1863	-88.1863	-88.1863	-88.1863	-88.1863	-88.1863	-88.1863	-88.1863 (71)
Water heating gains (Table 5)	103.4750	103.1957	98.8046	89.1802	83.2852	77.1233	73.3385	76.4653	80.1312	86.9685	96.1946	104.2445 (72)
Total internal gains	459.1339	469.7085	449.4140	432.4011	409.5445	390.9878	375.2973	376.4178	388.5144	405.7402	431.9278	449.3725 (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				1.3200	10.6334	0.6300	0.7000	0.7700	4.2896 (74)			
East				4.6700	19.6403	0.6300	0.7000	0.7700	28.0308 (76)			
West				5.2200	19.6403	0.6300	0.7000	0.7700	31.3321 (80)			
Solar gains	63.6526	124.3242	205.1737	301.2926	371.9651	382.1847	363.2613	310.0594	239.1726	147.5521	79.3104	52.3932 (83)
Total gains	522.7865	594.0327	654.5876	733.6937	781.5096	773.1725	738.5586	686.4773	627.6871	553.2923	511.2382	501.7657 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)											
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	54.6503	54.7712	54.8902	55.4562	55.5634	56.0678	56.0678	56.1623	55.8724	55.5634	55.3470	55.1225
alpha	4.6434	4.6514	4.6593	4.6971	4.7042	4.7379	4.7379	4.7442	4.7248	4.7042	4.6898	4.6748
util living area	0.9912	0.9832	0.9645	0.9056	0.7837	0.5997	0.4457	0.4968	0.7443	0.9368	0.9832	0.9927 (86)
MIT	19.6625	19.8595	20.1573	20.5482	20.8301	20.9633	20.9926	20.9880	20.9008	20.5234	20.0296	19.6312 (87)
Th 2	19.9699	19.9719	19.9739	19.9833	19.9851	19.9933	19.9933	19.9948	19.9901	19.9851	19.9815	19.9778 (88)
util rest of house	0.9887	0.9784	0.9542	0.8789	0.7288	0.5162	0.3467	0.3932	0.6651	0.9129	0.9776	0.9906 (89)
MIT 2	18.4269	18.6778	19.0527	19.5323	19.8437	19.9719	19.9908	19.9903	19.9228	19.5157	18.9025	18.3927 (90)
Living area fraction	18.9606	19.1882	19.5298	19.9711	20.2698	20.4001	20.4235	20.4212	20.3452	19.9510	19.3893	18.9277 (92)
MIT	18.9606	19.1882	19.5298	19.9711	20.2698	20.4001	20.4235	20.4212	20.3452	19.9510	19.3893	18.9277 (92)
Temperature adjustment	18.9606	19.1882	19.5298	19.9711	20.2698	20.4001	20.4235	20.4212	20.3452	19.9510	19.3893	18.9277 (93)
adjusted MIT	18.9606	19.1882	19.5298	19.9711	20.2698	20.4001	20.4235	20.4212	20.3452	19.9510	19.3893	18.9277 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9853	0.9737	0.9487	0.8785	0.7452	0.5509	0.3895	0.4379	0.6948	0.9119	0.9733	0.9876 (94)
Ext temp.	515.1076	578.4263	621.0324	644.5779	582.4186	425.9610	287.6580	300.6299	436.1246	504.5564	497.5873	495.5466 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	1139.8451	1108.4447	1008.6291	848.2615	655.3437	439.5536	289.7595	304.2298	474.9407	715.0807	943.4563	1135.2550 (97)
Space heating requirement - total per year (kWh/year)	464.8047	356.1723	288.3719	146.6522	54.2563	0.0000	0.0000	0.0000	0.0000	156.6301	321.0257	475.9431 (98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98c)
Space heating kWh	464.8047	356.1723	288.3719	146.6522	54.2563	0.0000	0.0000	0.0000	0.0000	156.6301	321.0257	475.9431 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	464.8047	356.1723	288.3719	146.6522	54.2563	0.0000	0.0000	0.0000	0.0000	156.6301	321.0257	475.9431 (98c)
Space heating per m2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)											
Fraction of space heat from main system(s)	1.0000 (202)											
Efficiency of main space heating system 1 (in %)	92.4000 (206)											
Efficiency of main space heating system 2 (in %)	0.0000 (207)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating efficiency (main heating system 1)	464.8047	356.1723	288.3719	146.6522	54.2563	0.0000	0.0000	0.0000	0.0000	156.6301	321.0257	475.9431 (98)
Space heating fuel (main heating system)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000 (210)
Space heating efficiency (main heating system 2)	503.0354	385.4679	312.0908	158.7145	58.7189	0.0000	0.0000	0.0000	0.0000	169.5131	347.4304	515.0899 (211)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	220.6833	195.2465	207.8246	183.8987	179.0121	162.1341	160.7118	166.6917	168.0551	186.3799	196.9004	218.4477 (64)
Efficiency of water heater (217)m	85.9370	85.6520	85.0834	83.9009	82.1484	80.3000	80.3000	80.3000	80.3000	84.0111	85.4220	80.3000 (216)
Fuel for water heating, kWh/month	256.7966	227.9533	244.2597	219.1855	217.9132	201.9104	200.1392	207.5862	209.2840	221.8515	230.5031	254.0019 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	21.0366	16.8763	15.1953	11.1327	8.5992	7.0256	7.8445	10.1966	13.2443	17.3773	19.6276	21.6212 (232)

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Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-32.1346	-45.3926	-65.3827	-73.6850	-79.6188	-74.3945	-73.4937	-69.3119	-61.9399	-52.0017	-35.3670	-27.7734	(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	-17.8824	-37.6519	-74.8916	-112.5563	-148.8892	-149.6040	-147.8251	-125.1193	-91.6634	-53.8491	-23.8786	-14.1368	(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												2450.0610	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												2691.3846	(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)												169.7772	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1688.4436	(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												3708.7792	(238)

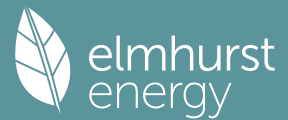
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2450.0610	0.2100	514.5128	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2691.3846	0.2100	565.1908	(264)
Space and water heating			1079.7036	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	169.7772	0.1443	24.5041	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-690.4958	0.1345	-92.8954	
PV Unit electricity exported	-997.9477	0.1259	-125.6213	
Total			-218.5167	(269)
Total CO2, kg/year			897.6203	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.1400	(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	2450.0610	1.1300	2768.5689	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2691.3846	1.1300	3041.2646	(278)
Space and water heating			5809.8335	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	169.7772	1.5338	260.4099	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-690.4958	1.4972	-1033.8195	
PV Unit electricity exported	-997.9477	0.4621	-461.1160	
Total			-1494.9355	(283)
Total Primary energy kWh/year			4705.4087	(286)
Target Primary Energy Rate (TPER)			68.8700	(287)

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Property Reference	Type 52 B52AX0-I Mid				Issued on Date	07/06/2024
Assessment Reference	1	Prop Type Ref				
Property	Type 52 DS00, Mid, Affordable Range, Part L2021 Masonry					
SAP Rating	91 B	DER	9.08	TER	10.12	
Environmental	92 A	% DER < TER				10.28
CO ₂ Emissions (t/year)	0.71	DFEE	28.47	TFEE	29.83	
Compliance Check	See BREL	% DFEE < TFEE				4.55
% DPER < TPER	6.92	DPER	49.11	TPER	52.76	
Assessor Details	Ms. Ruth Ferguson				Assessor ID	AE69-0001
Client						

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.4300 (1b)	x 2.3100 (2b)	= 98.0133 (1b) - (3b)
First floor	42.4300 (1c)	x 2.5600 (2c)	= 108.6208 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.8600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 206.6341 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	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	4.0000 (17)
Infiltration rate	0.2000 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1700 (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	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998 (22b)
Mechanical extract ventilation - decentralised												
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)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (Uw = 1.30)			9.9000	1.2357	12.2338		(27)
Opening Type 2			2.1400	1.2000	2.5680		(26)
Opening Type 5			2.1400	1.6000	3.4240		(26a)
225mm TE Platinum B&B			42.4300	0.0900	3.8187	135.0000	5728.0500 (28a)
100mm Ecobead	44.7600	14.1800	30.5800	0.2400	7.3392	60.0000	1834.7999 (29a)
500mm mineral wool	42.4300		42.4300	0.0900	3.8187	10.0000	424.3000 (30)
Total net area of external elements Aum(A, m ²)			129.6200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.2024		(33)
E-WM-20/22			89.9000	0.0000	0.0000	110.0000	9889.0002 (32)
Timber partitions			136.7800			7.0000	957.4600 (32c)
Solid partitions			8.8200			69.4000	612.1080 (32c)
Internal Floor 1			42.4300			18.0000	763.7400 (32d)
Internal Ceiling 1			42.4300			18.0000	763.7400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20973.1981 (34)

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

247.1506 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	5.7000	0.0260	0.1482
E2 Other lintels (including other steel lintels)	3.6700	0.0400	0.1468
E3 Sill	7.3300	0.0310	0.2272
E4 Jamb	21.9000	0.0360	0.7884
E5 Ground floor (normal)	9.1900	0.0590	0.5422
E6 Intermediate floor within a dwelling	9.1900	0.0060	0.0551
E10 Eaves (insulation at ceiling level)	9.1900	0.1240	1.1396
E18 Party wall between dwellings	19.4800	0.0530	1.0324
P1 Party wall - Ground floor	18.4600	0.0890	1.6429
P2 Party wall - Intermediate floor within a dwelling	18.4600	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	18.4600	0.0770	1.4214
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			7.1443 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	40.3468 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	34.0946	34.0946	34.0946	34.0946	34.0946	34.0946	34.0946	34.0946	34.0946	34.0946	34.0946	34.0946
Average = Sum(39)m / 12 =	74.4414	74.4414	74.4414	74.4414	74.4414	74.4414	74.4414	74.4414	74.4414	74.4414	74.4414	74.4414
HLP	0.8772	0.8772	0.8772	0.8772	0.8772	0.8772	0.8772	0.8772	0.8772	0.8772	0.8772	0.8772
HLP (average)												0.8772
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5486 (42)
Hot water usage for mixer showers	66.9520	65.9459	64.4797	61.6744	59.6042	57.2956	55.9833	57.4384	59.0334	61.5122	64.3777	66.6955 (42a)
Hot water usage for baths	28.9148	28.4854	27.8806	26.7656	25.9307	25.0050	24.5049	25.1054	25.7592	26.7498	27.8878	28.8170 (42b)
Hot water usage for other uses	40.7306	39.2495	37.7684	36.2873	34.8062	33.3250	33.3250	34.8062	36.2873	37.7684	39.2495	40.7306 (42c)
Average daily hot water use (litres/day)												125.5639 (43)
Daily hot water use	136.5974	133.6807	130.1287	124.7274	120.3411	115.6256	113.8133	117.3500	121.0799	126.0305	131.5150	136.2431 (44)
Energy conte	216.3369	190.3596	200.0030	170.7455	162.0023	142.1751	137.6473	145.3038	149.3037	171.0221	187.3673	213.3238 (45)
Energy content (annual)										Total = Sum(45)m =		2085.5904
Distribution loss (46)m = 0.15 x (45)m	32.4505	28.5539	30.0004	25.6118	24.3003	21.3263	20.6471	21.7956	22.3955	25.6533	28.1051	31.9986 (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	5.4922	4.9506	5.4595	5.2378	5.3835	5.1807	5.3348	5.3501	5.1949	5.4016	5.2710	5.4862 (61)
Total heat required for water heating calculated for each month	221.8291	195.3102	205.4625	175.9833	167.3858	147.3558	142.9821	150.6539	154.4986	176.4237	192.6383	218.8100 (62)
WWHRS	-59.6194	-52.7279	-55.2136	-45.7190	-42.6085	-36.4604	-34.1758	-36.3425	-37.7233	-44.4716	-50.3810	-58.5153 (63a)
FV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	162.2097	142.5823	150.2489	130.2643	124.7773	110.8954	108.8063	114.3113	116.7752	131.9521	142.2574	160.2947 (64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		1595.3750 (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	73.3051	64.5322	67.8659	58.0823	55.2116	48.5684	47.1014	49.6510	50.9422	58.2153	63.6174	72.3017 (65)

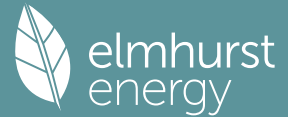
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	127.4319	127.4319	127.4319	127.4319	127.4319	127.4319	127.4319	127.4319	127.4319	127.4319	127.4319	127.4319 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	129.1748	143.0150	129.1748	133.4807	129.1748	133.4807	129.1748	129.1748	133.4807	129.1748	133.4807	129.1748 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	229.2978	231.6771	225.6812	212.9164	196.8032	181.6590	171.5418	169.1624	175.1584	187.9232	204.0364	219.1805 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7432	35.7432	35.7432	35.7432	35.7432	35.7432	35.7432	35.7432	35.7432	35.7432	35.7432	35.7432 (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)	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455 (71)
Water heating gains (Table 5)	98.5283	96.0301	91.2176	80.6699	74.2092	67.4561	63.3084	66.7353	70.7530	78.2463	88.3575	97.1797 (72)
Total internal gains	521.2305	534.9518	510.3031	491.2965	464.4168	443.8254	425.2546	426.3021	440.6217	459.5739	490.1041	509.7647 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
East				5.2200	19.6403	0.7300	0.7000		0.7700		36.3055 (76)	
West				4.6800	19.6403	0.7300	0.7000		0.7700		32.5497 (80)	
Solar gains	68.8552	134.6953	221.8241	323.5172	396.4824	405.8703	386.4051	331.9163	257.9906	159.8274	85.8543	56.6232 (83)

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Total gains 590.0857 669.6471 732.1272 814.8137 860.8992 849.6957 811.6597 758.2183 698.6122 619.4013 575.9584 566.3878 (84)

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.2614	78.2614	78.2614	78.2614	78.2614	78.2614	78.2614	78.2614	78.2614	78.2614	78.2614	78.2614	
alpha	6.2174	6.2174	6.2174	6.2174	6.2174	6.2174	6.2174	6.2174	6.2174	6.2174	6.2174	6.2174	
util living area	0.9949	0.9880	0.9693	0.9007	0.7529	0.5538	0.4027	0.4499	0.7030	0.9376	0.9882	0.9960	(86)
MIT	20.1195	20.2795	20.5038	20.7761	20.9408	20.9922	20.9991	20.9982	20.9697	20.7404	20.3752	20.0787	(87)
Th 2	20.1869	20.1869	20.1869	20.1869	20.1869	20.1869	20.1869	20.1869	20.1869	20.1869	20.1869	20.1869	(88)
util rest of house	0.9933	0.9844	0.9603	0.8743	0.7019	0.4865	0.3288	0.3713	0.6324	0.9145	0.9841	0.9948	(89)
MIT 2	19.1597	19.3625	19.6431	19.9668	20.1395	20.1826	20.1866	20.1863	20.1675	19.9334	19.4853	19.1078	(90)
Living area fraction									fLA = Living area / (4) =			0.2254	(91)
MIT	19.3761	19.5692	19.8371	20.1492	20.3202	20.3651	20.3698	20.3693	20.3483	20.1153	19.6859	19.3267	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.2261	19.4192	19.6871	19.9992	20.1702	20.2151	20.2198	20.2193	20.1983	19.9653	19.5359	19.1767	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9907	0.9800	0.9533	0.8674	0.7008	0.4889	0.3318	0.3744	0.6335	0.9069	0.9796	0.9926	(94)
Useful gains	584.6190	656.2384	697.9669	706.7474	603.3174	415.3996	269.2696	283.9137	442.5617	561.7167	564.1917	562.2220	(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	1111.1178	1080.8294	981.6665	826.2431	630.5313	417.9946	269.4593	284.3131	453.9680	697.1664	925.7475	1114.8851	(97)
Space heating kWh	391.7151	285.3251	211.0725	86.0369	20.2471	0.0000	0.0000	0.0000	0.0000	100.7746	260.3202	411.1813	(98a)
Space heating requirement - total per year (kWh/year)												1766.6728	
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	391.7151	285.3251	211.0725	86.0369	20.2471	0.0000	0.0000	0.0000	0.0000	100.7746	260.3202	411.1813	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1766.6728	
Space heating per m2										(98c) / (4) =		20.8187	(99)

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

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

Fraction of space heat from main system(s)

Efficiency of main space heating system 1 (in %)

Efficiency of main space heating system 2 (in %)

Efficiency of secondary/supplementary heating system, %

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	391.7151	285.3251	211.0725	86.0369	20.2471	0.0000	0.0000	0.0000	0.0000	100.7746	260.3202	411.1813	(98)
Space heating efficiency (main heating system 1)	89.0000	89.0000	89.0000	89.0000	89.0000	0.0000	0.0000	0.0000	0.0000	89.0000	89.0000	89.0000	(210)
Space heating fuel (main heating system)	440.1294	320.5901	237.1601	96.6707	22.7495	0.0000	0.0000	0.0000	0.0000	113.2298	292.4946	462.0015	(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	162.2097	142.5823	150.2489	130.2643	124.7773	110.8954	108.8063	114.3113	116.7752	131.9521	142.2574	160.2947	(64)
Efficiency of water heater (217)m	88.4954	88.4262	88.2851	87.9684	87.5334	87.3000	87.3000	87.3000	87.3000	88.0281	88.3918	87.3000	(216)
Fuel for water heating, kWh/month	183.2974	161.2443	170.1860	148.0808	142.5482	127.0280	124.6349	130.9408	133.7632	149.8977	160.9396	181.0901	(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	9.6726	8.7365	9.6726	9.3606	9.6726	9.3606	9.6726	9.6726	9.3606	9.6726	9.3606	9.6726	(231)
Lighting	26.4702	21.2353	19.1201	14.0082	10.8203	8.8403	9.8707	12.8303	16.6652	21.8657	24.6973	27.2058	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-10.3628	-17.3437	-30.0193	-39.8417	-47.8199	-46.4250	-45.5348	-40.1935	-31.6672	-21.8558	-12.1665	-8.5867	(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	-2.3065	-5.7912	-14.2380	-25.7949	-38.2289	-40.0777	-39.0301	-30.4835	-19.1757	-9.0814	-3.2649	-1.7370	(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												1985.0256	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												87.3000	
Water heating fuel used												1813.6512	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:

(MEV)Decentralised, Database: total watage = 3.2080, total flow = 29.0000, SFP = 0.1106)

mechanical ventilation fans (SFP = 0.1106)

central heating pump

27.8868 (230a)

41.0000 (230c)

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main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	113.8868 (231)
Electricity for lighting (calculated in Appendix L)	213.6294 (232)

Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-581.0267 (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	3545.1663 (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	1985.0256	0.2100	416.8554 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1813.6512	0.2100	380.8668 (264)
Space and water heating			797.7221 (265)
Pumps, fans and electric keep-hot	113.8868	0.1387	15.7975 (267)
Energy for lighting	213.6294	0.1443	30.8333 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-351.8169	0.1315	-46.2663
PV Unit electricity exported	-229.2098	0.1215	-27.8527
Total			-74.1190 (269)
Total CO2, kg/year			770.2340 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			9.0800 (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	1985.0256	1.1300	2243.0790 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1813.6512	1.1300	2049.4259 (278)
Space and water heating			4292.5048 (279)
Pumps, fans and electric keep-hot	113.8868	1.5128	172.2879 (281)
Energy for lighting	213.6294	1.5338	327.6719 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-351.8169	1.4859	-522.7473
PV Unit electricity exported	-229.2098	0.4458	-102.1870
Total			-624.9343 (283)
Total Primary energy kWh/year			4167.5303 (286)
Dwelling Primary energy Rate (DPER)			49.1100 (287)

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

1. Overall dwelling characteristics

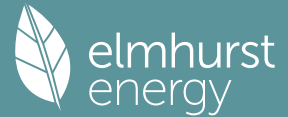
	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	42.4300 (1b)	x 2.3100 (2b)	= 98.0133 (1b) - (3b)
First floor	42.4300 (1c)	x 2.5600 (2c)	= 108.6208 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.8600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	206.6341 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1452 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3952 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3359 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)

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Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infiltr rate	0.4283	0.4199	0.4115	0.3695	0.3611	0.3191	0.3191	0.3107	0.3359	0.3611	0.3779	0.3947 (22b)
Effective ac	0.5917	0.5882	0.5847	0.5683	0.5652	0.5509	0.5509	0.5483	0.5564	0.5652	0.5714	0.5779 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			2.1400	1.0000	2.1400		(26)
TER Semi-glazed door			2.1400	1.0000	2.1400		(26a)
TER Opening Type (Uw = 1.20)			9.9000	1.1450	11.3359		(27)
225mm TE Platinum B&B			42.4300	0.1300	5.5159		(28a)
100mm Ecobead	44.7600	14.1800	30.5800	0.1800	5.5044		(29a)
500mm mineral wool	42.4300		42.4300	0.1100	4.6673		(30)
Total net area of external elements Aum(A, m2)			129.6200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.3035		(33)
E-WM-20/22			89.9000	0.0000	0.0000		(32)

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

247.1506 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	5.7000	0.0500	0.2850
E2 Other lintels (including other steel lintels)	3.6700	0.0500	0.1835
E3 Sill	7.3300	0.0500	0.3665
E4 Jamb	21.9000	0.0500	1.0950
E5 Ground floor (normal)	9.1900	0.1600	1.4704
E6 Intermediate floor within a dwelling	9.1900	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	9.1900	0.0600	0.5514
E18 Party wall between dwellings	19.4800	0.0600	1.1688
P1 Party wall - Ground floor	18.4600	0.0800	1.4768
P2 Party wall - Intermediate floor within a dwelling	18.4600	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	18.4600	0.1200	2.2152
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			8.8126 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss		(33) + (36) + (36a) =	40.1161 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.3484	40.1056	39.8675	38.7495	38.5403	37.5665	37.5665	37.3862	37.9416	38.5403	38.9635	39.4059 (38)
Heat transfer coeff	80.4645	80.2217	79.9836	78.8656	78.6564	77.6826	77.6826	77.5023	78.0577	78.6564	79.0796	79.5220 (39)
Average = Sum(39)m / 12 =												78.8646

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9482	0.9453	0.9425	0.9294	0.9269	0.9154	0.9154	0.9133	0.9198	0.9269	0.9319	0.9371 (40)
HLP (average)												0.9293
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

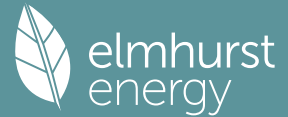
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.5486 (42)
Hot water usage for mixer showers													
66.9520	65.9459	64.4797	61.6744	59.6042	57.2956	55.9833	57.4384	59.0334	61.5122	64.3777	66.6955	(42a)	
Hot water usage for baths													
28.9148	28.4854	27.8806	26.7656	25.9307	25.0050	24.5049	25.1054	25.7592	26.7498	27.8878	28.8170	(42b)	
Hot water usage for other uses													
40.7306	39.2495	37.7684	36.2873	34.8062	33.3250	33.3250	34.8062	36.2873	37.7684	39.2495	40.7306	(42c)	
Average daily hot water use (litres/day)												125.5639 (43)	
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
136.5974	133.6807	130.1287	124.7274	120.3411	115.6256	113.8133	117.3500	121.0799	126.0305	131.5150	136.2431	(44)	
Energy conte	216.3369	190.3596	200.0030	170.7455	162.0023	142.1751	137.6473	145.3038	149.3037	171.0221	187.3673	213.3238 (45)	
Energy content (annual)										Total = Sum(45)m =		2085.5904	
Distribution loss (46)m = 0.15 x (45)m													
32.4505	28.5539	30.0004	25.6118	24.3003	21.3263	20.6471	21.7956	22.3955	25.6533	28.1051	31.9986	(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	(59)	
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589 (61)	
Total heat required for water heating calculated for each month													
267.2958	236.3870	250.9619	220.0606	212.9612	191.4902	188.6062	196.2627	198.6187	221.9810	236.6823	264.2827	(62)	
WWHRS	-30.6077	-27.0697	-28.3458	-23.4714	-21.8745	-18.7182	-17.5453	-18.6577	-19.3666	-22.8311	-25.8648	-30.0409 (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													
236.6882	209.3173	222.6161	196.5891	191.0867	172.7720	171.0609	177.6050	179.2522	199.1500	210.8175	234.2419	(64)	
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2401.1967 (64)	
Electric shower(s)												2401 (64)	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)	
												0.0000 (64a)	
Heat gains from water heating, kWh/month													
84.6718	74.8014	79.2407	69.1017	66.6055	59.6020	58.5075	61.0532	61.9722	69.6046	74.6284	83.6699	(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	127.4319	127.4319	127.4319	127.4319	127.4319	127.4319	127.4319	127.4319	127.4319	127.4319	127.4319	127.4319 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	129.1748	143.0150	129.1748	133.4807	129.1748	133.4807	129.1748	129.1748	133.4807	129.1748	133.4807	129.1748 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	229.2978	231.6771	225.6812	212.9164	196.8032	181.6590	171.5418	169.1624	175.1584	187.9232	204.0364	219.1805 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	35.7432	35.7432	35.7432	35.7432	35.7432	35.7432	35.7432	35.7432	35.7432	35.7432	35.7432	35.7432 (69)

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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)	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455 (71)
Water heating gains (Table 5)	113.8061	111.3116	106.5063	95.9745	89.5235	82.7806	78.6390	82.0608	86.0725	93.5546	103.6505	112.4595 (72)
Total internal gains	536.5083	550.2333	525.5919	506.6011	479.7311	459.1498	440.5853	441.6276	455.9412	474.8821	505.3972	525.0445 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
East				5.2200	19.6403	0.6300	0.7000	0.7700	31.3321 (76)			
West				4.6800	19.6403	0.6300	0.7000	0.7700	28.0909 (80)			
Solar gains	59.4230	116.2439	191.4372	279.1997	342.1698	350.2716	333.4729	286.4483	222.6494	137.9332	74.0935	48.8666 (83)
Total gains	595.9312	666.4773	717.0291	785.8009	821.9009	809.4215	774.0581	728.0759	678.5906	612.8153	579.4906	573.9110 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	72.4032	72.6224	72.8385	73.8711	74.0676	74.9960	74.9960	75.1705	74.6357	74.0676	73.6712	73.2614
alpha	5.8269	5.8415	5.8559	5.9247	5.9378	5.9997	5.9997	6.0114	5.9757	5.9378	5.9114	5.8841
util living area	0.9951	0.9897	0.9763	0.9245	0.8016	0.6011	0.4397	0.4862	0.7423	0.9478	0.9891	0.9960 (86)
MIT	20.0062	20.1630	20.3907	20.6973	20.9034	20.9858	20.9981	20.9967	20.9536	20.6847	20.3015	19.9860 (87)
Th 2	20.1267	20.1291	20.1315	20.1426	20.1447	20.1544	20.1544	20.1562	20.1507	20.1447	20.1405	20.1361 (88)
util rest of house	0.9936	0.9866	0.9688	0.9018	0.7515	0.5273	0.3562	0.3989	0.6696	0.9271	0.9852	0.9948 (89)
MIT 2	18.9693	19.1703	19.4587	19.8392	20.0652	20.1464	20.1538	20.1550	20.1201	19.8333	19.3561	18.9507 (90)
Living area fraction	19.2030	19.3941	19.6688	20.0326	20.2542	20.3356	20.3441	20.3447	20.3080	20.0252	19.5692	19.1841 (92)
MIT	19.2030	19.3941	19.6688	20.0326	20.2542	20.3356	20.3441	20.3447	20.3080	20.0252	19.5692	19.1841 (93)
Temperature adjustment												0.0000
adjusted MIT	19.2030	19.3941	19.6688	20.0326	20.2542	20.3356	20.3441	20.3447	20.3080	20.0252	19.5692	19.1841 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9914	0.9831	0.9638	0.8985	0.7584	0.5435	0.3751	0.4186	0.6839	0.9237	0.9817	0.9929 (94)
Useful gains	590.7912	655.2080	691.0912	706.0378	623.2886	439.8992	290.3415	304.7614	464.1046	566.0300	568.9042	569.8423 (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	1199.1639	1162.7377	1053.2900	877.9812	672.8397	445.5593	290.8532	305.7263	484.5814	741.3542	986.0606	1191.5648 (97)
Space heating kWh	452.6293	341.0600	269.4759	123.7993	36.8661	0.0000	0.0000	0.0000	0.0000	130.4412	300.3526	462.5616 (98a)
Space heating requirement - total per year (kWh/year)												2117.1860
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	452.6293	341.0600	269.4759	123.7993	36.8661	0.0000	0.0000	0.0000	0.0000	130.4412	300.3526	462.5616 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2117.1860
Space heating per m2										(98c) / (4) =		24.9492 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.4000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	452.6293	341.0600	269.4759	123.7993	36.8661	0.0000	0.0000	0.0000	0.0000	130.4412	300.3526	462.5616 (98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000 (210)
Space heating fuel (main heating system)	489.8585	369.1126	291.6406	133.9819	39.8983	0.0000	0.0000	0.0000	0.0000	141.1701	325.0570	500.6078 (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	236.6882	209.3173	222.6161	196.5891	191.0867	172.7720	171.0609	177.6050	179.2522	199.1500	210.8175	234.2419 (64)
Efficiency of water heater (217)m	85.7468	85.4207	84.7918	83.4182	81.5763	80.3000	80.3000	80.3000	80.3000	83.4967	85.1394	85.8106 (217)
Fuel for water heating, kWh/month	276.0316	245.0428	262.5442	235.6671	234.2430	215.1582	213.0272	221.1768	223.2281	238.5123	247.6145	272.9756 (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	26.8400	21.5320	19.3872	14.2039	10.9715	8.9638	10.0086	13.0095	16.8981	22.1712	25.0423	27.5859 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-39.4405	-55.4581	-79.4919	-89.1002	-95.8249	-89.3366	-88.2360	-83.4404	-74.9122	-63.3063	-43.3118	-34.1160 (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)												

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(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	-22.6854	-47.6912	-94.7422	-142.2295	-188.0040	-188.8910	-186.6632	-158.0619	-115.8779	-68.1705	-30.2770	-17.9405	(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												2291.3268	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												2885.2213	(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)												216.6140	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2097.2091	(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												3381.9531	(238)

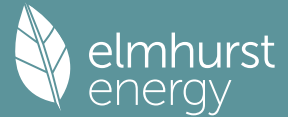
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2291.3268	0.2100	481.1786	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2885.2213	0.2100	605.8965	(264)
Space and water heating			1087.0751	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	216.6140	0.1443	31.2641	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-835.9748	0.1347	-112.5644	
PV Unit electricity exported	-1261.2343	0.1259	-158.8016	
Total			-271.3660	(269)
Total CO2, kg/year			858.9025	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.1200	(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	2291.3268	1.1300	2589.1993	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2885.2213	1.1300	3260.3001	(278)
Space and water heating			5849.4994	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	216.6140	1.5338	332.2498	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-835.9748	1.4976	-1251.9969	
PV Unit electricity exported	-1261.2343	0.4622	-582.9117	
Total			-1834.9086	(283)
Total Primary energy kWh/year			4476.9414	(286)
Target Primary Energy Rate (TPER)			52.7600	(287)

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Property Reference	Type 52 B52AX0-I Mid			Issued on Date	07/06/2024
Assessment Reference	1	Prop Type Ref			
Property	Type 52 DS00, Mid, Affordable Range, Part L2021 Masonry				
SAP Rating	91 B	DER	9.08	TER	10.12
Environmental	92 A	% DER < TER			10.28
CO ₂ Emissions (t/year)	0.71	DFEE	28.47	TFEE	29.83
Compliance Check	See BREL	% DFEE < TFEE			4.55
% DPER < TPER	6.92	DPER	49.11	TPER	52.76
Assessor Details	Ms. Ruth Ferguson			Assessor ID	AE69-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.4300 (1b)	x 2.3100 (2b)	= 98.0133 (1b) - (3b)
First floor	42.4300 (1c)	x 2.5600 (2c)	= 108.6208 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.8600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 206.6341 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1452 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.3452 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2934 (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	0.3741	0.3668	0.3594	0.3227	0.3154	0.2787	0.2787	0.2714	0.2934	0.3154	0.3301	0.3448 (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	0.5700	0.5673	0.5646	0.5521	0.5497	0.5388	0.5388	0.5368	0.5430	0.5497	0.5545	0.5594 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (Uw = 1.30)			9.9000	1.2357	12.2338		(27)
Opening Type 2			2.1400	1.2000	2.5680		(26)
Opening Type 5			2.1400	1.6000	3.4240		(26a)
225mm TE Platinum B&B			42.4300	0.0900	3.8187	135.0000	5728.0500 (28a)
100mm Ecobead	44.7600	14.1800	30.5800	0.2400	7.3392	60.0000	1834.7999 (29a)
500mm mineral wool	42.4300		42.4300	0.0900	3.8187	10.0000	424.3000 (30)
Total net area of external elements Aum(A, m ²)			129.6200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.2024		(33)
E-WM-20/22			89.9000	0.0000	0.0000	110.0000	9889.0002 (32)
Timber partitions			136.7800			7.0000	957.4600 (32c)
Solid partitions			8.8200			69.4000	612.1080 (32c)
Internal Floor 1			42.4300			18.0000	763.7400 (32d)
Internal Ceiling 1			42.4300			18.0000	763.7400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20973.1981 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							247.1506 (35)
List of Thermal Bridges							

elmhurst
energy

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	38.8660	38.6807	38.4991	37.6461	37.4865	36.7436	36.7436	36.6060	37.0297	37.4865	37.8094	38.1469 (38)
Heat transfer coeff												
	79.2128	79.0275	78.8459	77.9929	77.8333	77.0903	77.0903	76.9528	77.3765	77.8333	78.1562	78.4937 (39)
Average = Sum(39)m / 12 =												77.9921
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9335	0.9313	0.9291	0.9191	0.9172	0.9084	0.9084	0.9068	0.9118	0.9172	0.9210	0.9250 (40)
HLP (average)												0.9191
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												
Hot water usage for mixer showers												2.5486 (42)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	28.9148	28.4854	27.8806	26.7656	25.9307	25.0050	24.5049	25.1054	25.7592	26.7498	27.8878	28.8170 (42b)
Hot water usage for other uses	40.7306	39.2495	37.7684	36.2873	34.8062	33.3250	33.3250	34.8062	36.2873	37.7684	39.2495	40.7306 (42c)
Average daily hot water use (litres/day)												63.8364 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	69.6454	67.7349	65.6490	63.0529	60.7369	58.3300	57.8300	59.9116	62.0465	64.5182	67.1373	69.5476 (44)
Energy content (annual)	110.3013	96.4535	100.9001	86.3163	81.7635	71.7236	69.9403	74.1830	76.5096	87.5506	95.6494	108.8948 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m = 1060.1861											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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	93.7561	81.9855	85.7651	73.3688	69.4990	60.9650	59.4493	63.0556	65.0331	74.4180	81.3020	92.5606 (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	93.7561	81.9855	85.7651	73.3688	69.4990	60.9650	59.4493	63.0556	65.0331	74.4180	81.3020	92.5606 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m = 901.1581											
Electric shower(s)	53.6174	47.7736	52.1669	49.7822	50.7164	48.3785	49.9911	50.7164	49.7822	52.1669	51.1860	53.6174 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 609.8949 (64a)											
Heat gains from water heating, kWh/month	36.8434	32.4398	34.4830	30.7878	30.0538	27.3359	27.3601	28.4430	28.7038	31.6462	33.1220	36.5445 (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	127.4319	127.4319	127.4319	127.4319	127.4319	127.4319	127.4319	127.4319	127.4319	127.4319	127.4319	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	129.1748	143.0150	129.1748	133.4807	129.1748	133.4807	129.1748	129.1748	133.4807	129.1748	133.4807	129.1748 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	229.2978	231.6771	225.6812	212.9164	196.8032	181.6590	171.5418	169.1624	175.1584	187.9232	204.0364	219.1805 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7432	35.7432	35.7432	35.7432	35.7432	35.7432	35.7432	35.7432	35.7432	35.7432	35.7432	35.7432 (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)	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455 (71)
Water heating gains (Table 5)	49.5207	48.2735	46.3481	42.7608	40.3950	37.9665	36.7743	38.2298	39.8664	42.5353	46.0028	49.1189 (72)
Total internal gains	469.2228	484.1952	462.4337	450.3874	427.6025	414.3358	398.7205	397.7966	409.7351	420.8628	444.7494	458.7039 (73)

6. Solar gains												
[Jan]				Area	Solar flux	g			FF	Access		Gains
				m2	Table 6a	Specific data			or Table 6c	factor		W
					W/m2	or Table 6b				Table 6d		
East				5.2200	19.6403			0.7300	0.7000		0.7700	36.3055 (76)
West				4.6800	19.6403			0.7300	0.7000		0.7700	32.5497 (80)
Solar gains	68.8552	134.6953	221.8241	323.5172	396.4824	405.8703	386.4051	331.9163	257.9906	159.8274	85.8543	56.6232 (83)
Total gains	538.0780	618.8905	684.2577	773.9046	824.0850	820.2061	785.1256	729.7129	667.7256	580.6902	530.6037	515.3270 (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, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	73.5473	73.7197	73.8895	74.6977	74.8508	75.5722	75.5722	75.7073	75.2927	74.8508	74.5416	74.2211
alpha	5.9032	5.9146	5.9260	5.9798	5.9901	6.0381	6.0381	6.0472	6.0195	5.9901	5.9694	5.9481
util living area	0.9971	0.9927	0.9803	0.9267	0.7959	0.5901	0.4305	0.4819	0.7469	0.9571	0.9929	0.9977 (86)
MIT	19.9561	20.1262	20.3722	20.6984	20.9095	20.9875	20.9984	20.9969	20.9531	20.6622	20.2554	19.9302 (87)
Th 2	20.1392	20.1410	20.1428	20.1513	20.1529	20.1603	20.1603	20.1617	20.1575	20.1529	20.1497	20.1463 (88)
util rest of house	0.9961	0.9904	0.9739	0.9046	0.7457	0.5176	0.3492	0.3958	0.6748	0.9394	0.9902	0.9970 (89)
MIT 2	19.1851	19.3554	19.5991	19.9151	20.0951	20.1548	20.1599	20.1608	20.1333	19.8892	19.4916	19.1651 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	19.3589	19.5292	19.7733	20.0917	20.2787	20.3425	20.3489	20.3493	20.3181	20.0635	19.6638	19.3376 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.3589	19.5292	19.7733	20.0917	20.2787	20.3425	20.3489	20.3493	20.3181	20.0635	19.6638	19.3376 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9950	0.9883	0.9705	0.9028	0.7536	0.5337	0.3675	0.4153	0.6894	0.9371	0.9882	0.9961 (94)
Useful gains	535.3793	611.6557	664.0993	698.7169	621.0697	437.7096	288.5685	303.0208	460.3571	544.1899	524.3309	513.2927 (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	1192.8575	1156.1086	1046.5489	872.8731	667.7073	442.6948	289.0062	303.9106	481.1382	736.5723	981.9386	1188.2058 (97)
Space heating kWh	489.1638	365.8724	284.5425	125.3924	34.6984	0.0000	0.0000	0.0000	0.0000	143.1325	329.4776	502.1353 (98a)
Space heating requirement - total per year (kWh/year)	2274.4149											
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	489.1638	365.8724	284.5425	125.3924	34.6984	0.0000	0.0000	0.0000	0.0000	143.1325	329.4776	502.1353 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	2274.4149											
Space heating per m2	(98c) / (4) = 26.8020 (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	724.6493	570.4686	584.8410	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9323	0.9702	0.9542	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	675.5964	553.4543	558.0293	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	898.6088	860.4749	798.3526	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	160.5689	228.4233	178.8005	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction	fc = cooled area / (4) =											
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	40.1422	57.1058	44.7001	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement	141.9482 (107)											
Energy for space heating	26.8020 (99)											
Energy for space cooling	1.6727 (108)											
Total	28.4747 (109)											
Fabric Energy Efficiency (DFEE)	28.5 (109)											

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

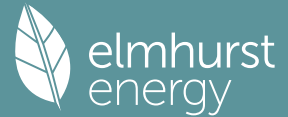
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	42.4300 (1b)	x 2.3100 (2b)	= 98.0133 (1b) - (3b)
First floor	42.4300 (1c)	x 2.5600 (2c)	= 108.6208 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.8600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 206.6341 (5)

2. Ventilation rate

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

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Number of flueless gas fires

0 * 40 = 0.0000 (7c)

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

Air changes per hour
30.0000 / (5) = 0.1452 (8)

Pressure test
Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Yes
Blower Door
5.0000 (17)
0.3952 (18)
2 (19)

Shelter factor

(20) = 1 - [0.075 x (19)] = 0.8500 (20)

Infiltration rate adjusted to include shelter factor

(21) = (18) x (20) = 0.3359 (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	0.4283	0.4199	0.4115	0.3695	0.3611	0.3191	0.3191	0.3107	0.3359	0.3611	0.3779	0.3947 (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	0.5917	0.5882	0.5847	0.5683	0.5652	0.5509	0.5509	0.5483	0.5564	0.5652	0.5714	0.5779 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			2.1400	1.0000	2.1400		(26)
TER Semi-glazed door			2.1400	1.0000	2.1400		(26a)
TER Opening Type (Uw = 1.20)			9.9000	1.1450	11.3359		(27)
225mm TE Platinum B&B			42.4300	0.1300	5.5159		(28a)
100mm Ecobead	44.7600	14.1800	30.5800	0.1800	5.5044		(29a)
500mm mineral wool	42.4300		42.4300	0.1100	4.6673		(30)
Total net area of external elements Aum(A, m2)			129.6200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	31.3035	(33)
E-WM-20/22			89.9000	0.0000	0.0000		(32)

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

247.1506 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	5.7000	0.0500	0.2850
E2 Other lintels (including other steel lintels)	3.6700	0.0500	0.1835
E3 Sill	7.3300	0.0500	0.3665
E4 Jamb	21.9000	0.0500	1.0950
E5 Ground floor (normal)	9.1900	0.1600	1.4704
E6 Intermediate floor within a dwelling	9.1900	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	9.1900	0.0600	0.5514
E18 Party wall between dwellings	19.4800	0.0600	1.1688
P1 Party wall - Ground floor	18.4600	0.0800	1.4768
P2 Party wall - Intermediate floor within a dwelling	18.4600	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	18.4600	0.1200	2.2152

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

8.8126 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 40.1161 (37)

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

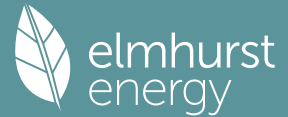
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.3484	40.1056	39.8675	38.7495	38.5403	37.5665	37.5665	37.3862	37.9416	38.5403	38.9635	39.4059 (38)
Heat transfer coeff	80.4645	80.2217	79.9836	78.8656	78.6564	77.6826	77.6826	77.5023	78.0577	78.6564	79.0796	79.5220 (39)
Average = Sum(39)m / 12 =												78.8646

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9482	0.9453	0.9425	0.9294	0.9269	0.9154	0.9154	0.9133	0.9198	0.9269	0.9319	0.9371 (40)
HLP (average)												0.9293
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.5486 (42)
Hot water usage for mixer showers													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths													
28.9148	28.4854	27.8806	26.7656	25.9307	25.0050	24.5049	25.1054	25.7592	26.7498	27.8878	28.8170	28.8170	(42b)
Hot water usage for other uses													
40.7306	39.2495	37.7684	36.2873	34.8062	33.3250	33.3250	34.8062	36.2873	37.7684	39.2495	40.7306	40.7306	(42c)
Average daily hot water use (litres/day)													63.8364 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	69.6454	67.7349	65.6490	63.0529	60.7369	58.3300	57.8300	59.9116	62.0465	64.5182	67.1373	69.5476	(44)
Energy content (annual)	110.3013	96.4535	100.9001	86.3163	81.7635	71.7236	69.9403	74.1830	76.5096	87.5506	95.6494	108.8948	(45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1060.1861	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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	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													
93.7561	81.9855	85.7651	73.3688	69.4990	60.9650	59.4493	63.0556	65.0331	74.4180	81.3020	92.5606	92.5606	(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													
93.7561	81.9855	85.7651	73.3688	69.4990	60.9650	59.4493	63.0556	65.0331	74.4180	81.3020	92.5606	92.5606	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		901.1581	(64)
Electric shower(s)												901	(64)
53.6174	47.7736	52.1669	49.7822	50.7164	48.3785	49.9911	50.7164	49.7822	52.1669	51.1860	53.6174	53.6174	(64a)

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Heat gains from water heating, kWh/month
36.8434 32.4398 34.4830 30.7878 30.0538 27.3359 27.3601 28.4430 28.7038 31.6462 33.1220 36.5445 (65)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 609.8949 (64a)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	127.4319	127.4319	127.4319	127.4319	127.4319	127.4319	127.4319	127.4319	127.4319	127.4319	127.4319	127.4319	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	129.1748	143.0150	129.1748	133.4807	129.1748	133.4807	129.1748	129.1748	133.4807	129.1748	133.4807	129.1748	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	229.2978	231.6771	225.6812	212.9164	196.8032	181.6590	171.5418	169.1624	175.1584	187.9232	204.0364	219.1805	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7432	35.7432	35.7432	35.7432	35.7432	35.7432	35.7432	35.7432	35.7432	35.7432	35.7432	35.7432	(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)	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	(71)
Water heating gains (Table 5)	49.5207	48.2735	46.3481	42.7608	40.3950	37.9665	36.7743	38.2298	39.8664	42.5353	46.0028	49.1189	(72)
Total internal gains	469.2228	484.1952	462.4337	450.3874	427.6025	414.3358	398.7205	397.7966	409.7351	420.8628	444.7494	458.7039	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d			Gains W
East					5.2200	19.6403	0.6300	0.7000	0.7700			31.3321 (76)
West					4.6800	19.6403	0.6300	0.7000	0.7700			28.0909 (80)

Solar gains	59.4230	116.2439	191.4372	279.1997	342.1698	350.2716	333.4729	286.4483	222.6494	137.9332	74.0935	48.8666 (83)
Total gains	528.6458	600.4391	653.8709	729.5872	769.7723	764.6074	732.1934	684.2449	632.3845	558.7960	518.8428	507.5704 (84)

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, nil,m (see Table 9a)													21.0000 (85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	72.4032	72.6224	72.8385	73.8711	74.0676	74.9960	74.9960	75.1705	74.6357	74.0676	73.6712	73.2614	
alpha	5.8269	5.8415	5.8559	5.9247	5.9378	5.9997	5.9997	6.0114	5.9757	5.9378	5.9114	5.8841	
util living area	0.9974	0.9939	0.9845	0.9432	0.8332	0.6321	0.4642	0.5160	0.7798	0.9645	0.9937	0.9979	(86)
MIT	19.9191	20.0797	20.3161	20.6464	20.8802	20.9816	20.9975	20.9954	20.9395	20.6291	20.2250	19.8996	(87)
Th 2	20.1267	20.1291	20.1315	20.1426	20.1447	20.1544	20.1544	20.1562	20.1507	20.1447	20.1405	20.1361	(88)
util rest of house	0.9965	0.9919	0.9793	0.9247	0.7859	0.5562	0.3764	0.4240	0.7089	0.9492	0.9914	0.9972	(89)
MIT 2	19.1382	19.2998	19.5352	19.8609	20.0660	20.1462	20.1538	20.1549	20.1187	19.8518	19.4541	19.1264	(90)
Living area fraction									fLA = Living area / (4) =			0.2254	(91)
MIT	19.3143	19.4756	19.7113	20.0380	20.2495	20.3345	20.3440	20.3444	20.3037	20.0270	19.6279	19.3007	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3143	19.4756	19.7113	20.0380	20.2495	20.3345	20.3440	20.3444	20.3037	20.0270	19.6279	19.3007	(93)

8. Space heating requirement

Utilisation	0.9954	0.9900	0.9762	0.9220	0.7922	0.5729	0.3963	0.4448	0.7227	0.9466	0.9895	0.9964	(94)
Useful gains	526.2290	594.4233	638.2952	672.7044	609.8476	438.0286	290.1502	304.3613	456.9944	528.9326	513.3809	505.7191	(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	1208.1160	1169.2807	1056.6841	878.4041	672.4735	445.4710	290.8401	305.6987	484.2483	741.4948	990.6996	1200.8379	(97)
Space heating kWh	507.3239	386.3041	311.2813	148.1038	46.5937	0.0000	0.0000	0.0000	0.0000	158.1463	343.6695	517.1684	(98a)
Space heating requirement - total per year (kWh/year)												2418.5909	
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	507.3239	386.3041	311.2813	148.1038	46.5937	0.0000	0.0000	0.0000	0.0000	158.1463	343.6695	517.1684	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2418.5909	
Space heating per m ²										(98c) / (4) =		28.5010	(99)

8c. Space cooling requirement

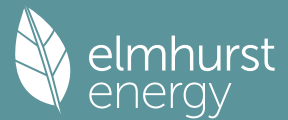
Calculated for June, July and August. See Table 10b

Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	730.2167	574.8514	589.0175	0.0000	0.0000	0.0000	0.0000	(100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.9073	0.9567	0.9369	0.0000	0.0000	0.0000	0.0000	(101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	662.4995	549.9517	551.8508	0.0000	0.0000	0.0000	0.0000	(102)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	833.6233	798.6061	745.2082	0.0000	0.0000	0.0000	0.0000	(103)
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	30.8023	46.2497	35.9645	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												113.0165	(107)
Energy for space heating												28.5010	(99)
Energy for space cooling												1.3318	(108)

Total
Fabric Energy Efficiency (TFEE)

29.8328 (109)
29.8 (109)

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Property Reference	Type 52 B52AX0-I Mid				Issued on Date	07/06/2024
Assessment Reference	1	Prop Type Ref				
Property	Type 52 DS00, Mid, Affordable Range, Part L2021 Masonry					
SAP Rating	91 B	DER	9.08	TER	10.12	
Environmental	92 A	% DER < TER				10.28
CO ₂ Emissions (t/year)	0.71	DFEE	28.47	TFEE	29.83	
Compliance Check	See BREL	% DFEE < TFEE				4.55
% DPER < TPER	6.92	DPER	49.11	TPER	52.76	
Assessor Details	Ms. Ruth Ferguson				Assessor ID	AE69-0001
Client						

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.4300 (1b)	x 2.3100 (2b)	= 98.0133 (1b) - (3b)
First floor	42.4300 (1c)	x 2.5600 (2c)	= 108.6208 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.8600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 206.6341 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	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	4.0000 (17)
Infiltration rate	0.2000 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1700 (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	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998 (22b)
Mechanical extract ventilation - decentralised												
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)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (Uw = 1.30)			9.9000	1.2357	12.2338		(27)
Opening Type 2			2.1400	1.2000	2.5680		(26)
Opening Type 5			2.1400	1.6000	3.4240		(26a)
225mm TE Platinum B&B			42.4300	0.0900	3.8187	135.0000	5728.0500 (28a)
100mm Ecobead	44.7600	14.1800	30.5800	0.2400	7.3392	60.0000	1834.7999 (29a)
500mm mineral wool	42.4300		42.4300	0.0900	3.8187	10.0000	424.3000 (30)
Total net area of external elements Aum(A, m ²)			129.6200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.2024		(33)
E-WM-20/22			89.9000	0.0000	0.0000	110.0000	9889.0002 (32)
Timber partitions			136.7800			7.0000	957.4600 (32c)
Solid partitions			8.8200			69.4000	612.1080 (32c)
Internal Floor 1			42.4300			18.0000	763.7400 (32d)
Internal Ceiling 1			42.4300			18.0000	763.7400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20973.1981 (34)

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

247.1506 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	5.7000	0.0260	0.1482
E2 Other lintels (including other steel lintels)	3.6700	0.0400	0.1468
E3 Sill	7.3300	0.0310	0.2272
E4 Jamb	21.9000	0.0360	0.7884
E5 Ground floor (normal)	9.1900	0.0590	0.5422
E6 Intermediate floor within a dwelling	9.1900	0.0060	0.0551
E10 Eaves (insulation at ceiling level)	9.1900	0.1240	1.1396
E18 Party wall between dwellings	19.4800	0.0530	1.0324
P1 Party wall - Ground floor	18.4600	0.0890	1.6429
P2 Party wall - Intermediate floor within a dwelling	18.4600	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	18.4600	0.0770	1.4214

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

7.1443 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 40.3468 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	34.0946	34.0946	34.0946	34.0946	34.0946	34.0946	34.0946	34.0946	34.0946	34.0946	34.0946	34.0946
Average = Sum(39)m / 12 =	74.4414	74.4414	74.4414	74.4414	74.4414	74.4414	74.4414	74.4414	74.4414	74.4414	74.4414	74.4414

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.8772	0.8772	0.8772	0.8772	0.8772	0.8772	0.8772	0.8772	0.8772	0.8772	0.8772	0.8772
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.5486 (42)											
Hot water usage for mixer showers	66.9520 65.9459 64.4797 61.6744 59.6042 57.2956 55.9833 57.4384 59.0334 61.5122 64.3777 66.6955 (42a)											
Hot water usage for baths	28.9148 28.4854 27.8806 26.7656 25.9307 25.0050 24.5049 25.1054 25.7592 26.7498 27.8878 28.8170 (42b)											
Hot water usage for other uses	40.7306 39.2495 37.7684 36.2873 34.8062 33.3250 33.3250 34.8062 36.2873 37.7684 39.2495 40.7306 (42c)											
Average daily hot water use (litres/day)	125.5639 (43)											
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	136.5974	133.6807	130.1287	124.7274	120.3411	115.6256	113.8133	117.3500	121.0799	126.0305	131.5150	136.2431 (44)
Energy content (annual)	216.3369	190.3596	200.0030	170.7455	162.0023	142.1751	137.6473	145.3038	149.3037	171.0221	187.3673	213.3238 (45)
Distribution loss (46)m = 0.15 x (45)m	32.4505 28.5539 30.0004 25.6118 24.3003 21.3263 20.6471 21.7956 22.3955 25.6533 28.1051 31.9986 (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	5.4922	4.9506	5.4595	5.2378	5.3835	5.1807	5.3348	5.3501	5.1949	5.4016	5.2710	5.4862 (61)
Total heat required for water heating calculated for each month												
WWHRS	221.8291	195.3102	205.4625	175.9833	167.3858	147.3558	142.9821	150.6539	154.4986	176.4237	192.6383	218.8100 (62)
FV diverter	-59.6194	-52.7279	-55.2136	-45.7190	-42.6085	-36.4604	-34.1758	-36.3425	-37.7233	-44.4716	-50.3810	-58.5153 (63a)
Solar input	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	162.2097	142.5823	150.2489	130.2643	124.7773	110.8954	108.8063	114.3113	116.7752	131.9521	142.2574	160.2947 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m = 1595.3750 (64)											
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	73.3051	64.5322	67.8659	58.0823	55.2116	48.5684	47.1014	49.6510	50.9422	58.2153	63.6174	72.3017 (65)

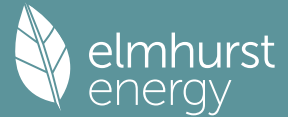
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	127.4319	127.4319	127.4319	127.4319	127.4319	127.4319	127.4319	127.4319	127.4319	127.4319	127.4319	127.4319 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	129.1748	143.0150	129.1748	133.4807	129.1748	133.4807	129.1748	129.1748	133.4807	129.1748	133.4807	129.1748 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	229.2978	231.6771	225.6812	212.9164	196.8032	181.6590	171.5418	169.1624	175.1584	187.9232	204.0364	219.1805 (68)
Pumps, fans	35.7432	35.7432	35.7432	35.7432	35.7432	35.7432	35.7432	35.7432	35.7432	35.7432	35.7432	35.7432 (69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455 (71)
Total internal gains	98.5283	96.0301	91.2176	80.6699	74.2092	67.4561	63.3084	66.7353	70.7530	78.2463	88.3575	97.1797 (72)
Solar gains	521.2305	534.9518	510.3031	491.2965	464.4168	443.8254	425.2546	426.3021	440.6217	459.5739	490.1041	509.7647 (73)

6. Solar gains

[Jan]														
	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
East	5.2200				19.6403		0.7300		0.7000		0.7700		36.3055 (76)	
West	4.6800				19.6403		0.7300		0.7000		0.7700		32.5497 (80)	
Solar gains	68.8552	134.6953	221.8241	323.5172	396.4824	405.8703	386.4051	331.9163	257.9906	159.8274	85.8543	56.6232 (83)		

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Total gains 590.0857 669.6471 732.1272 814.8137 860.8992 849.6957 811.6597 758.2183 698.6122 619.4013 575.9584 566.3878 (84)

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.2614	78.2614	78.2614	78.2614	78.2614	78.2614	78.2614	78.2614	78.2614	78.2614	78.2614	78.2614	
alpha	6.2174	6.2174	6.2174	6.2174	6.2174	6.2174	6.2174	6.2174	6.2174	6.2174	6.2174	6.2174	
util living area	0.9949	0.9880	0.9693	0.9007	0.7529	0.5538	0.4027	0.4499	0.7030	0.9376	0.9882	0.9960	(86)
MIT	20.1195	20.2795	20.5038	20.7761	20.9408	20.9922	20.9991	20.9982	20.9697	20.7404	20.3752	20.0787	(87)
Th 2	20.1869	20.1869	20.1869	20.1869	20.1869	20.1869	20.1869	20.1869	20.1869	20.1869	20.1869	20.1869	(88)
util rest of house	0.9933	0.9844	0.9603	0.8743	0.7019	0.4865	0.3288	0.3713	0.6324	0.9145	0.9841	0.9948	(89)
MIT 2	19.1597	19.3625	19.6431	19.9668	20.1395	20.1826	20.1866	20.1863	20.1675	19.9334	19.4853	19.1078	(90)
Living area fraction									fLA = Living area / (4) =				0.2254 (91)
MIT	19.3761	19.5692	19.8371	20.1492	20.3202	20.3651	20.3698	20.3693	20.3483	20.1153	19.6859	19.3267	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.2261	19.4192	19.6871	19.9992	20.1702	20.2151	20.2198	20.2193	20.1983	19.9653	19.5359	19.1767	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9907	0.9800	0.9533	0.8674	0.7008	0.4889	0.3318	0.3744	0.6335	0.9069	0.9796	0.9926	(94)
Useful gains	584.6190	656.2384	697.9669	706.7474	603.3174	415.3996	269.2696	283.9137	442.5617	561.7167	564.1917	562.2220	(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	1111.1178	1080.8294	981.6665	826.2431	630.5313	417.9946	269.4593	284.3131	453.9680	697.1664	925.7475	1114.8851	(97)
Space heating kWh	391.7151	285.3251	211.0725	86.0369	20.2471	0.0000	0.0000	0.0000	0.0000	100.7746	260.3202	411.1813	(98a)
Space heating requirement - total per year (kWh/year)												1766.6728	
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	391.7151	285.3251	211.0725	86.0369	20.2471	0.0000	0.0000	0.0000	0.0000	100.7746	260.3202	411.1813	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1766.6728	
Space heating per m2										(98c) / (4) =		20.8187	(99)

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

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

Fraction of space heat from main system(s)

Efficiency of main space heating system 1 (in %)

Efficiency of main space heating system 2 (in %)

Efficiency of secondary/supplementary heating system, %

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	391.7151	285.3251	211.0725	86.0369	20.2471	0.0000	0.0000	0.0000	0.0000	100.7746	260.3202	411.1813	(98)
Space heating efficiency (main heating system 1)	89.0000	89.0000	89.0000	89.0000	89.0000	0.0000	0.0000	0.0000	0.0000	89.0000	89.0000	89.0000	(210)
Space heating fuel (main heating system)	440.1294	320.5901	237.1601	96.6707	22.7495	0.0000	0.0000	0.0000	0.0000	113.2298	292.4946	462.0015	(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	162.2097	142.5823	150.2489	130.2643	124.7773	110.8954	108.8063	114.3113	116.7752	131.9521	142.2574	160.2947	(64)
Efficiency of water heater (217)m	88.4954	88.4262	88.2851	87.9684	87.5334	87.3000	87.3000	87.3000	87.3000	88.0281	88.3918	87.3000	(216)
Fuel for water heating, kWh/month	183.2974	161.2443	170.1860	148.0808	142.5482	127.0280	124.6349	130.9408	133.7632	149.8977	160.9396	181.0901	(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	9.6726	8.7365	9.6726	9.3606	9.6726	9.3606	9.6726	9.6726	9.3606	9.6726	9.3606	9.6726	(231)
Lighting	26.4702	21.2353	19.1201	14.0082	10.8203	8.8403	9.8707	12.8303	16.6652	21.8657	24.6973	27.2058	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-10.3628	-17.3437	-30.0193	-39.8417	-47.8199	-46.4250	-45.5348	-40.1935	-31.6672	-21.8558	-12.1665	-8.5867	(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	-2.3065	-5.7912	-14.2380	-25.7949	-38.2289	-40.0777	-39.0301	-30.4835	-19.1757	-9.0814	-3.2649	-1.7370	(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												1985.0256	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												87.3000	
Water heating fuel used												1813.6512	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:

(MEV)Decentralised, Database: total watage = 3.2080, total flow = 29.0000, SFP = 0.1106)

mechanical ventilation fans (SFP = 0.1106)

central heating pump

27.8868 (230a)

41.0000 (230c)

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main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	113.8868 (231)
Electricity for lighting (calculated in Appendix L)	213.6294 (232)

Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-581.0267 (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	3545.1663 (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	1985.0256	0.2100	416.8554 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1813.6512	0.2100	380.8668 (264)
Space and water heating			797.7221 (265)
Pumps, fans and electric keep-hot	113.8868	0.1387	15.7975 (267)
Energy for lighting	213.6294	0.1443	30.8333 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-351.8169	0.1315	-46.2663
PV Unit electricity exported	-229.2098	0.1215	-27.8527
Total			-74.1190 (269)
Total CO2, kg/year			770.2340 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			9.0800 (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	1985.0256	1.1300	2243.0790 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1813.6512	1.1300	2049.4259 (278)
Space and water heating			4292.5048 (279)
Pumps, fans and electric keep-hot	113.8868	1.5128	172.2879 (281)
Energy for lighting	213.6294	1.5338	327.6719 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-351.8169	1.4859	-522.7473
PV Unit electricity exported	-229.2098	0.4458	-102.1870
Total			-624.9343 (283)
Total Primary energy kWh/year			4167.5303 (286)
Dwelling Primary energy Rate (DPER)			49.1100 (287)

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

1. Overall dwelling characteristics

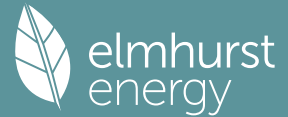
	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	42.4300 (1b)	x 2.3100 (2b)	= 98.0133 (1b) - (3b)
First floor	42.4300 (1c)	x 2.5600 (2c)	= 108.6208 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.8600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	206.6341 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1452 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3952 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3359 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)

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Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infiltr rate	0.4283	0.4199	0.4115	0.3695	0.3611	0.3191	0.3191	0.3107	0.3359	0.3611	0.3779	0.3947 (22b)
Effective ac	0.5917	0.5882	0.5847	0.5683	0.5652	0.5509	0.5509	0.5483	0.5564	0.5652	0.5714	0.5779 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			2.1400	1.0000	2.1400		(26)
TER Semi-glazed door			2.1400	1.0000	2.1400		(26a)
TER Opening Type (Uw = 1.20)			9.9000	1.1450	11.3359		(27)
225mm TE Platinum B&B			42.4300	0.1300	5.5159		(28a)
100mm Ecobead	44.7600	14.1800	30.5800	0.1800	5.5044		(29a)
500mm mineral wool	42.4300		42.4300	0.1100	4.6673		(30)
Total net area of external elements Aum(A, m2)			129.6200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.3035		(33)
E-WM-20/22			89.9000	0.0000	0.0000		(32)

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

247.1506 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	5.7000	0.0500	0.2850
E2 Other lintels (including other steel lintels)	3.6700	0.0500	0.1835
E3 Sill	7.3300	0.0500	0.3665
E4 Jamb	21.9000	0.0500	1.0950
E5 Ground floor (normal)	9.1900	0.1600	1.4704
E6 Intermediate floor within a dwelling	9.1900	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	9.1900	0.0600	0.5514
E18 Party wall between dwellings	19.4800	0.0600	1.1688
P1 Party wall - Ground floor	18.4600	0.0800	1.4768
P2 Party wall - Intermediate floor within a dwelling	18.4600	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	18.4600	0.1200	2.2152
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			8.8126 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss		(33) + (36) + (36a) =	40.1161 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.3484	40.1056	39.8675	38.7495	38.5403	37.5665	37.5665	37.3862	37.9416	38.5403	38.9635	39.4059 (38)
Heat transfer coeff	80.4645	80.2217	79.9836	78.8656	78.6564	77.6826	77.6826	77.5023	78.0577	78.6564	79.0796	79.5220 (39)
Average = Sum(39)m / 12 =												78.8646
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9482	0.9453	0.9425	0.9294	0.9269	0.9154	0.9154	0.9133	0.9198	0.9269	0.9319	0.9371 (40)
HLP (average)												0.9293
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

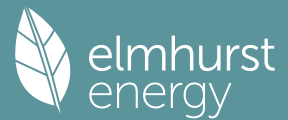
4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5486 (42)
Hot water usage for mixer showers												
66.9520	65.9459	64.4797	61.6744	59.6042	57.2956	55.9833	57.4384	59.0334	61.5122	64.3777	66.6955 (42a)	
Hot water usage for baths												
28.9148	28.4854	27.8806	26.7656	25.9307	25.0050	24.5049	25.1054	25.7592	26.7498	27.8878	28.8170 (42b)	
Hot water usage for other uses												
40.7306	39.2495	37.7684	36.2873	34.8062	33.3250	33.3250	34.8062	36.2873	37.7684	39.2495	40.7306 (42c)	
Average daily hot water use (litres/day)												125.5639 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	136.5974	133.6807	130.1287	124.7274	120.3411	115.6256	113.8133	117.3500	121.0799	126.0305	131.5150	136.2431 (44)
Energy content (annual)	216.3369	190.3596	200.0030	170.7455	162.0023	142.1751	137.6473	145.3038	149.3037	171.0221	187.3673	213.3238 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		2085.5904
32.4505	28.5539	30.0004	25.6118	24.3003	21.3263	20.6471	21.7956	22.3955	25.6533	28.1051	31.9986 (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 (59)	
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
267.2958	236.3870	250.9619	220.0606	212.9612	191.4902	188.6062	196.2627	198.6187	221.9810	236.6823	264.2827 (62)	
WWHRS	-30.6077	-27.0697	-28.3458	-23.4714	-21.8745	-18.7182	-17.5453	-18.6577	-19.3666	-22.8311	-25.8648	-30.0409 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)	
Output from w/h												
236.6882	209.3173	222.6161	196.5891	191.0867	172.7720	171.0609	177.6050	179.2522	199.1500	210.8175	234.2419 (64)	
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2401.1967 (64)
Electric shower(s)												2401 (64)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)	
												0.0000 (64a)
Heat gains from water heating, kWh/month												
84.6718	74.8014	79.2407	69.1017	66.6055	59.6020	58.5075	61.0532	61.9722	69.6046	74.6284	83.6699 (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	127.4319	127.4319	127.4319	127.4319	127.4319	127.4319	127.4319	127.4319	127.4319	127.4319	127.4319	127.4319 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	129.1748	143.0150	129.1748	133.4807	129.1748	133.4807	129.1748	129.1748	133.4807	129.1748	133.4807	129.1748 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	229.2978	231.6771	225.6812	212.9164	196.8032	181.6590	171.5418	169.1624	175.1584	187.9232	204.0364	219.1805 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	35.7432	35.7432	35.7432	35.7432	35.7432	35.7432	35.7432	35.7432	35.7432	35.7432	35.7432	35.7432 (69)

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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)	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455	-101.9455 (71)
Water heating gains (Table 5)	113.8061	111.3116	106.5063	95.9745	89.5235	82.7806	78.6390	82.0608	86.0725	93.5546	103.6505	112.4595 (72)
Total internal gains	536.5083	550.2333	525.5919	506.6011	479.7311	459.1498	440.5853	441.6276	455.9412	474.8821	505.3972	525.0445 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
East				5.2200	19.6403	0.6300	0.7000	0.7700	31.3321 (76)			
West				4.6800	19.6403	0.6300	0.7000	0.7700	28.0909 (80)			
Solar gains	59.4230	116.2439	191.4372	279.1997	342.1698	350.2716	333.4729	286.4483	222.6494	137.9332	74.0935	48.8666 (83)
Total gains	595.9312	666.4773	717.0291	785.8009	821.9009	809.4215	774.0581	728.0759	678.5906	612.8153	579.4906	573.9110 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	72.4032	72.6224	72.8385	73.8711	74.0676	74.9960	74.9960	75.1705	74.6357	74.0676	73.6712	73.2614
alpha	5.8269	5.8415	5.8559	5.9247	5.9378	5.9997	5.9997	6.0114	5.9757	5.9378	5.9114	5.8841
util living area	0.9951	0.9897	0.9763	0.9245	0.8016	0.6011	0.4397	0.4862	0.7423	0.9478	0.9891	0.9960 (86)
MIT	20.0062	20.1630	20.3907	20.6973	20.9034	20.9858	20.9981	20.9967	20.9536	20.6847	20.3015	19.9860 (87)
Th 2	20.1267	20.1291	20.1315	20.1426	20.1447	20.1544	20.1544	20.1562	20.1507	20.1447	20.1405	20.1361 (88)
util rest of house	0.9936	0.9866	0.9688	0.9018	0.7515	0.5273	0.3562	0.3989	0.6696	0.9271	0.9852	0.9948 (89)
MIT 2	18.9693	19.1703	19.4587	19.8392	20.0652	20.1464	20.1538	20.1550	20.1201	19.8333	19.3561	18.9507 (90)
Living area fraction	19.2030	19.3941	19.6688	20.0326	20.2542	20.3356	20.3441	20.3447	20.3080	20.0252	19.5692	19.1841 (92)
MIT	19.2030	19.3941	19.6688	20.0326	20.2542	20.3356	20.3441	20.3447	20.3080	20.0252	19.5692	19.1841 (93)
Temperature adjustment	19.2030	19.3941	19.6688	20.0326	20.2542	20.3356	20.3441	20.3447	20.3080	20.0252	19.5692	19.1841 (93)
adjusted MIT	19.2030	19.3941	19.6688	20.0326	20.2542	20.3356	20.3441	20.3447	20.3080	20.0252	19.5692	19.1841 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9914	0.9831	0.9638	0.8985	0.7584	0.5435	0.3751	0.4186	0.6839	0.9237	0.9817	0.9929 (94)
Ext temp.	590.7912	655.2080	691.0912	706.0378	623.2886	439.8992	290.3415	304.7614	464.1046	566.0300	568.9042	569.8423 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	1199.1639	1162.7377	1053.2900	877.9812	672.8397	445.5593	290.8532	305.7263	484.5814	741.3542	986.0606	1191.5648 (97)
Space heating requirement - total per year (kWh/year)	452.6293	341.0600	269.4759	123.7993	36.8661	0.0000	0.0000	0.0000	0.0000	130.4412	300.3526	462.5616 (98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	452.6293	341.0600	269.4759	123.7993	36.8661	0.0000	0.0000	0.0000	0.0000	130.4412	300.3526	462.5616 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (99)
Space heating per m2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.4000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	452.6293	341.0600	269.4759	123.7993	36.8661	0.0000	0.0000	0.0000	0.0000	130.4412	300.3526	462.5616 (98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000 (210)
Space heating fuel (main heating system)	489.8585	369.1126	291.6406	133.9819	39.8983	0.0000	0.0000	0.0000	0.0000	141.1701	325.0570	500.6078 (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	236.6882	209.3173	222.6161	196.5891	191.0867	172.7720	171.0609	177.6050	179.2522	199.1500	210.8175	234.2419 (64)
Efficiency of water heater (217)m	85.7468	85.4207	84.7918	83.4182	81.5763	80.3000	80.3000	80.3000	80.3000	83.4967	85.1394	80.3000 (216)
Fuel for water heating, kWh/month	276.0316	245.0428	262.5442	235.6671	234.2430	215.1582	213.0272	221.1768	223.2281	238.5123	247.6145	272.9756 (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	26.8400	21.5320	19.3872	14.2039	10.9715	8.9638	10.0086	13.0095	16.8981	22.1712	25.0423	27.5859 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-39.4405	-55.4581	-79.4919	-89.1002	-95.8249	-89.3366	-88.2360	-83.4404	-74.9122	-63.3063	-43.3118	-34.1160 (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)												

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(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	-22.6854	-47.6912	-94.7422	-142.2295	-188.0040	-188.8910	-186.6632	-158.0619	-115.8779	-68.1705	-30.2770	-17.9405	(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												2291.3268	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												2885.2213	(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)												216.6140	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2097.2091	(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												3381.9531	(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	2291.3268	0.2100	481.1786	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2885.2213	0.2100	605.8965	(264)
Space and water heating			1087.0751	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	216.6140	0.1443	31.2641	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-835.9748	0.1347	-112.5644	
PV Unit electricity exported	-1261.2343	0.1259	-158.8016	
Total			-271.3660	(269)
Total CO2, kg/year			858.9025	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.1200	(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	2291.3268	1.1300	2589.1993	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2885.2213	1.1300	3260.3001	(278)
Space and water heating			5849.4994	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	216.6140	1.5338	332.2498	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-835.9748	1.4976	-1251.9969	
PV Unit electricity exported	-1261.2343	0.4622	-582.9117	
Total			-1834.9086	(283)
Total Primary energy kWh/year			4476.9414	(286)
Target Primary Energy Rate (TPER)			52.7600	(287)