



Designed SAP Calculation

Carbon Emissions Calculation - Part L England

Development at Meadow View, Blagrove Lane, Caversham, Reading, RG4 7DX.

For Mr. Sean Carney and Mrs. Tara Walsh

8th August 2023

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

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

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

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

This document contains the following information:

1. U-values used.
2. DER-TER, DFEE-TFEE & DPER-TPER Comparison
3. Construction, heating & ventilation overview
4. Explanation of SAP
5. Conclusion

Appendix: SAP Calculation outputs including BREL reports

Project Ref: 709849

Report Date: 08/08/2023

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1. U-Values

The table below outlines the Part L threshold or 'back-stop' U-values alongside the proposed dwelling U-values that have been used to run the calculation.

Building Element	Part L Threshold U-values	Proposed U-values*
Wall	0.26	0.16/0.14/0.13
Floor	0.18	0.13
Slope Roof	0.16	0.11
Flat Roof	0.16	0.11
Window /Glazed/Half glazed/Solid Door	1.60	1.40/1.20
Roof Light	2.20	1.40

*Please note that these U-values are based on the element's component parts listed in section 3 of this report. If the element construction changes the U-value may also change.

2. DER-TER, DFEE-TFEE & DPER-TPER Comparison

The tables below highlight the proposed dwelling emission rating, fabric energy efficiency and primary energy rating against the target set out by a notional dwelling:

Averaged	Result
DER (Dwelling Emission Rate)	3.05
TER (Target Emission Rate)	11.27
Overall Result	Pass

Averaged	Result
DFEE (Dwelling Fabric Energy Efficiency)	46.95
TFEE (Target Fabric Energy Efficiency)	47.55
Overall Result	Pass

Averaged	Result
DPER (Dwelling Primary Energy Rating)	31.19
TPER (Target Primary Energy Rating)	59.72
Overall Result	Pass

As outlined in the tables above Regulation 26, 26A, 26B & 26C have been met.

3. Construction, heating & ventilation overview

The table below lists all the construction, heating & ventilation details for the proposed dwelling:

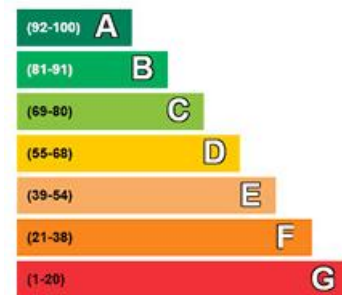
Building Element	Construction	U Value
Wall	Dormer wall – U value as calculated. 120mm stud frame filled with 100mm Celotex.	0.16
	Basement Wall - U value as Calculated. 300mm Reinforced Concrete, 140mm Celotex with 10mm air gap, 150mm lightweight Concrete block.	0.13
	Cavity wall – U value as Provided.	0.14
	Timber frame wall – U value as Provided.	0.14
Floor	Solid Floor – U value as Provided	0.13
Roof	Flat Roof – U value as Provided.	0.11
	Slope Roof – U value as Provided.	0.11
Opening	Windows/ Roof Light/ Glazed Door - Double glazed	1.40
	Half Glazed Door - Double Glazed	1.20
	Solid Door	1.00
System		Efficiency
Primary heating	Air source Heat Pump feeding radiators and Underfloor: Eg: Grant AERONA HPID12R32	325.3%
Secondary heating	Log burner, Wood Logs	65.0%
Water Heating	From main system, 200L cylinder	*Size tbc
Heating controls	Time and temperature zone control	
Ventilation	Natural	
Renewables	6 PV panels –1.8kWp total on South	Assumed 300W each
Others		
Air permeability	A design air permeability of 5.00m ³ /(h.m ²) at 50Pa has been allowed for.	
Thermal Bridging	Psi values from Table R2 under SAP10 conventions have been followed as a guideline. **These will either need to be calculated or provided by the insulation manufacturer themselves at as-built stage**.	
Lighting	100% L.E.L fittings have been allowed for.	Power = 10W Efficacy = 75 lm/W

4. SAP Explanation

4.1 What is a SAP?

SAP stands for 'Standard Assessment Procedure' and is the only, official government approved system for assessing the energy and carbon emissions rating for new dwellings.

A SAP rating is a way of comparing energy performance of different dwellings – it results in a figure between 1 and 100+ (100 representing zero energy cost and anything over means you are exporting energy). The higher the SAP rating, the lower the fuel costs and the lower the associated emissions of carbon dioxide.



The SAP Calculations establish an energy cost based on the construction of the home, its heating system, internal lighting and any renewable technologies installed. It does **not** include energy used for cooking or appliances; this would be unregulated energy.

4.2 How is the SAP calculated?

The SAP Assessor will work from provided plans and construction details, together with a full HVAC (heating, ventilation and (where applicable) air conditioning) specification.

The assessor will scale off these plans either electronically or by hand to create a model of the dwelling(s) in SAP software. Once the site form is established, the heating, lighting and ventilation systems are added – specific products will be chosen from manufacturer databases where they are known.

All thermal elements (walls, floors, roofs and openings) are added in detail together with all calculations for thermal junctions. Any renewable technologies and cooling are also added.

Once complete, a SAP calculation is capable of producing a raft of detailed reporting outputs, from site form, heat losses and energy demand to seasonal variations, CO₂ emissions and renewables contributions amongst others.

4.3 Carbon Emissions

The headline emissions target is achieved using the DER/TER figures. CO₂ emissions are measured by comparing a Target Emission Rate (TER) against the predicted Dwelling Emission Rate (DER).

This target rate is set within the SAP calculations by reference to a notional dwelling of the same size and shape, using a set of baseline values.

4.4 Fabric Energy Efficiency

Fabric Energy Efficiency (FEE) is assessed using DFEE/TFEE figures. As with emissions the target is set within SAP using a set of baseline values depending on the size of the property.

It is a measure of the energy demand in units of kilowatt-hours per m² per year. How well a dwelling retains the heat it produces will have an impact on its CO₂ emissions as well as being assessed separately to gauge compliance.

4.5 Primary Energy Rating

The Primary Energy Rating is assessed using the DPER/TPER figures. It considers how much energy in kilowatt hours is required to provide heating and hot water to a newly built dwelling. It will also include energy used by lighting, ventilation, cooling systems and showers.

A notional specification will be used to set the target rate again using a set of baseline values as per the FEE and emissions.

5. Conclusion

The proposed development at Meadow View, Blagrove Lane, Caversham, Reading achieves an SAP rating of **84B** and an Environmental Impact (EI) rating of **97A**.

Appendix:

SAP Calculation Outputs

Building Regulations England Part L (BREL) Compliance Report

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

Date: Tue 08 Aug 2023 12:02:38

Project Information			
Assessed By	Kyle Jones	Building Type	House, Detached
OCDEA Registration	EES/027281	Assessment Date	2023-08-08

Dwelling Details			
Assessment Type	As designed	Total Floor Area	304 m ²
Site Reference	709849	Plot Reference	709849
Address	Meadow View Blagrove Lane, Caversham, Reading, RG47DX		

Client Details	
Name	Tara Walsh
Company	NA
Address	23 Wantage Road, Reading, RG30 2SH

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

1a Target emission rate and dwelling emission rate			
Fuel for main heating system	Electricity		
Target carbon dioxide emission rate	11.27 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	3.05 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	59.72 kWh _{PE} /m ²		
Dwelling primary energy	31.19 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	47.6 kWh/m ²		
Dwelling fabric energy efficiency	46.9 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.14	Walls (4) (0.33)	OK
Party walls	0.2	N/A	N/A	N/A
Curtain walls	1.6	N/A	N/A	N/A
Floors	0.18	0.13	Basement Floor` (0.13)	OK
Roofs	0.16	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	1.6	1.38	W (1.4)	OK
Rooflights	2.2	1.4	N, North (1.4)	OK

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	Net area [m ²]	U-Value [W/m ² K]
Exposed wall: Walls (1)	208.99	0.14 (!)
Exposed wall: Walls (2)	15.7	0.14 (!)
Exposed wall: Walls (3)	61.13	0.13 (!)
Exposed wall: Walls (4)	8.76	0.33
Exposed wall: Walls (5)	8.77	0.16
Basement floor: Basement Floor`, Basement Floor`	45.83	0.13
Ground floor: Ground Floor , Ground Floor	100.78	0.13
Exposed roof: Roof (1)	166.54	0.11
Exposed roof: Roof (2)	11.86	0.11
Exposed roof: Roof (3)	1.51	0.08 (!)

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
W, Window	4.97	West	0.7	1.4
W, Window	15.5	West	0.7	1.4
W, Solid Door	2.32	West	N/A	1 (!)
W, Dormer Windows	2	West	0.7	1.4
S, Half Glazed Door	2.16	South	N/A	1.2
E, Window	28.81	East	0.7	1.4
E, Dormer Windows	2.15	East	0.7	1.4

Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
N, Window	7.04	North	0.7	1.4
N, Roof Light	0.76	North	0.7	1.4

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E3: Sill	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.16	
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.07	
External wall	E11: Eaves (insulation at rafter level)	Calculated by person with suitable expertise	0.04	
External wall	E13: Gable (insulation at rafter level)	Calculated by person with suitable expertise	0.08	
External wall	E14: Flat roof	Calculated by person with suitable expertise	0.08	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	-0.09	
Roof	R1: Head of roof window	Calculated by person with suitable expertise	0.08	
Roof	R2: Sill of roof window	Calculated by person with suitable expertise	0.06	
Roof	R3: Jamb of roof window	Calculated by person with suitable expertise	0.08	

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

Maximum permitted air permeability at 50Pa	8 m ³ /hm ²	
Dwelling air permeability at 50Pa	5 m ³ /hm ² , Design value	OK
Air permeability test certificate reference		

4 Space heating

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

Efficiency	325.3%
Emitter type	Underfloor
Flow temperature	45°C
System type	Heat Pump
Manufacturer	Grant Engineering (UK) Ltd
Model	AERONA3
Commissioning	

Secondary heating system: Closed room heater

Fuel	Wood logs
Efficiency	65.0%
Commissioning	

5 Hot water

Cylinder/store - type: Cylinder

Capacity	200 litres
Declared heat loss	2 kWh/day
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	

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

Efficiency	
Manufacturer	
Model	

6 Controls		
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services		
Function		
Ecodesign class		
Manufacturer		
Model		
Water heating - type: Cylinder thermostat and HW separately timed		
Manufacturer		
Model		
7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	75 lm/W	OK
External lights control	N/A	
8 Mechanical ventilation		
System type: N/A		
Maximum permitted specific fan power	N/A	
Specific fan power	N/A	N/A
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model		
Commissioning		
9 Local generation		
Technology type: Photovoltaic system (1)		
Peak power	1.8 kWp	
Orientation	South	
Pitch	45°	
Overshading	None or very little	
Manufacturer		
MCS certificate		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
a. Assessor Declaration		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed:	Assessor ID:	
Name:	Date:	
b. Client Declaration		
N/A		

Full SAP Calculation Printout



Property Reference	709849	Issued on Date	08/08/2023
Assessment Reference	709849	Prop Type Ref	709849
Property	Meadow View, Blagrove Lane, Caversham, Reading, RG47DX		
SAP Rating	84 B	DER	3.05
Environmental	97 A	TER	11.27
CO ₂ Emissions (t/year)	0.84	% DER < TER	72.94
Compliance Check	See BREL	DFEE	46.95
% DPER < TPER	47.78	TFEE	47.55
		% DFEE < TFEE	1.27
		DPER	31.19
		TPER	59.72
Assessor Details	Mr. Kyle Jones	Assessor ID	AV53-0001
Client	709849, Tara Walsh		

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)
Basement floor	45.8300 (1a)	x 2.2100 (2a)	= 101.2843 (1a) -
Ground floor	146.6100 (1b)	x 2.7000 (2b)	= 395.8470 (1b) -
First floor	111.1000 (1c)	x 2.9000 (2c)	= 322.1900 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	303.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 819.3213 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	1 * 20 = 20.0000 (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	5 * 10 = 50.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

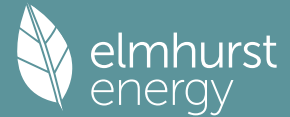
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour	70.0000 / (5) = 0.0854 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000 (17)	
Infiltration rate		0.3354 (18)	
Number of sides sheltered		0 (19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3354 (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	0.4277	0.4193	0.4109	0.3690	0.3606	0.3187	0.3187	0.3103	0.3354	0.3606	0.3774	0.3941 (22b)
Effective ac	0.5915	0.5879	0.5844	0.5681	0.5650	0.5508	0.5508	0.5481	0.5563	0.5650	0.5712	0.5777 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.40)			56.3200	1.3258	74.6667		(27)
Half Glazed Door			2.1600	1.2000	2.5920		(26a)
Solid Door			2.3200	1.0000	2.3200		(26)
Dormer Windows (Uw = 1.40)			4.1500	1.3258	5.5019		(27)
N			0.7600	1.3258	1.0076		(27a)
Basement Floor`			45.8300	0.1300	5.9579	110.0000	5041.3000 (28)

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Ground Floor			100.7800	0.1300	13.1014	110.0000	11085.8000 (28a)
External Cavity wall	268.9700	59.9800	208.9900	0.1400	29.2586	150.0000	31348.5000 (29a)
External Timber Wall	20.6700	4.9700	15.7000	0.1400	2.1980	9.0000	141.3000 (29a)
Basement wall	61.1300		61.1300	0.1300	7.9469	110.0000	6724.3000 (29a)
Secondary wall	8.7600		8.7600	0.3300	2.8908	9.0000	78.8400 (29a)
Dormer wall	8.7700		8.7700	0.1600	1.4032	9.0000	78.9300 (29a)
External Slope Roof	167.3000	0.7600	166.5400	0.1100	18.3194	9.0000	1498.8600 (30)
External Flat Roof	11.8600		11.8600	0.1100	1.3046	9.0000	106.7400 (30)
Secondary Plane	1.5100		1.5100	0.0800	0.1208	9.0000	13.5900 (30)
Total net area of external elements Aum(A, m2)			695.5800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	168.5897			(33)
Internal Wall			430.0000			9.0000	3870.0000 (32c)
First Floor			111.1000			18.0000	1999.8000 (32d)
Ground Floor Ceiling			111.1000			9.0000	999.9000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 62987.8600 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 207.5109 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	34.5200	0.0500	1.7260
E3 Sill	19.8100	0.0500	0.9905
E4 Jamb	64.4600	0.0500	3.2230
E5 Ground floor (normal)	55.1500	0.1600	8.8240
E6 Intermediate floor within a dwelling	91.2600	0.0700	6.3882
E11 Eaves (insulation at rafter level)	26.9100	0.0400	1.0764
E13 Gable (insulation at rafter level)	30.3000	0.0800	2.4240
E14 Flat roof	16.9900	0.0800	1.3592
E16 Corner (normal)	67.1700	0.0900	6.0453
E17 Corner (inverted - internal area greater than external area)	18.6900	-0.0900	-1.6821
R1 Head of roof window	0.9800	0.0800	0.0784
R2 Sill of roof window	0.9800	0.0600	0.0588
R3 Jamb of roof window	1.5600	0.0800	0.1248

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 30.6365 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 199.2262 (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	159.9155	158.9553	158.0141	153.5934	152.7663	148.9160	148.9160	148.2030	150.3991	152.7663	154.4395	156.1888 (38)
Heat transfer coeff	359.1417	358.1815	357.2403	352.8196	351.9925	348.1422	348.1422	347.4292	349.6253	351.9925	353.6657	355.4150 (39)
Average = Sum(39)m / 12 =												352.8157

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1832	1.1800	1.1769	1.1623	1.1596	1.1469	1.1469	1.1446	1.1518	1.1596	1.1651	1.1709 (40)
HLP (average)												1.1623
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.1365 (42)
Hot water usage for mixer showers	115.2138	113.4824	110.9594	106.1320	102.5695	98.5966	96.3384	98.8424	101.5872	105.8528	110.7839	114.7724 (42a)	
Hot water usage for baths	33.1537	32.6613	31.9680	30.6895	29.7322	28.6707	28.0974	28.7859	29.5356	30.6714	31.9762	33.0416 (42b)	
Hot water usage for other uses	46.7512	45.0512	43.3511	41.6511	39.9510	38.2510	38.2510	39.9510	41.6511	43.3511	45.0512	46.7512 (42c)	
Average daily hot water use (litres/day)												179.4631 (43)	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	195.1188	191.1949	186.2784	178.4726	172.2527	165.5183	162.6868	167.5793	172.7738	179.8753	187.8113	194.5653 (44)
Energy conte	309.0204	272.2590	286.3030	244.3200	231.8853	203.5241	196.7556	207.4982	213.0474	244.0891	267.5716	304.6422 (45)
Energy content (annual)										Total = Sum(45)m =		2980.9159

Distribution loss (46)m = 0.15 x (45)m
 46.3531 40.8389 42.9455 36.6480 34.7828 30.5286 29.5133 31.1247 31.9571 36.6134 40.1357 45.6963 (46)

Water storage loss:
 Store volume 200.0000 (47)
 a) If manufacturer declared loss factor is known (kWh/day): 2.0000 (48)
 Temperature factor from Table 2b 0.5400 (49)
 Enter (49) or (54) in (55) 1.0800 (55)
 Total storage loss

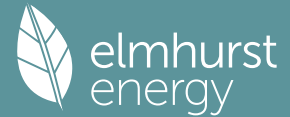
	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (56)
If cylinder contains dedicated solar storage	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)

Total heat required for water heating calculated for each month	365.7628	323.5102	343.0454	299.2320	288.6277	258.4361	253.4980	264.2406	267.9594	300.8315	322.4836	361.3846 (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	365.7628	323.5102	343.0454	299.2320	288.6277	258.4361	253.4980	264.2406	267.9594	300.8315	322.4836	361.3846 (64)
Total per year (kWh/year) = Sum(64)m =												3649.0119 (64)
12Total per year (kWh/year)												3649 (64)

Electric shower(s) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)
 Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

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148.1432 131.5271 140.5897 125.1660 122.4958 111.6014 110.8151 114.3871 114.7679 126.5536 132.8971 146.6874 (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	156.8266	156.8266	156.8266	156.8266	156.8266	156.8266	156.8266	156.8266	156.8266	156.8266	156.8266	156.8266	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	233.9611	259.0284	233.9611	241.7598	233.9611	241.7598	233.9611	233.9611	241.7598	233.9611	241.7598	233.9611	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	461.1248	465.9098	453.8517	428.1814	395.7772	365.3218	344.9758	340.1908	352.2489	377.9192	410.3234	440.7787	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.6827	38.6827	38.6827	38.6827	38.6827	38.6827	38.6827	38.6827	38.6827	38.6827	38.6827	38.6827	(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)	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	(71)
Water heating gains (Table 5)	199.1172	195.7248	188.9646	173.8417	164.6449	155.0019	148.9451	153.7461	159.3998	170.0989	184.5794	197.1605	(72)
Total internal gains	964.2511	990.7110	946.8254	913.8308	864.4311	832.1315	797.9300	797.9459	823.4565	852.0272	906.7105	941.9484	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.0400	10.6334	0.7600	0.7000	0.7700	27.5987	(74)
East	28.8100	19.6403	0.7600	0.7000	0.7700	208.6102	(76)
West	20.4700	19.6403	0.7600	0.7000	0.7700	148.2211	(80)
North	0.7600	15.2954	0.7600	0.7000	1.0000	5.5658	(82)
East	2.1500	19.6403	0.7600	0.7000	0.7700	15.5679	(76)
West	2.0000	19.6403	0.7600	0.7000	0.7700	14.4818	(80)

Solar gains	420.0455	819.9269	1354.2803	1994.1207	2468.9267	2540.3930	2413.0854	2054.5966	1580.1315	973.2049	523.2263	345.8696	(83)
Total gains	1384.2966	1810.6379	2301.1057	2907.9515	3333.3578	3372.5245	3211.0154	2852.5425	2403.5880	1825.2320	1429.9369	1287.8180	(84)

7. Mean internal temperature (heating season)

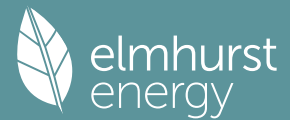
Temperature during heating periods in the living area from Table 9, Th1 (C)

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	48.7179	48.8485	48.9772	49.5909	49.7074	50.2571	50.2571	50.3603	50.0439	49.7074	49.4722	49.2287	
alpha	4.2479	4.2566	4.2651	4.3061	4.3138	4.3505	4.3505	4.3574	4.3363	4.3138	4.2981	4.2819	
util living area	0.9985	0.9950	0.9823	0.9298	0.8044	0.6192	0.4669	0.5396	0.8141	0.9745	0.9965	0.9989	(86)
Living	19.5248	19.7218	20.0392	20.4505	20.7475	20.8861	20.9189	20.9110	20.7893	20.3536	19.8633	19.5007	
Non living	18.1896	18.4435	18.8489	19.3663	19.7047	19.8454	19.8679	19.8662	19.7638	19.2596	18.6343	18.1661	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	7	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	24	19	0	0	0	0	0	0	0	0	0	31	
MIT	20.3532	20.0979	20.0392	20.4505	20.7475	20.8861	20.9189	20.9110	20.7893	20.3536	19.8633	20.1509	(87)
Th 2	19.9335	19.9360	19.9385	19.9502	19.9524	19.9627	19.9627	19.9646	19.9587	19.9524	19.9480	19.9434	(88)
util rest of house	0.9980	0.9936	0.9769	0.9089	0.7521	0.5339	0.3617	0.4276	0.7425	0.9634	0.9952	0.9986	(89)
MIT 2	19.3376	19.0093	18.8489	19.3663	19.7047	19.8454	19.8679	19.8662	19.7638	19.2596	18.6343	19.1589	(90)
Living area fraction									fLA = Living area / (4) =			0.1639	(91)
MIT	19.5040	19.1877	19.0440	19.5440	19.8756	20.0160	20.0401	20.0374	19.9319	19.4389	18.8357	19.3215	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5040	19.1877	19.0440	19.5440	19.8756	20.0160	20.0401	20.0374	19.9319	19.4389	18.8357	19.3215	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9978	0.9922	0.9708	0.8990	0.7478	0.5385	0.3698	0.4358	0.7404	0.9560	0.9933	0.9983	(94)
Useful gains	1381.2567	1796.5341	2233.8659	2614.1666	2492.8187	1816.1885	1187.3150	1243.2185	1779.6172	1744.9177	1420.2922	1285.6588	(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	5460.4043	5117.5834	4481.2129	3755.4270	2877.7476	1885.5298	1197.6540	1263.7509	2038.9731	3111.2305	4150.5272	5374.4082	(97)
Space heating kWh	3034.8859	2231.7451	1672.0261	821.7075	286.3871	0.0000	0.0000	0.0000	0.0000	1016.5367	1965.7692	3042.0295	(98a)
Space heating requirement - total per year (kWh/year)												14071.0872	
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	3034.8859	2231.7451	1672.0261	821.7075	286.3871	0.0000	0.0000	0.0000	0.0000	1016.5367	1965.7692	3042.0295	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												14071.0872	
Space heating per m2										(98c) / (4) =		46.3566	(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 %)												325.2651 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	3034.8859	2231.7451	1672.0261	821.7075	286.3871	0.0000	0.0000	0.0000	0.0000	1016.5367	1965.7692	3042.0295 (98)
Space heating efficiency (main heating system 1)	325.2651	325.2651	325.2651	325.2651	325.2651	0.0000	0.0000	0.0000	0.0000	325.2651	325.2651	325.2651 (210)
Space heating fuel (main heating system)	933.0501	686.1312	514.0503	252.6270	88.0473	0.0000	0.0000	0.0000	0.0000	312.5257	604.3592	935.2463 (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	365.7628	323.5102	343.0454	299.2320	288.6277	258.4361	253.4980	264.2406	267.9594	300.8315	322.4836	361.3846 (64)
Efficiency of water heater (217)m	164.3243	164.3243	164.3243	164.3243	164.3243	164.3243	164.3243	164.3243	164.3243	164.3243	164.3243	164.3243 (216)
Fuel for water heating, kWh/month	222.5860	196.8731	208.7613	182.0985	175.6452	157.2720	154.2669	160.8044	163.0675	183.0719	196.2483	219.9216 (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 (217)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	60.4356	48.4837	43.6542	31.9829	24.7045	20.1838	22.5363	29.2935	38.0494	49.9229	56.3878	62.1153 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-42.5898	-63.9705	-95.4905	-109.6917	-118.7750	-108.7271	-107.5798	-99.8217	-86.5507	-73.7987	-47.9322	-36.4487 (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												4326.0371 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												164.3243
Water heating fuel used												2220.6167 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												487.7499 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-991.3763 (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												6043.0273 (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	4326.0371	0.1559	674.4726 (261)
Total CO2 associated with community systems			0.0000 (273)
Water heating (other fuel)	2220.6167	0.1411	313.2260 (264)
Space and water heating			987.6987 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	487.7499	0.1443	70.3974 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-991.3763	0.1343	-133.0950
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-133.0950 (269)
Total CO2, kg/year			925.0010 (272)

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EPC Dwelling Carbon Dioxide Emission Rate (DER)

3.0500 (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	4326.0371	1.5772	6822.9951 (275)	
Total CO2 associated with community systems			0.0000 (473)	
Water heating (other fuel)	2220.6167	1.5216	3378.8304 (278)	
Space and water heating			10201.8255 (279)	
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)	
Energy for lighting	487.7499	1.5338	748.1270 (282)	
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-991.3763	1.4962	-1483.2682	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-1483.2682 (283)	
Total Primary energy kWh/year			9466.6843 (286)	
Dwelling Primary energy Rate (DPER)			31.1900 (287)	

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)	
Basement floor	45.8300 (1a)	x 2.2100 (2a)	= 101.2843 (1a)	-
Ground floor	146.6100 (1b)	x 2.7000 (2b)	= 395.8470 (1b)	-
First floor	111.1000 (1c)	x 2.9000 (2c)	= 322.1900 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	303.5400			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	819.3213 (5)	

2. Ventilation rate

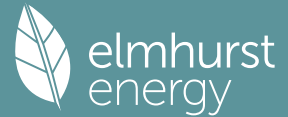
	m ³ per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0488 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.2988	(18)
Number of sides sheltered	0 (19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2988 (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	0.3810	0.3735	0.3661	0.3287	0.3212	0.2839	0.2839	0.2764	0.2988	0.3212	0.3362	0.3511	(22b)
Effective ac	0.5726	0.5698	0.5670	0.5540	0.5516	0.5403	0.5403	0.5382	0.5446	0.5516	0.5565	0.5616	(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			2.3200	1.0000	2.3200			(26)

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TER Semi-glazed door			2.1600	1.0000	2.1600	(26a)
TER Opening Type (Uw = 1.20)			60.4700	1.1450	69.2405	(27)
N			0.7600	1.8519	1.4074	(27a)
Basement Floor			45.8300	0.1300	5.9579	(28)
Ground Floor			100.7800	0.1300	13.1014	(28a)
External Cavity wall	268.9700	59.9800	208.9900	0.1800	37.6182	(29a)
External Timber Wall	20.6700	4.9700	15.7000	0.1800	2.8260	(29a)
Basement wall	61.1300		61.1300	0.1800	11.0034	(29a)
Secondary wall	8.7600		8.7600	0.1800	1.5768	(29a)
Dormer wall	8.7700		8.7700	0.1800	1.5786	(29a)
External Slope Roof	167.3000	0.7600	166.5400	0.1100	18.3194	(30)
External Flat Roof	11.8600		11.8600	0.1100	1.3046	(30)
Secondary Plane	1.5100		1.5100	0.1100	0.1661	(30)
Total net area of external elements Aum(A, m2)			695.5800			(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	168.5803	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 207.5109 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	34.5200	0.0500	1.7260
E3 Sill	19.8100	0.0500	0.9905
E4 Jamb	64.4600	0.0500	3.2230
E5 Ground floor (normal)	55.1500	0.1600	8.8240
E6 Intermediate floor within a dwelling	91.2600	0.0000	0.0000
E11 Eaves (insulation at rafter level)	26.9100	0.0400	1.0764
E13 Gable (insulation at rafter level)	30.3000	0.0800	2.4240
E14 Flat roof	16.9900	0.0800	1.3592
E16 Corner (normal)	67.1700	0.0900	6.0453
E17 Corner (inverted - internal area greater than external area)	18.6900	-0.0900	-1.6821
R1 Head of roof window	0.9800	0.0800	0.0784
R2 Sill of roof window	0.9800	0.0600	0.0588
R3 Jamb of roof window	1.5600	0.0800	0.1248

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 24.2483 (36)

Point Thermal Bridges

Total fabric heat loss (33) + (36) + (36a) = 192.8286 (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	154.8117	154.0497	153.3028	149.7945	149.1381	146.0825	146.0825	145.5167	147.2595	149.1381	150.4660	151.8542
Heat transfer coeff	347.6403	346.8782	346.1313	342.6231	341.9667	338.9111	338.9111	338.3452	340.0880	341.9667	343.2945	344.6828
Average = Sum(39)m / 12 =												342.6199

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1453	1.1428	1.1403	1.1288	1.1266	1.1165	1.1165	1.1147	1.1204	1.1266	1.1310	1.1355
HLP (average)												1.1287
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.1365 (42)
Hot water usage for mixer showers													
76.8092	75.6549	73.9729	70.7546	68.3796	65.7311	64.2256	65.8949	67.7248	70.5685	73.8559	76.5149	76.5149	(42a)
Hot water usage for baths													
33.1537	32.6613	31.9680	30.6895	29.7322	28.6707	28.0974	28.7859	29.5356	30.6714	31.9762	33.0416	33.0416	(42b)
Hot water usage for other uses													
46.7512	45.0512	43.3511	41.6511	39.9510	38.2510	38.2510	39.9510	41.6511	43.3511	45.0512	46.7512	46.7512	(42c)
Average daily hot water use (litres/day)													144.0554 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	156.7142	153.3674	149.2920	143.0952	138.0629	132.6528	130.5740	134.6318	138.9114	144.5911	150.8833	156.3078 (44)
Energy conte	248.1969	218.3932	229.4562	195.8902	185.8592	163.1121	157.9179	166.7023	171.2917	196.2087	214.9609	244.7402 (45)
Energy content (annual)										Total =	Sum(45)m =	2392.7296
Distribution loss (46)m = 0.15 x (45)m												
	37.2295	32.7590	34.4184	29.3835	27.8789	24.4668	23.6877	25.0054	25.6938	29.4313	32.2441	36.7110 (46)

Water storage loss:

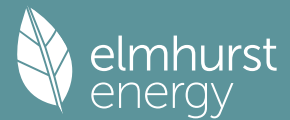
Store volume													200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6525 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.8924 (55)

Total storage loss													
27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)
If cylinder contains dedicated solar storage													
27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
299.1230	264.3909	280.3823	245.1735	236.7853	212.3954	208.8440	217.6284	220.5750	247.1348	264.2442	295.6663	295.6663	(62)
WWHRS	-35.1140	-31.0551	-32.5191	-26.9271	-25.0951	-21.4740	-20.1285	-21.4046	-22.2179	-26.1924	-29.6728	-34.4637	(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	264.0090	233.3358	247.8632	218.2464	211.6902	190.9213	188.7155	196.2238	198.3571	220.9424	234.5714	261.2026	(64)
Total per year (kWh/year) = Sum(64)m =													2666.0787 (64)
12Total per year (kWh/year)													2666 (64)

Electric shower(s)													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)

Heat gains from water heating, kWh/month

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123.2663 109.4139 117.0351 104.5601 102.5390 93.6614 93.2486 96.1694 96.3811 105.9803 110.9011 122.1170 (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	156.8266	156.8266	156.8266	156.8266	156.8266	156.8266	156.8266	156.8266	156.8266	156.8266	156.8266	156.8266	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	233.9611	259.0284	233.9611	241.7598	233.9611	241.7598	233.9611	233.9611	241.7598	233.9611	241.7598	233.9611	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	461.1248	465.9098	453.8517	428.1814	395.7772	365.3218	344.9758	340.1908	352.2489	377.9192	410.3234	440.7787	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.6827	38.6827	38.6827	38.6827	38.6827	38.6827	38.6827	38.6827	38.6827	38.6827	38.6827	38.6827	(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)	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	(71)
Water heating gains (Table 5)	165.6806	162.8183	157.3052	145.2224	137.8213	130.0853	125.3341	129.2599	133.8627	142.4466	154.0294	164.1357	(72)
Total internal gains	933.8144	960.8045	918.1660	888.2116	840.6076	807.2149	774.3190	773.4598	797.9194	827.3749	879.1605	911.9236	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.0400	10.6334	0.6300	0.7000	0.7700	22.8779	(74)
East	30.9600	19.6403	0.6300	0.7000	0.7700	185.8318	(76)
West	22.4700	19.6403	0.6300	0.7000	0.7700	134.8721	(80)
North	0.7600	15.2954	0.6300	0.7000	1.0000	4.6138	(82)

Solar gains	348.1956	679.6762	1122.6271	1653.0211	2046.6103	2105.8521	2000.3208	1703.1524	1309.8458	806.7356	433.7271	286.7077	(83)
Total gains	1282.0101	1640.4808	2040.7930	2541.2327	2887.2178	2913.0670	2774.6398	2476.6122	2107.7652	1634.1105	1312.8876	1198.6313	(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	50.3297	50.4403	50.5491	51.0667	51.1647	51.6260	51.6260	51.7124	51.4473	51.1647	50.9668	50.7615	21.0000 (85)
alpha	4.3553	4.3627	4.3699	4.4044	4.4110	4.4417	4.4417	4.4475	4.4298	4.4110	4.3978	4.3841	
util living area	0.9989	0.9966	0.9883	0.9517	0.8523	0.6804	0.5211	0.5963	0.8568	0.9822	0.9975	0.9992	(86)
MIT	19.1521	19.3861	19.7728	20.2922	20.7050	20.9231	20.9814	20.9673	20.7780	20.2000	19.5819	19.1205	(87)
Th 2	19.9640	19.9661	19.9680	19.9774	19.9792	19.9874	19.9874	19.9889	19.9842	19.9792	19.9756	19.9719	(88)
util rest of house	0.9986	0.9956	0.9846	0.9362	0.8071	0.5949	0.4089	0.4796	0.7941	0.9743	0.9966	0.9990	(89)
MIT 2	17.7813	18.0824	18.5767	19.2327	19.7157	19.9384	19.9803	19.9749	19.8117	19.1294	18.3401	17.7461	(90)
Living area fraction									fLA = Living area / (4) =			0.1639	(91)
MIT	18.0060	18.2960	18.7727	19.4064	19.8778	20.0998	20.1443	20.1375	19.9701	19.3049	18.5436	17.9713	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0060	18.2960	18.7727	19.4064	19.8778	20.0998	20.1443	20.1375	19.9701	19.3049	18.5436	17.9713	(93)

8. Space heating requirement

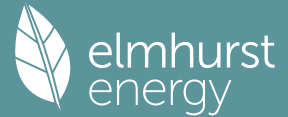
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9976	0.9931	0.9785	0.9252	0.8020	0.6051	0.4269	0.4977	0.7930	0.9667	0.9946	0.9982	(94)
Useful gains	1278.9271	1629.1370	1996.8696	2351.0542	2315.4142	1762.6426	1184.5102	1232.6138	1671.4896	1579.6777	1305.8181	1196.4828	(95)
Ext temp.	4.3000	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	4764.7632	4646.7968	4247.9796	3599.7240	2796.5417	1863.9421	1201.2172	1264.5751	1996.3424	2976.7690	3928.5343	4746.7404	(97)
Space heating kWh	2593.4621	2027.8674	1674.8259	899.0423	357.9588	0.0000	0.0000	0.0000	0.0000	1039.4359	1888.3556	2641.3917	(98a)
Space heating requirement - total per year (kWh/year)												13122.3397	
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	2593.4621	2027.8674	1674.8259	899.0423	357.9588	0.0000	0.0000	0.0000	0.0000	1039.4359	1888.3556	2641.3917	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												13122.3397	
Space heating per m2										(98c) / (4) =		43.2310	(99)

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

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

0.0000 (201)

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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	2593.4621	2027.8674	1674.8259	899.0423	357.9588	0.0000	0.0000	0.0000	0.0000	1039.4359	1888.3556	2641.3917	(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)	2809.8181	2197.0394	1814.5459	974.0437	387.8210	0.0000	0.0000	0.0000	0.0000	1126.1495	2045.8891	2861.7461	(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	264.0090	233.3358	247.8632	218.2464	211.6902	190.9213	188.7155	196.2238	198.3571	220.9424	234.5714	261.2026	(64)
Efficiency of water heater												79.8000	(216)
(217)m	87.8842	87.7784	87.5274	86.8859	85.2280	79.8000	79.8000	79.8000	79.8000	87.0784	87.7070	87.9078	(217)
Fuel for water heating, kWh/month	300.4055	265.8237	283.1835	251.1875	248.3811	239.2498	236.4856	245.8945	248.5678	253.7280	267.4488	297.1324	(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	48.6125	38.9988	35.1141	25.7261	19.8715	16.2352	18.1275	23.5628	30.6057	40.1564	45.3566	49.9636	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-47.8073	-70.1343	-104.8033	-122.5635	-136.1316	-128.3377	-126.6013	-117.4752	-102.1920	-82.1292	-53.4653	-41.0074	(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	-19.2968	-41.2805	-83.3926	-127.3030	-170.4411	-172.1848	-170.3262	-143.3791	-103.8865	-59.8831	-26.0202	-15.2205	(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												14217.0527	(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												3137.4881	(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)	392.3307	(232)

Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2265.2626	(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	15567.6090	(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	14217.0527	0.2100	2985.5811	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3137.4881	0.2100	658.8725	(264)
Space and water heating			3644.4536	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	392.3307	0.1443	56.6254	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1132.6482	0.1338	-151.5499	
PV Unit electricity exported	-1132.6144	0.1254	-142.0265	
Total			-293.5764	(269)
Total CO2, kg/year			3419.4319	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.2700	(273)

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

	Energy	Primary energy factor	Primary energy
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Space heating - main system 1	kWh/year	kg CO2/kWh	kWh/year
Total CO2 associated with community systems	14217.0527	1.1300	16065.2696 (275)
Water heating (other fuel)	3137.4881	1.1300	0.0000 (473)
Space and water heating			3545.3615 (278)
Pumps, fans and electric keep-hot	86.0000	1.5128	19610.6311 (279)
Energy for lighting	392.3307	1.5338	130.1008 (281)
			601.7700 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1132.6482	1.4945	-1692.7010
PV Unit electricity exported	-1132.6144	0.4603	-521.3055
Total			-2214.0065 (283)
Total Primary energy kWh/year			18128.4954 (286)
Target Primary Energy Rate (TPER)			59.7200 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Basement floor	45.8300 (1a)	x 2.2100 (2a)	= 101.2843 (1a) -
Ground floor	146.6100 (1b)	x 2.7000 (2b)	= 395.8470 (1b) -
First floor	111.1000 (1c)	x 2.9000 (2c)	= 322.1900 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	303.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 819.3213 (5)

2. Ventilation rate

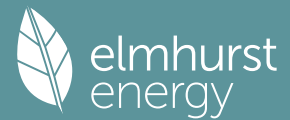
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour 40.0000 / (5) = 0.0488 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.2988 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2988 (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	0.3810	0.3735	0.3661	0.3287	0.3212	0.2839	0.2839	0.2764	0.2988	0.3212	0.3362	0.3511 (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	0.5726	0.5698	0.5670	0.5540	0.5516	0.5403	0.5403	0.5382	0.5446	0.5516	0.5565	0.5616 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.40)			56.3200	1.3258	74.6667		(27)
Half Glazed Door			2.1600	1.2000	2.5920		(26a)
Solid Door			2.3200	1.0000	2.3200		(26)
Dormer Windows (Uw = 1.40)			4.1500	1.3258	5.5019		(27)
N			0.7600	1.3258	1.0076		(27a)
Basement Floor			45.8300	0.1300	5.9579	110.0000	5041.3000 (28)
Ground Floor			100.7800	0.1300	13.1014	110.0000	11085.8000 (28a)
External Cavity wall	268.9700	59.9800	208.9900	0.1400	29.2586	150.0000	31348.5000 (29a)

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External Timber Wall	20.6700	4.9700	15.7000	0.1400	2.1980	9.0000	141.3000 (29a)
Basement wall	61.1300		61.1300	0.1300	7.9469	110.0000	6724.3000 (29a)
Secondary wall	8.7600		8.7600	0.3300	2.8908	9.0000	78.8400 (29a)
Dormer wall	8.7700		8.7700	0.1600	1.4032	9.0000	78.9300 (29a)
External Slope Roof	167.3000	0.7600	166.5400	0.1100	18.3194	9.0000	1498.8600 (30)
External Flat Roof	11.8600		11.8600	0.1100	1.3046	9.0000	106.7400 (30)
Secondary Plane	1.5100		1.5100	0.0800	0.1208	9.0000	13.5900 (30)
Total net area of external elements Aum(A, m2)			695.5800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	168.5897			(33)
Internal Wall			430.0000			9.0000	3870.0000 (32c)
First Floor			111.1000			18.0000	1999.8000 (32d)
Ground Floor Ceiling			111.1000			9.0000	999.9000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 62987.8600 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 207.5109 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	34.5200	0.0500	1.7260
E3 Sill	19.8100	0.0500	0.9905
E4 Jamb	64.4600	0.0500	3.2230
E5 Ground floor (normal)	55.1500	0.1600	8.8240
E6 Intermediate floor within a dwelling	91.2600	0.0700	6.3882
E11 Eaves (insulation at rafter level)	26.9100	0.0400	1.0764
E13 Gable (insulation at rafter level)	30.3000	0.0800	2.4240
E14 Flat roof	16.9900	0.0800	1.3592
E16 Corner (normal)	67.1700	0.0900	6.0453
E17 Corner (inverted - internal area greater than external area)	18.6900	-0.0900	-1.6821
R1 Head of roof window	0.9800	0.0800	0.0784
R2 Sill of roof window	0.9800	0.0600	0.0588
R3 Jamb of roof window	1.5600	0.0800	0.1248
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			30.6365 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 199.2262 (37)

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

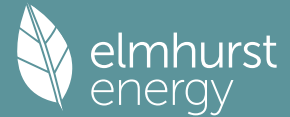
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	154.8117	154.0497	153.3028	149.7945	149.1381	146.0825	146.0825	145.5167	147.2595	149.1381	150.4660	151.8542	(38)
Heat transfer coeff	354.0379	353.2759	352.5290	349.0207	348.3643	345.3088	345.3088	344.7429	346.4857	348.3643	349.6922	351.0804	(39)
Average = Sum(39)m / 12 =												349.0176	
HLP	1.1664	1.1639	1.1614	1.1498	1.1477	1.1376	1.1376	1.1357	1.1415	1.1477	1.1520	1.1566	(40)
HLP (average)												1.1498	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.1365 (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	33.1537	32.6613	31.9680	30.6895	29.7322	28.6707	28.0974	28.7859	29.5356	30.6714	31.9762	33.0416	(42b)
Hot water usage for other uses	46.7512	45.0512	43.3511	41.6511	39.9510	38.2510	38.2510	39.9510	41.6511	43.3511	45.0512	46.7512	(42c)
Average daily hot water use (litres/day)													73.2398 (43)
Daily hot water use	79.9049	77.7125	75.3191	72.3406	69.6832	66.9217	66.3484	68.7369	71.1866	74.0225	77.0273	79.7928	(44)
Energy conte	126.5499	110.6616	115.7626	99.0306	93.8070	82.2881	80.2426	85.1107	87.7803	100.4479	109.7396	124.9363	(45)
Energy content (annual)										Total = Sum(45)m =		1216.3571	
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	107.5674	94.0623	98.3982	84.1760	79.7360	69.9449	68.2062	72.3441	74.6132	85.3807	93.2786	106.1959	(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	107.5674	94.0623	98.3982	84.1760	79.7360	69.9449	68.2062	72.3441	74.6132	85.3807	93.2786	106.1959	(64)
										Total per year (kWh/year) = Sum(64)m =		1033.9035	(64)
12Total per year (kWh/year)												1034	(64)
Electric shower(s)	61.5114	54.8072	59.8473	57.1116	58.1832	55.5012	57.3512	58.1832	57.1116	59.8473	58.7220	61.5114	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		699.6885	(64a)
Heat gains from water heating, kWh/month	42.2697	37.2174	39.5614	35.3219	34.4798	31.3615	31.3894	32.6318	32.9312	36.3070	38.0001	41.9268	(65)

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

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Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	156.8266	156.8266	156.8266	156.8266	156.8266	156.8266	156.8266	156.8266	156.8266	156.8266	156.8266	156.8266	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	233.9611	259.0284	233.9611	241.7598	233.9611	241.7598	233.9611	233.9611	241.7598	233.9611	241.7598	233.9611	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	461.1248	465.9098	453.8517	428.1814	395.7772	365.3218	344.9758	340.1908	352.2489	377.9192	410.3234	440.7787	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.6827	38.6827	38.6827	38.6827	38.6827	38.6827	38.6827	38.6827	38.6827	38.6827	38.6827	38.6827	(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)	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	(71)
Water heating gains (Table 5)	56.8141	55.3830	53.1739	49.0582	46.3438	43.5576	42.1900	43.8600	45.7378	48.7997	52.7780	56.3532	(72)
Total internal gains	821.9480	850.3692	811.0347	789.0474	746.1301	720.6873	691.1749	688.0598	709.7945	730.7280	774.9092	801.1411	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	g or Table 6c	FF or Table 6c	Access factor Table 6d	Gains W	
North	7.0400	10.6334	0.7600	0.7600	0.7000	0.7700	27.5987	(74)
East	28.8100	19.6403	0.7600	0.7600	0.7000	0.7700	208.6102	(75)
West	20.4700	19.6403	0.7600	0.7600	0.7000	0.7700	148.2211	(80)
North	0.7600	15.2954	0.7600	0.7600	1.0000	0.7700	5.5658	(82)
East	2.1500	19.6403	0.7600	0.7600	0.7000	0.7700	15.5679	(76)
West	2.0000	19.6403	0.7600	0.7600	0.7000	0.7700	14.4818	(80)

Solar gains	420.0455	819.9269	1354.2803	1994.1207	2468.9267	2540.3930	2413.0854	2054.5966	1580.1315	973.2049	523.2263	345.8696	(83)
Total gains	1241.9935	1670.2961	2165.3150	2783.1681	3215.0568	3261.0803	3104.2603	2742.6564	2289.9260	1703.9329	1298.1355	1147.0107	(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	49.4202	49.5268	49.6317	50.1306	50.2251	50.6695	50.6695	50.7527	50.4974	50.2251	50.0344	49.8365
alpha	4.2947	4.3018	4.3088	4.3420	4.3483	4.3780	4.3780	4.3835	4.3665	4.3483	4.3356	4.3224
util living area	0.9990	0.9964	0.9856	0.9375	0.8161	0.6323	0.4783	0.5549	0.8308	0.9797	0.9976	0.9993 (86)
MIT	19.1006	19.3633	19.7882	20.3415	20.7486	20.9395	20.9858	20.9738	20.8004	20.2026	19.5459	19.0641 (87)
Th 2	19.9470	19.9490	19.9510	19.9603	19.9621	19.9702	19.9702	19.9718	19.9671	19.9621	19.9586	19.9549 (88)
util rest of house	0.9987	0.9953	0.9812	0.9184	0.7655	0.5469	0.3717	0.4415	0.7623	0.9707	0.9967	0.9991 (89)
MIT 2	18.1991	18.4626	18.8858	19.4282	19.7918	19.9412	19.9662	19.9633	19.8497	19.3060	18.6525	18.1683 (90)
Living area fraction	18.3468	18.6102	19.0337	19.5779	19.9486	20.1048	20.1333	20.1290	20.0055	19.4530	18.7990	18.3151 (92)
Temperature adjustment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
adjusted MIT	18.3468	18.6102	19.0337	19.5779	19.9486	20.1048	20.1333	20.1290	20.0055	19.4530	18.7990	18.3151 (93)

8. Space heating requirement

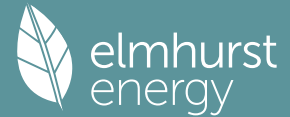
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9933	0.9759	0.9098	0.7647	0.5587	0.3890	0.4596	0.7652	0.9646	0.9953	0.9986	(94)
Useful gains	1239.5835	1659.0326	2113.0333	2532.0179	2458.6951	1821.8936	1207.5745	1260.4567	1752.2796	1643.6229	1292.0102	1145.4316	(95)
Ext temp.	4.3000	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													
Space heating	4973.1148	4843.4968	4418.4813	3726.8084	2873.5307	1900.8643	1220.0724	1285.5326	2046.1658	3084.0530	4091.0367	4955.5428	(97)
Space heating requirement - total per year (kWh/year)													
Solar heating	2777.7473	2139.9599	1715.2533	860.2492	308.6377	0.0000	0.0000	0.0000	0.0000	1071.6800	2015.2991	2834.7227	(98a)
Solar heating contribution - total per year (kWh/year)													
Space heating	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Space heating requirement after solar contribution - total per year (kWh/year)													
Space heating per m2	2777.7473	2139.9599	1715.2533	860.2492	308.6377	0.0000	0.0000	0.0000	0.0000	1071.6800	2015.2991	2834.7227	(98c)

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	3245.9023	2555.2848	2620.0461	0.0000	0.0000	0.0000	0.0000	(100)

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Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8622	0.9173	0.8752	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	2798.4958	2343.9901	2293.0519	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	3689.4312	3511.2459	3095.4666	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	641.4735	868.4383	596.9966	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	160.3684	217.1096	149.2491	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												526.7271 (107)
Energy for space heating												45.2117 (99)
Energy for space cooling												1.7353 (108)
Total												46.9469 (109)
Fabric Energy Efficiency (DFEE)												46.9 (109)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Basement floor	45.8300 (1a)	x 2.2100 (2a)	= 101.2843 (1a) -
Ground floor	146.6100 (1b)	x 2.7000 (2b)	= 395.8470 (1b) -
First floor	111.1000 (1c)	x 2.9000 (2c)	= 322.1900 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	303.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	819.3213 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour 40.0000 / (5) = 0.0488 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.2988 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2988 (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	0.3810	0.3735	0.3661	0.3287	0.3212	0.2839	0.2839	0.2764	0.2988	0.3212	0.3362	0.3511 (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	0.5726	0.5698	0.5670	0.5540	0.5516	0.5403	0.5403	0.5382	0.5446	0.5516	0.5565	0.5616 (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			2.3200	1.0000	2.3200		(26)
TER Semi-glazed door			2.1600	1.0000	2.1600		(26a)
TER Opening Type (Uw = 1.20)			60.4700	1.1450	69.2405		(27)
N			0.7600	1.8519	1.4074		(27a)
Basement Floor			45.8300	0.1300	5.9579		(28)
Ground Floor			100.7800	0.1300	13.1014		(28a)
External Cavity wall	268.9700	59.9800	208.9900	0.1800	37.6182		(29a)

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External Timber Wall	20.6700	4.9700	15.7000	0.1800	2.8260	(29a)
Basement wall	61.1300		61.1300	0.1800	11.0034	(29a)
Secondary wall	8.7600		8.7600	0.1800	1.5768	(29a)
Dormer wall	8.7700		8.7700	0.1800	1.5786	(29a)
External Slope Roof	167.3000	0.7600	166.5400	0.1100	18.3194	(30)
External Flat Roof	11.8600		11.8600	0.1100	1.3046	(30)
Secondary Plane	1.5100		1.5100	0.1100	0.1661	(30)
Total net area of external elements Aum(A, m2)			695.5800			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	168.5803		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 207.5109 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	34.5200	0.0500	1.7260
E3 Sill	19.8100	0.0500	0.9905
E4 Jamb	64.4600	0.0500	3.2230
E5 Ground floor (normal)	55.1500	0.1600	8.8240
E6 Intermediate floor within a dwelling	91.2600	0.0000	0.0000
E11 Eaves (insulation at rafter level)	26.9100	0.0400	1.0764
E13 Gable (insulation at rafter level)	30.3000	0.0800	2.4240
E14 Flat roof	16.9900	0.0800	1.3592
E16 Corner (normal)	67.1700	0.0900	6.0453
E17 Corner (inverted - internal area greater than external area)	18.6900	-0.0900	-1.6821
R1 Head of roof window	0.9800	0.0800	0.0784
R2 Sill of roof window	0.9800	0.0600	0.0588
R3 Jamb of roof window	1.5600	0.0800	0.1248

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 24.2483 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 192.8286 (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	154.8117	154.0497	153.3028	149.7945	149.1381	146.0825	146.0825	145.5167	147.2595	149.1381	150.4660	151.8542
Heat transfer coeff	347.6403	346.8782	346.1313	342.6231	341.9667	338.9111	338.9111	338.3452	340.0880	341.9667	343.2945	344.6828
Average = Sum(39)m / 12 =												342.6199

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1453	1.1428	1.1403	1.1288	1.1266	1.1165	1.1165	1.1147	1.1204	1.1266	1.1310	1.1355
HLP (average)												1.1287
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

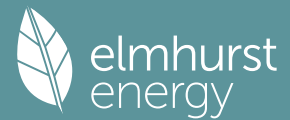
4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.1365
Hot water usage for mixer showers												0.0000
Hot water usage for baths												33.1537
Hot water usage for other uses												46.7512
Average daily hot water use (litres/day)												73.2398
Daily hot water use												79.9049
Energy conte												126.5499
Energy content (annual)												99.0306
Distribution loss (46)m = 0.15 x (45)m												0.0000
Water storage loss:												0.0000
Total storage loss												0.0000
If cylinder contains dedicated solar storage												0.0000
Primary loss												0.0000
Combi loss												0.0000
Total heat required for water heating calculated for each month												107.5674
WVHRS												0.0000
PV diverter												0.0000
Solar input												0.0000
FGHRS												0.0000
Output from w/h												107.5674
12Total per year (kWh/year)												1033.9035
Electric shower(s)												61.5114
Heat gains from water heating, kWh/month												42.2697

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

Metabolic gains (Table 5), Watts												
(66)m	156.8266	156.8266	156.8266	156.8266	156.8266	156.8266	156.8266	156.8266	156.8266	156.8266	156.8266	156.8266

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Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	233.9611	259.0284	233.9611	241.7598	233.9611	241.7598	233.9611	241.7598	233.9611	241.7598	233.9611	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	461.1248	465.9098	453.8517	428.1814	395.7772	365.3218	344.9758	340.1908	352.2489	377.9192	410.3234	440.7787 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.6827	38.6827	38.6827	38.6827	38.6827	38.6827	38.6827	38.6827	38.6827	38.6827	38.6827	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	(71)
Water heating gains (Table 5)	56.8141	55.3830	53.1739	49.0582	46.3438	43.5576	42.1900	43.8600	45.7378	48.7997	52.7780	56.3532 (72)
Total internal gains	821.9480	850.3692	811.0347	789.0474	746.1301	720.6873	691.1749	688.0598	709.7945	730.7280	774.9092	801.1411 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	7.0400	10.6334	0.6300	0.7000	0.7700	22.8779 (74)
East	30.9600	19.6403	0.6300	0.7000	0.7700	185.8318 (76)
West	22.4700	19.6403	0.6300	0.7000	0.7700	134.8721 (80)
North	0.7600	15.2954	0.6300	0.7000	1.0000	4.6138 (82)

Solar gains	348.1956	679.6762	1122.6271	1653.0211	2046.6103	2105.8521	2000.3208	1703.1524	1309.8458	806.7356	433.7271	286.7077 (83)
Total gains	1170.1436	1530.0454	1933.6618	2442.0685	2792.7404	2826.5394	2691.4957	2391.2123	2019.6403	1537.4636	1208.6363	1087.8488 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, n _{li,m} (see Table 9a)													
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	50.3297	50.4403	50.5491	51.0667	51.1647	51.6260	51.6260	51.7124	51.4473	51.1647	50.9668	50.7615	
alpha	4.3553	4.3627	4.3699	4.4044	4.4110	4.4417	4.4417	4.4475	4.4298	4.4110	4.3978	4.3841	
util living area	0.9993	0.9974	0.9904	0.9576	0.8640	0.6952	0.5354	0.6136	0.8714	0.9858	0.9982	0.9995 (86)	
MIT	19.1066	19.3417	19.7312	20.2594	20.6854	20.9162	20.9793	20.9634	20.7591	20.1633	19.5396	19.0753 (87)	
Th 2	19.9640	19.9661	19.9680	19.9774	19.9792	19.9874	19.9874	19.9889	19.9842	19.9792	19.9756	19.9719 (88)	
util rest of house	0.9990	0.9967	0.9874	0.9437	0.8207	0.6098	0.4209	0.4952	0.8121	0.9793	0.9976	0.9993 (89)	
MIT 2	18.2176	18.4538	18.8428	19.3665	19.7581	19.9453	19.9812	19.9765	19.8360	19.2815	18.6590	18.1922 (90)	
Living area fraction	18.3633	18.5993	18.9884	19.5128	19.9101	20.1045	20.1448	20.1383	f _{LA} = Living area / (4) =	19.4260	18.8033	0.1639 (91)	
MIT	18.3633	18.5993	18.9884	19.5128	19.9101	20.1045	20.1448	20.1383	19.9873	19.4260	18.8033	18.3369 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.3633	18.5993	18.9884	19.5128	19.9101	20.1045	20.1448	20.1383	19.9873	19.4260	18.8033	18.3369 (93)	

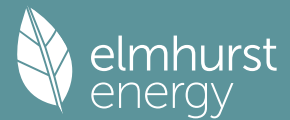
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9985	0.9952	0.9833	0.9356	0.8173	0.6204	0.4394	0.5138	0.8123	0.9743	0.9964	0.9989 (94)	
Useful gains	1168.3854	1522.6365	1901.4555	2284.8943	2282.6307	1753.6951	1182.6371	1228.6207	1640.5034	1497.9446	1204.3379	1086.6684 (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	4888.9830	4751.9975	4322.6370	3636.1943	2807.5815	1865.5236	1201.3565	1264.8209	2002.1919	3018.2001	4017.6781	4872.7450 (97)	
Space heating kWh	2768.1246	2170.1306	1801.3591	972.9360	390.5634	0.0000	0.0000	0.0000	0.0000	1131.0701	2025.6050	2816.8411 (98a)	
Space heating requirement - total per year (kWh/year)												14076.6298	
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	2768.1246	2170.1306	1801.3591	972.9360	390.5634	0.0000	0.0000	0.0000	0.0000	1131.0701	2025.6050	2816.8411 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												14076.6298	
Space heating per m2										(98c) / (4) =		46.3749 (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	
	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	3185.7642	2507.9420	2571.4238	0.0000	0.0000	0.0000	0.0000 (100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8159	0.8843	0.8337	0.0000	0.0000	0.0000	0.0000 (101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	2599.2182	2217.6919	2143.8659	0.0000	0.0000	0.0000	0.0000 (102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	3183.0367	3030.1841	2685.7235	0.0000	0.0000	0.0000	0.0000 (103)	
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	420.3493	604.4943	403.1421	0.0000	0.0000	0.0000	0.0000 (104)	
Cooled fraction									f _C = cooled area / (4) =			1.0000 (105)	

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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 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	105.0873	151.1236	100.7855	0.0000	0.0000	0.0000 (107)
Space cooling requirement											356.9964 (107)
Energy for space heating											46.3749 (99)
Energy for space cooling											1.1761 (108)
Total											47.5510 (109)
Fabric Energy Efficiency (TFEE)											47.6 (109)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Basement floor	45.8300 (1a)	x 2.2100 (2a)	= 101.2843 (1a) -
Ground floor	146.6100 (1b)	x 2.7000 (2b)	= 395.8470 (1b) -
First floor	111.1000 (1c)	x 2.9000 (2c)	= 322.1900 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	303.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	819.3213 (5)

2. Ventilation rate

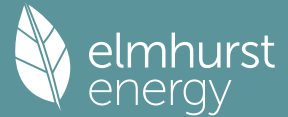
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	1 * 20 = 20.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	5 * 10 = 50.0000 (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) =	70.0000 / (5) = 0.0854 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3354 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3354 (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	0.4277	0.4193	0.4109	0.3690	0.3606	0.3187	0.3187	0.3103	0.3354	0.3606	0.3774	0.3941 (22b)
Effective ac	0.5915	0.5879	0.5844	0.5681	0.5650	0.5508	0.5508	0.5481	0.5563	0.5650	0.5712	0.5777 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.40)			56.3200	1.3258	74.6667		(27)
Half Glazed Door			2.1600	1.2000	2.5920		(26a)
Solid Door			2.3200	1.0000	2.3200		(26)
Dormer Windows (Uw = 1.40)			4.1500	1.3258	5.5019		(27)
N			0.7600	1.3258	1.0076		(27a)
Basement Floor			45.8300	0.1300	5.9579	110.0000	5041.3000 (28)
Ground Floor			100.7800	0.1300	13.1014	110.0000	11085.8000 (28a)
External Cavity wall	268.9700	59.9800	208.9900	0.1400	29.2586	150.0000	31348.5000 (29a)
External Timber Wall	20.6700	4.9700	15.7000	0.1400	2.1980	9.0000	141.3000 (29a)
Basement wall	61.1300		61.1300	0.1300	7.9469	110.0000	6724.3000 (29a)
Secondary wall	8.7600		8.7600	0.3300	2.8908	9.0000	78.8400 (29a)
Dormer wall	8.7700		8.7700	0.1600	1.4032	9.0000	78.9300 (29a)
External Slope Roof	167.3000	0.7600	166.5400	0.1100	18.3194	9.0000	1498.8600 (30)
External Flat Roof	11.8600		11.8600	0.1100	1.3046	9.0000	106.7400 (30)
Secondary Plane	1.5100		1.5100	0.0800	0.1208	9.0000	13.5900 (30)

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Total net area of external elements Aum(A, m2)	695.5800			(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =	168.5897		(33)
Internal Wall	430.0000		9.0000	3870.0000 (32c)
First Floor	111.1000		18.0000	1999.8000 (32d)
Ground Floor Ceiling	111.1000		9.0000	999.9000 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	62987.8600		(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		207.5109		(35)

List of Thermal Bridges				
K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	34.5200	0.0500	1.7260	
E3 Sill	19.8100	0.0500	0.9905	
E4 Jamb	64.4600	0.0500	3.2230	
E5 Ground floor (normal)	55.1500	0.1600	8.8240	
E6 Intermediate floor within a dwelling	91.2600	0.0700	6.3882	
E11 Eaves (insulation at rafter level)	26.9100	0.0400	1.0764	
E13 Gable (insulation at rafter level)	30.3000	0.0800	2.4240	
E14 Flat roof	16.9900	0.0800	1.3592	
E16 Corner (normal)	67.1700	0.0900	6.0453	
E17 Corner (inverted - internal area greater than external area)	18.6900	-0.0900	-1.6821	
R1 Head of roof window	0.9800	0.0800	0.0784	
R2 Sill of roof window	0.9800	0.0600	0.0588	
R3 Jamb of roof window	1.5600	0.0800	0.1248	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				30.6365 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =			199.2262 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(38)
Heat transfer coeff	159.9155	158.9553	158.0141	153.5934	152.7663	148.9160	148.9160	148.2030	150.3991	152.7663	154.4395	156.1888	
Average = Sum(39)m / 12 =	359.1417	358.1815	357.2403	352.8196	351.9925	348.1422	348.1422	347.4292	349.6253	351.9925	353.6657	355.4150	(39)
												352.8157	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1832	1.1800	1.1769	1.1623	1.1596	1.1469	1.1469	1.1446	1.1518	1.1596	1.1651	1.1709	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

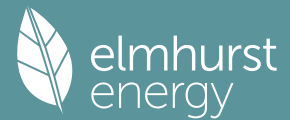
4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.1365 (42)
Hot water usage for mixer showers	115.2138	113.4824	110.9594	106.1320	102.5695	98.5966	96.3384	98.8424	101.5872	105.8528	110.7839	114.7724	(42a)
Hot water usage for baths	33.1537	32.6613	31.9680	30.6895	29.7322	28.6707	28.0974	28.7859	29.5356	30.6714	31.9762	33.0416	(42b)
Hot water usage for other uses	46.7512	45.0512	43.3511	41.6511	39.9510	38.2510	38.2510	39.9510	41.6511	43.3511	45.0512	46.7512	(42c)
Average daily hot water use (litres/day)												179.4631	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	195.1188	191.1949	186.2784	178.4726	172.2527	165.5183	162.6868	167.5793	172.7738	179.8753	187.8113	194.5653	(44)
Energy content (annual)	309.0204	272.2590	286.3030	244.3200	231.8853	203.5241	196.7556	207.4982	213.0474	244.0891	267.5716	304.6422	(45)
Distribution loss (46)m = 0.15 x (45)m													
Water storage loss:	46.3531	40.8389	42.9455	36.6480	34.7828	30.5286	29.5133	31.1247	31.9571	36.6134	40.1357	45.6963	(46)
Store volume													200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.0000 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.0800 (55)
Total storage loss	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(56)
If cylinder contains dedicated solar storage	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	365.7628	323.5102	343.0454	299.2320	288.6277	258.4361	253.4980	264.2406	267.9594	300.8315	322.4836	361.3846	(62)
WVHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	365.7628	323.5102	343.0454	299.2320	288.6277	258.4361	253.4980	264.2406	267.9594	300.8315	322.4836	361.3846	(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	148.1432	131.5271	140.5897	125.1660	122.4958	111.6014	110.8151	114.3871	114.7679	126.5536	132.8971	146.6874	(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	(66)
	188.1919	188.1919	188.1919	188.1919	188.1919	188.1919	188.1919	188.1919	188.1919	188.1919	188.1919	188.1919	

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Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	69.0460	61.3261	49.8737	37.7576	28.2243	23.8281	25.7471	33.4671	44.9194	57.0355	66.5689	70.9650 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	688.2459	695.3878	677.3906	639.0767	590.7122	545.2565	514.8892	507.7474	525.7446	564.0585	612.4230	657.8787 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.9557	56.9557	56.9557	56.9557	56.9557	56.9557	56.9557	56.9557	56.9557	56.9557	56.9557	56.9557 (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)	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613 (71)
Water heating gains (Table 5)	199.1172	195.7248	188.9646	173.8417	164.6449	155.0019	148.9451	153.7461	159.3998	170.0989	184.5794	197.1605 (72)
Total internal gains	1076.0956	1072.1250	1035.9153	970.3623	903.2677	843.7728	809.2678	814.6469	849.7502	910.8793	983.2576	1045.6907 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	7.0400	10.6334	0.7600	0.7000	0.7700	27.5987 (74)
East	28.8100	19.6403	0.7600	0.7000	0.7700	208.6102 (76)
West	20.4700	19.6403	0.7600	0.7000	0.7700	148.2211 (80)
North	0.7600	15.2954	0.7600	0.7000	1.0000	5.5658 (82)
East	2.1500	19.6403	0.7600	0.7000	0.7700	15.5679 (76)
West	2.0000	19.6403	0.7600	0.7000	0.7700	14.4818 (80)

Solar gains	420.0455	819.9269	1354.2803	1994.1207	2468.9267	2540.3930	2413.0854	2054.5966	1580.1315	973.2049	523.2263	345.8696 (83)
Total gains	1496.1411	1892.0519	2390.1956	2964.4830	3372.1944	3384.1658	3222.3532	2869.2435	2429.8817	1884.0842	1506.4839	1391.5602 (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	48.7179	48.8485	48.9772	49.5909	49.7074	50.2571	50.2571	50.3603	50.0439	49.7074	49.4722	49.2287
alpha	4.2479	4.2566	4.2651	4.3061	4.3138	4.3505	4.3505	4.3574	4.3363	4.3138	4.2981	4.2819
util living area	0.9979	0.9941	0.9798	0.9257	0.7996	0.6175	0.4654	0.5369	0.8097	0.9715	0.9957	0.9985 (86)
Living	19.5585	19.7459	20.0640	20.4629	20.7521	20.8866	20.9191	20.9113	20.7926	20.3694	19.8862	19.5321
Non living	18.2328	18.4742	18.8798	19.3807	19.7091	19.8457	19.8679	19.8663	19.7666	19.2788	18.6635	18.2064
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	7	0	0	0	0	0	0	0	0	0	0	0
16 / 9	24	19	0	0	0	0	0	0	0	0	0	31
MIT	20.3679	20.1149	20.0640	20.4629	20.7521	20.8866	20.9191	20.9113	20.7926	20.3694	19.8862	20.1686 (87)
Th 2	19.9335	19.9360	19.9385	19.9502	19.9524	19.9627	19.9627	19.9646	19.9587	19.9524	19.9480	19.9434 (88)
util rest of house	0.9973	0.9924	0.9737	0.9039	0.7468	0.5323	0.3605	0.4252	0.7375	0.9594	0.9942	0.9981 (89)
MIT 2	19.3523	19.0283	18.8798	19.3807	19.7091	19.8457	19.8679	19.8663	19.7666	19.2788	18.6635	19.1767 (90)
Living area fraction									fLA = Living area / (4) =			0.1639 (91)
MIT	19.5188	19.2064	19.0739	19.5580	19.8800	20.0163	20.0402	20.0376	19.9348	19.4576	18.8639	19.3393 (92)
Temperature adjustment												0.0000
adjusted MIT	19.5188	19.2064	19.0739	19.5580	19.8800	20.0163	20.0402	20.0376	19.9348	19.4576	18.8639	19.3393 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9970	0.9909	0.9671	0.8940	0.7427	0.5369	0.3685	0.4335	0.7355	0.9516	0.9919	0.9977 (94)
Ext temp.	1491.7112	1874.7818	2311.5097	2650.1481	2504.6536	1817.0757	1187.4723	1243.7096	1787.2842	1792.9288	1494.2246	1388.4056 (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	5465.6978	5124.2928	4491.9162	3760.3655	2879.3096	1885.6426	1197.6752	1263.8158	2039.9845	3117.8074	4160.4872	5380.7189 (97)
Space heating requirement - total per year (kWh/year)	2956.6461	2183.6714	1622.2224	799.3565	278.7440	0.0000	0.0000	0.0000	0.0000	985.7096	1919.7091	2970.2811 (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)	2956.6461	2183.6714	1622.2224	799.3565	278.7440	0.0000	0.0000	0.0000	0.0000	985.7096	1919.7091	2970.2811 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												13716.3403 (98c) / (4) =
Space heating per m2												45.1879 (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 %)	325.2651 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)

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Efficiency of secondary/supplementary heating system, %												65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	2956.6461	2183.6714	1622.2224	799.3565	278.7440	0.0000	0.0000	0.0000	0.0000	985.7096	1919.7091	2970.2811 (98)
Space heating efficiency (main heating system 1)	325.2651	325.2651	325.2651	325.2651	325.2651	0.0000	0.0000	0.0000	0.0000	325.2651	325.2651	325.2651 (210)
Space heating fuel (main heating system)	908.9959	671.3514	498.7386	245.7554	85.6975	0.0000	0.0000	0.0000	0.0000	303.0481	590.1984	913.1879 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	365.7628	323.5102	343.0454	299.2320	288.6277	258.4361	253.4980	264.2406	267.9594	300.8315	322.4836	361.3846 (64)
Efficiency of water heater	164.3243	164.3243	164.3243	164.3243	164.3243	164.3243	164.3243	164.3243	164.3243	164.3243	164.3243	164.3243 (216)
Fuel for water heating, kWh/month	222.5860	196.8731	208.7613	182.0985	175.6452	157.2720	154.2669	160.8044	163.0675	183.0719	196.2483	219.9216 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	60.4356	48.4837	43.6542	31.9829	24.7045	20.1838	22.5363	29.2935	38.0494	49.9229	56.3878	62.1153 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-42.5390	-63.8886	-95.3037	-109.5179	-118.6747	-108.7271	-107.5798	-99.8217	-86.5507	-73.6809	-47.8763	-36.4115 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												4216.9732 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												164.3243
Water heating fuel used												2220.6167 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												487.7499 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-990.5719 (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												5934.7678 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4216.9732	16.4900	695.3789 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2220.6167	16.4900	366.1797 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	487.7499	16.4900	80.4300 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-990.5719	16.4900	-163.3453
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-163.3453 (252)
Total energy cost			978.6432 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] = 1.0108 (257)$

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SAP value 83.6146
SAP rating (Section 12) 84 (258)
SAP band B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4216.9732	0.1559	657.5288	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2220.6167	0.1411	313.2260	(264)
Space and water heating			970.7548	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	487.7499	0.1443	70.3974	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-990.5719	0.1342	-132.9764	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-132.9764	(269)
Total CO2, kg/year			908.1757	(272)
CO2 emissions per m2			2.9900	(273)
EI value			96.5084	
EI rating			97	(274)
EI band			A	

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

1. Overall dwelling characteristics

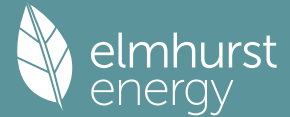
	Area (m2)	Storey height (m)	Volume (m3)	
Basement floor	45.8300 (1a)	x 2.2100 (2a)	= 101.2843 (1a)	-
Ground floor	146.6100 (1b)	x 2.7000 (2b)	= 395.8470 (1b)	-
First floor	111.1000 (1c)	x 2.9000 (2c)	= 322.1900 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	303.5400			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	819.3213	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	1 * 20 =	20.0000 (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	5 * 10 =	50.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour 70.0000 / (5) =	0.0854 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3354	(18)
Number of sides sheltered	0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3354 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.4000	4.2000	4.2000	3.8000	3.8000	3.4000	3.5000	3.3000	3.5000	3.8000	3.7000	4.0000	(22)
Wind factor	1.1000	1.0500	1.0500	0.9500	0.9500	0.8500	0.8750	0.8250	0.8750	0.9500	0.9250	1.0000	(22a)
Adj infilt rate	0.3690	0.3522	0.3522	0.3187	0.3187	0.2851	0.2935	0.2767	0.2935	0.3187	0.3103	0.3354	(22b)
Effective ac	0.5681	0.5620	0.5620	0.5508	0.5508	0.5406	0.5431	0.5383	0.5431	0.5508	0.5481	0.5563	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Window (Uw = 1.40)			56.3200	1.3258	74.6667		(27)
Half Glazed Door			2.1600	1.2000	2.5920		(26a)
Solid Door			2.3200	1.0000	2.3200		(26)
Dormer Windows (Uw = 1.40)			4.1500	1.3258	5.5019		(27)
N			0.7600	1.3258	1.0076		(27a)
Basement Floor`			45.8300	0.1300	5.9579	110.0000	5041.3000 (28)
Ground Floor			100.7800	0.1300	13.1014	110.0000	11085.8000 (28a)
External Cavity wall	268.9700	59.9800	208.9900	0.1400	29.2586	150.0000	31348.5000 (29a)
External Timber Wall	20.6700	4.9700	15.7000	0.1400	2.1980	9.0000	141.3000 (29a)
Basement wall	61.1300		61.1300	0.1300	7.9469	110.0000	6724.3000 (29a)
Secondary wall	8.7600		8.7600	0.3300	2.8908	9.0000	78.8400 (29a)
Dormer wall	8.7700		8.7700	0.1600	1.4032	9.0000	78.9300 (29a)
External Slope Roof	167.3000	0.7600	166.5400	0.1100	18.3194	9.0000	1498.8600 (30)
External Flat Roof	11.8600		11.8600	0.1100	1.3046	9.0000	106.7400 (30)
Secondary Plane	1.5100		1.5100	0.0800	0.1208	9.0000	13.5900 (30)
Total net area of external elements Aum(A, m2)			695.5800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	168.5897		(33)
Internal Wall			430.0000			9.0000	3870.0000 (32c)
First Floor			111.1000			18.0000	1999.8000 (32d)
Ground Floor Ceiling			111.1000			9.0000	999.9000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 62987.8600 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 207.5109 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	34.5200	0.0500	1.7260
E3 Sill	19.8100	0.0500	0.9905
E4 Jamb	64.4600	0.0500	3.2230
E5 Ground floor (normal)	55.1500	0.1600	8.8240
E6 Intermediate floor within a dwelling	91.2600	0.0700	6.3882
E11 Eaves (insulation at rafter level)	26.9100	0.0400	1.0764
E13 Gable (insulation at rafter level)	30.3000	0.0800	2.4240
E14 Flat roof	16.9900	0.0800	1.3592
E16 Corner (normal)	67.1700	0.0900	6.0453
E17 Corner (inverted - internal area greater than external area)	18.6900	-0.0900	-1.6821
R1 Head of roof window	0.9800	0.0800	0.0784
R2 Sill of roof window	0.9800	0.0600	0.0588
R3 Jamb of roof window	1.5600	0.0800	0.1248

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 30.6365 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 199.2262 (37)

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

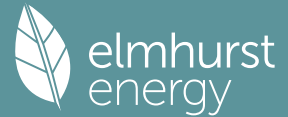
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	153.5934	151.9582	151.9582	148.9160	148.9160	146.1780	146.8340	145.5410	146.8340	148.9160	148.2030	150.3991 (38)
Heat transfer coeff	352.8196	351.1844	351.1844	348.1422	348.1422	345.4042	346.0602	344.7673	346.0602	348.1422	347.4292	349.6253 (39)
Average = Sum(39)m / 12 =												348.2468

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1623	1.1570	1.1570	1.1469	1.1469	1.1379	1.1401	1.1358	1.1401	1.1469	1.1446	1.1518 (40)
HLP (average)												1.1473
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.1365 (42)
Hot water usage for mixer showers													
115.2138	113.4824	110.9594	106.1320	102.5695	98.5966	96.3384	98.8424	101.5872	105.8528	110.7839	114.7724	(42a)	
Hot water usage for baths													
33.1537	32.6613	31.9680	30.6895	29.7322	28.6707	28.0974	28.7859	29.5356	30.6714	31.9762	33.0416	(42b)	
Hot water usage for other uses													
46.7512	45.0512	43.3511	41.6511	39.9510	38.2510	38.2510	39.9510	41.6511	43.3511	45.0512	46.7512	(42c)	
Average daily hot water use (litres/day)													179.4631 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
195.1188	191.1949	186.2784	178.4726	172.2527	165.5183	162.6868	167.5793	172.7738	179.8753	187.8113	194.5653	(44)	
Energy content (annual)	309.0204	272.2590	286.3030	244.3200	231.8853	203.5241	196.7556	207.4982	213.0474	244.0891	267.5716	304.6422 (45)	
Distribution loss (46)m = 0.15 x (45)m													Total = Sum(45)m = 2980.9159
46.3531	40.8389	42.9455	36.6480	34.7828	30.5286	29.5133	31.1247	31.9571	36.6134	40.1357	45.6963	(46)	
Water storage loss:													
Store volume													200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.0000 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.0800 (55)
Total storage loss													
33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(56)	
If cylinder contains dedicated solar storage													
33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	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	(61)	
Total heat required for water heating calculated for each month													
365.7628	323.5102	343.0454	299.2320	288.6277	258.4361	253.4980	264.2406	267.9594	300.8315	322.4836	361.3846	(62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)	
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)	

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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	365.7628	323.5102	343.0454	299.2320	288.6277	258.4361	253.4980	264.2406	267.9594	300.8315	322.4836	361.3846 (64)
Total per year (kWh/year) = Sum(64)m =												3649.0119 (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	148.1432	131.5271	140.5897	125.1660	122.4958	111.6014	110.8151	114.3871	114.7679	126.5536	132.8971	146.6874 (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	188.1919	188.1919	188.1919	188.1919	188.1919	188.1919	188.1919	188.1919	188.1919	188.1919	188.1919	188.1919 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	69.0460	61.3261	49.8737	37.7576	28.2243	23.8281	25.7471	33.4671	44.9194	57.0355	66.5689	70.9650 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	688.2459	695.3878	677.3906	639.0767	590.7122	545.2565	514.8892	507.7474	525.7446	564.0585	612.4230	657.8787 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.9557	56.9557	56.9557	56.9557	56.9557	56.9557	56.9557	56.9557	56.9557	56.9557	56.9557	56.9557 (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)	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613 (71)
Water heating gains (Table 5)	199.1172	195.7248	188.9646	173.8417	164.6449	155.0019	148.9451	153.7461	159.3998	170.0989	184.5794	197.1605 (72)
Total internal gains	1076.0956	1072.1250	1035.9153	970.3623	903.2677	843.7728	809.2678	814.6469	849.7502	910.8793	983.2576	1045.6907 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	7.0400	12.7500	0.7600	0.7000	0.7700	33.0923 (74)
East	28.8100	23.7835	0.7600	0.7000	0.7700	252.6176 (76)
West	20.4700	23.7835	0.7600	0.7000	0.7700	179.4892 (80)
North	0.7600	18.1387	0.7600	0.7000	1.0000	6.6005 (82)
East	2.1500	23.7835	0.7600	0.7000	0.7700	18.8521 (76)
West	2.0000	23.7835	0.7600	0.7000	0.7700	17.5368 (80)

Solar gains	508.1884	882.2709	1421.5332	2134.9340	2555.7090	2792.5182	2627.9435	2285.7349	1767.1234	1104.9060	623.7449	420.7418 (83)
Total gains	1584.2840	1954.3960	2457.4485	3105.2963	3458.9767	3636.2910	3437.2113	3100.3817	2616.8736	2015.7853	1607.0025	1466.4324 (84)

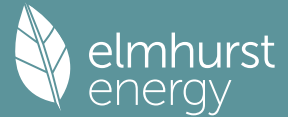
7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n _{l1,m} (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	49.5909	49.8218	49.8218	50.2571	50.2571	50.6555	50.5595	50.7491	50.5595	50.2571	50.3603	50.0439
alpha	4.3061	4.3215	4.3215	4.3505	4.3505	4.3770	4.3706	4.3833	4.3706	4.3505	4.3574	4.3363
util living area	0.9972	0.9928	0.9744	0.9024	0.7555	0.5239	0.3790	0.4273	0.7476	0.9573	0.9936	0.9979 (86)
Living	19.6553	19.8260	20.1579	20.5504	20.8017	20.9098	20.9255	20.9234	20.8394	20.4645	19.9921	19.6332
Non living	18.3692	18.5905	19.0105	19.4940	19.7684	19.8691	19.8764	19.8794	19.8168	19.4032	18.8112	18.3475
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	7	0	0	0	0	0	0	0	0	0	0	0
16 / 9	24	16	0	0	0	0	0	0	0	0	0	31
MIT	20.4104	20.1169	20.1579	20.5504	20.8017	20.9098	20.9255	20.9234	20.8394	20.4645	19.9921	20.2259 (87)
Th 2	19.9502	19.9546	19.9546	19.9627	19.9627	19.9700	19.9682	19.9717	19.9682	19.9627	19.9646	19.9587 (88)
util rest of house	0.9963	0.9907	0.9666	0.8748	0.6953	0.4365	0.2780	0.3179	0.6643	0.9394	0.9913	0.9973 (89)
MIT 2	19.4100	19.0259	19.0105	19.4940	19.7684	19.8691	19.8764	19.8794	19.8168	19.4032	18.8112	19.2475 (90)
Living area fraction										f _{LA} = Living area / (4) =		0.1639 (91)
MIT	19.5739	19.2047	19.1985	19.6671	19.9377	20.0397	20.0484	20.0505	19.9844	19.5772	19.0047	19.4079 (92)
Temperature adjustment												0.0000
adjusted MIT	19.5739	19.2047	19.1985	19.6671	19.9377	20.0397	20.0484	20.0505	19.9844	19.5772	19.0047	19.4079 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9960	0.9887	0.9593	0.8655	0.6938	0.4426	0.2859	0.3264	0.6657	0.9306	0.9883	0.9969 (94)
Useful gains	1577.9053	1932.4051	2357.3540	2687.5154	2399.6878	1609.3631	982.7149	1012.0555	1742.1003	1875.9226	1588.1318	1461.8804 (95)
Ext temp.	4.7000	5.2000	7.0000	9.4000	12.3000	15.3000	17.2000	17.1000	14.5000	11.1000	7.6000	4.7000 (96)
Heat loss rate W	5247.8168	4918.2427	4283.9341	3574.4244	2659.0131	1637.1133	985.7115	1017.2355	1897.9482	2951.2630	3962.3292	5142.2540 (97)
Space heating kWh												

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2730.4142	2006.4829	1433.3756	638.5745	192.9380	0.0000	0.0000	0.0000	0.0000	800.0533	1709.4221	2738.1980	(98a)
Space heating requirement - total per year (kWh/year)												12249.4585
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												
2730.4142	2006.4829	1433.3756	638.5745	192.9380	0.0000	0.0000	0.0000	0.0000	800.0533	1709.4221	2738.1980	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												12249.4585
Space heating per m2												(98c) / (4) = 40.3553 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	323.3451	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	65.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	2730.4142	2006.4829	1433.3756	638.5745	192.9380	0.0000	0.0000	0.0000	0.0000	800.0533	1709.4221	2738.1980	(98)
Space heating efficiency (main heating system 1)	323.3451	323.3451	323.3451	323.3451	323.3451	0.0000	0.0000	0.0000	0.0000	323.3451	323.3451	323.3451	(210)
Space heating fuel (main heating system)	844.4272	620.5391	443.2959	197.4901	59.6694	0.0000	0.0000	0.0000	0.0000	247.4301	528.6680	846.8345	(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	365.7628	323.5102	343.0454	299.2320	288.6277	258.4361	253.4980	264.2406	267.9594	300.8315	322.4836	361.3846	(64)
Efficiency of water heater (217)m	164.3083	164.3083	164.3083	164.3083	164.3083	164.3083	164.3083	164.3083	164.3083	164.3083	164.3083	164.3083	(216)
Fuel for water heating, kWh/month	222.6077	196.8922	208.7816	182.1162	175.6623	157.2873	154.2819	160.8200	163.0833	183.0897	196.2674	219.9430	(219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	60.4356	48.4837	43.6542	31.9829	24.7045	20.1838	22.5363	29.2935	38.0494	49.9229	56.3878	62.1153	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-49.3310	-66.4076	-96.7211	-112.6081	-119.4111	-115.2688	-113.2376	-106.5296	-92.6490	-79.4644	-54.4724	-42.5006	(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												3788.3544	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												164.3083	
Water heating fuel used												2220.8325	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												487.7499	(232)

Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1048.6012	(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												5448.3355	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3788.3544	21.5100	814.8750	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2220.8325	21.5100	477.7011	(247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(247a)

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Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	487.7499	21.5100	104.9150 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1048.6012	21.5100	-225.5541
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-225.5541 (252)
Total energy cost			1171.9370 (255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3788.3544	0.1564	592.3830 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2220.8325	0.1411	313.2565 (264)
Space and water heating			905.6395 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	487.7499	0.1443	70.3974 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1048.6012	0.1344	-140.9259
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-140.9259 (269)
Total CO2, kg/year			835.1109 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3788.3544	1.5789	5981.3897 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2220.8325	1.5216	3379.1587 (278)
Space and water heating			9360.5485 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	487.7499	1.5338	748.1270 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1048.6012	1.4967	-1569.4244
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1569.4244 (283)
Total Primary energy kWh/year			8539.2511 (286)

SAP 10 EPC IMPROVEMENTS

709849

Current energy efficiency rating: B 84
Current environmental impact rating: A 97

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

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

Measures omitted - SAP change or cost saving too small:
N Solar water heating + 0.9 -£ 84 -49 kg (5.8%)

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

Potential energy efficiency rating: B 84
Potential environmental impact rating: A 97

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

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

	Current	Potential	Saving
Electricity	£1397	£1397	£0

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Space heating	£815	£815	£0
Water heating	£478	£478	£0
Lighting	£105	£105	£0
Generated (PV)	-£226	-£226	£0
Total cost of fuels	£1171	£1171	£0
Total cost of uses	£1172	£1172	£0
Delivered energy	18 kWh/m²	18 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.8 tonnes	0.0 tonnes
CO2 emissions per m²	3 kg/m²	3 kg/m²	0 kg/m²
Primary energy	28 kWh/m²	28 kWh/m²	0 kWh/m²

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

1. Overall dwelling characteristics

	Area (m²)		Storey height (m)		Volume (m³)
Basement floor	45.8300 (1a)	x	2.2100 (2a)	=	101.2843 (1a) -
Ground floor	146.6100 (1b)	x	2.7000 (2b)	=	395.8470 (1b) -
First floor	111.1000 (1c)	x	2.9000 (2c)	=	322.1900 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	303.5400				(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	819.3213 (5)

2. Ventilation rate

	m³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	1 * 20 = 20.0000 (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	5 * 10 = 50.0000 (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) =	70.0000 / (5) = 0.0854 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3354 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3354 (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	0.4277	0.4193	0.4109	0.3690	0.3606	0.3187	0.3187	0.3103	0.3354	0.3606	0.3774	0.3941 (22b)
Effective ac	0.5915	0.5879	0.5844	0.5681	0.5650	0.5508	0.5508	0.5481	0.5563	0.5650	0.5712	0.5777 (25)

3. Heat losses and heat loss parameter

Element	Gross m²	Openings m²	NetArea m²	U-value W/m²K	A x U W/K	K-value kJ/m²K	A x K kJ/K
Window (Uw = 1.40)			56.3200	1.3258	74.6667		(27)
Half Glazed Door			2.1600	1.2000	2.5920		(26a)
Solid Door			2.3200	1.0000	2.3200		(26)
Dormer Windows (Uw = 1.40)			4.1500	1.3258	5.5019		(27)
N			0.7600	1.3258	1.0076		(27a)
Basement Floor			45.8300	0.1300	5.9579	110.0000	5041.3000 (28)
Ground Floor			100.7800	0.1300	13.1014	110.0000	11085.8000 (28a)
External Cavity wall	268.9700	59.9800	208.9900	0.1400	29.2586	150.0000	31348.5000 (29a)
External Timber Wall	20.6700	4.9700	15.7000	0.1400	2.1980	9.0000	141.3000 (29a)
Basement wall	61.1300		61.1300	0.1300	7.9469	110.0000	6724.3000 (29a)
Secondary wall	8.7600		8.7600	0.3300	2.8908	9.0000	78.8400 (29a)
Dormer wall	8.7700		8.7700	0.1600	1.4032	9.0000	78.9300 (29a)

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External Slope Roof	167.3000	0.7600	166.5400	0.1100	18.3194	9.0000	1498.8600 (30)
External Flat Roof	11.8600		11.8600	0.1100	1.3046	9.0000	106.7400 (30)
Secondary Plane	1.5100		1.5100	0.0800	0.1208	9.0000	13.5900 (30)
Total net area of external elements Aum(A, m2)			695.5800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	168.5897			(33)
Internal Wall			430.0000			9.0000	3870.0000 (32c)
First Floor			111.1000			18.0000	1999.8000 (32d)
Ground Floor Ceiling			111.1000			9.0000	999.9000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 62987.8600 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 207.5109 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	34.5200	0.0500	1.7260
E3 Sill	19.8100	0.0500	0.9905
E4 Jamb	64.4600	0.0500	3.2230
E5 Ground floor (normal)	55.1500	0.1600	8.8240
E6 Intermediate floor within a dwelling	91.2600	0.0700	6.3882
E11 Eaves (insulation at rafter level)	26.9100	0.0400	1.0764
E13 Gable (insulation at rafter level)	30.3000	0.0800	2.4240
E14 Flat roof	16.9900	0.0800	1.3592
E16 Corner (normal)	67.1700	0.0900	6.0453
E17 Corner (inverted - internal area greater than external area)	18.6900	-0.0900	-1.6821
R1 Head of roof window	0.9800	0.0800	0.0784
R2 Sill of roof window	0.9800	0.0600	0.0588
R3 Jamb of roof window	1.5600	0.0800	0.1248

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 30.6365 (36)

Point Thermal bridges

Total fabric heat loss (33) + (36) + (36a) = 199.2262 (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	159.9155	158.9553	158.0141	153.5934	152.7663	148.9160	148.9160	148.2030	150.3991	152.7663	154.4395	156.1888 (38)
Heat transfer coeff	359.1417	358.1815	357.2403	352.8196	351.9925	348.1422	348.1422	347.4292	349.6253	351.9925	353.6657	355.4150 (39)
Average = Sum(39)m / 12 =												352.8157

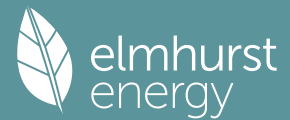
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1832	1.1800	1.1769	1.1623	1.1596	1.1469	1.1469	1.1446	1.1518	1.1596	1.1651	1.1709 (40)
HLP (average)												1.1623
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.1365 (42)
Hot water usage for mixer showers	115.2138	113.4824	110.9594	106.1320	102.5695	98.5966	96.3384	98.8424	101.5872	105.8528	110.7839	114.7724 (42a)
Hot water usage for baths	33.1537	32.6613	31.9680	30.6895	29.7322	28.6707	28.0974	28.7859	29.5356	30.6714	31.9762	33.0416 (42b)
Hot water usage for other uses	46.7512	45.0512	43.3511	41.6511	39.9510	38.2510	38.2510	39.9510	41.6511	43.3511	45.0512	46.7512 (42c)
Average daily hot water use (litres/day)												179.4631 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	195.1188	191.1949	186.2784	178.4726	172.2527	165.5183	162.6868	167.5793	172.7738	179.8753	187.8113	194.5653 (44)
Energy content (annual)	309.0204	272.2590	286.3030	244.3200	231.8853	203.5241	196.7556	207.4982	213.0474	244.0891	267.5716	304.6422 (45)
Distribution loss (46)m = 0.15 x (45)m												2980.9159
	46.3531	40.8389	42.9455	36.6480	34.7828	30.5286	29.5133	31.1247	31.9571	36.6134	40.1357	45.6963 (46)
Water storage loss:												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0800 (55)
Total storage loss	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (56)
If cylinder contains dedicated solar storage	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	365.7628	323.5102	343.0454	299.2320	288.6277	258.4361	253.4980	264.2406	267.9594	300.8315	322.4836	361.3846 (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	365.7628	323.5102	343.0454	299.2320	288.6277	258.4361	253.4980	264.2406	267.9594	300.8315	322.4836	361.3846 (64)
	Total per year (kWh/year) = Sum(64)m =											3649.0119 (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	148.1432	131.5271	140.5897	125.1660	122.4958	111.6014	110.8151	114.3871	114.7679	126.5536	132.8971	146.6874 (65)

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

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Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	188.1919	188.1919	188.1919	188.1919	188.1919	188.1919	188.1919	188.1919	188.1919	188.1919	188.1919	188.1919	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	69.0460	61.3261	49.8737	37.7576	28.2243	23.8281	25.7471	33.4671	44.9194	57.0355	66.5689	70.9650	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	688.2459	695.3878	677.3906	639.0767	590.7122	545.2565	514.8892	507.7474	525.7446	564.0585	612.4230	657.8787	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.9557	56.9557	56.9557	56.9557	56.9557	56.9557	56.9557	56.9557	56.9557	56.9557	56.9557	56.9557	(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)	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	(71)
Water heating gains (Table 5)	199.1172	195.7248	188.9646	173.8417	164.6449	155.0019	148.9451	153.7461	159.3998	170.0989	184.5794	197.1605	(72)
Total internal gains	1076.0956	1072.1250	1035.9153	970.3623	903.2677	843.7728	809.2678	814.6469	849.7502	910.8793	983.2576	1045.6907	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	7.0400	10.6334	0.7600	0.7000	0.7700	27.5987 (74)
East	28.8100	19.6403	0.7600	0.7000	0.7700	208.6102 (76)
West	20.4700	19.6403	0.7600	0.7000	0.7700	148.2211 (80)
North	0.7600	15.2954	0.7600	0.7000	1.0000	5.5658 (82)
East	2.1500	19.6403	0.7600	0.7000	0.7700	15.5679 (76)
West	2.0000	19.6403	0.7600	0.7000	0.7700	14.4818 (80)

Solar gains	420.0455	819.9269	1354.2803	1994.1207	2468.9267	2540.3930	2413.0854	2054.5966	1580.1315	973.2049	523.2263	345.8696	(83)
Total gains	1496.1411	1892.0519	2390.1956	2964.4830	3372.1944	3384.1658	3222.3532	2869.2435	2429.8817	1884.0842	1506.4839	1391.5602	(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	48.7179	48.8485	48.9772	49.5909	49.7074	50.2571	50.2571	50.3603	50.0439	49.7074	49.4722	49.2287	
alpha	4.2479	4.2566	4.2651	4.3061	4.3138	4.3505	4.3505	4.3574	4.3363	4.3138	4.2981	4.2819	
util living area	0.9979	0.9941	0.9798	0.9257	0.7996	0.6175	0.4654	0.5369	0.8097	0.9715	0.9957	0.9985	(86)
Living	19.5585	19.7459	20.0640	20.4629	20.7521	20.8866	20.9191	20.9113	20.7926	20.3694	19.8862	19.5321	
Non living	18.2328	18.4742	18.8798	19.3807	19.7091	19.8457	19.8679	19.8663	19.7666	19.2788	18.6635	18.2064	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	7	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	24	19	0	0	0	0	0	0	0	0	0	31	
MIT	20.3679	20.1149	20.0640	20.4629	20.7521	20.8866	20.9191	20.9113	20.7926	20.3694	19.8862	20.1686	(87)
Th 2	19.9335	19.9360	19.9385	19.9502	19.9524	19.9627	19.9627	19.9646	19.9587	19.9524	19.9480	19.9434	(88)
util rest of house	0.9973	0.9924	0.9737	0.9039	0.7468	0.5323	0.3605	0.4252	0.7375	0.9594	0.9942	0.9981	(89)
MIT 2	19.3523	19.0283	18.8798	19.3807	19.7091	19.8457	19.8679	19.8663	19.7666	19.2788	18.6635	19.1767	(90)
Living area fraction									fLA = Living area / (4) =			0.1639	(91)
MIT	19.5188	19.2064	19.0739	19.5580	19.8800	20.0163	20.0402	20.0376	19.9348	19.4576	18.8639	19.3393	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5188	19.2064	19.0739	19.5580	19.8800	20.0163	20.0402	20.0376	19.9348	19.4576	18.8639	19.3393	(93)

8. Space heating requirement

Utilisation	0.9970	0.9909	0.9671	0.8940	0.7427	0.5369	0.3685	0.4335	0.7355	0.9516	0.9919	0.9977	(94)
Useful gains	1491.7112	1874.7818	2311.5097	2650.1481	2504.6536	1817.0757	1187.4723	1243.7096	1787.2842	1792.9288	1494.2246	1388.4056	(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	5465.6978	5124.2928	4491.9162	3760.3655	2879.3096	1885.6426	1197.6752	1263.8158	2039.9845	3117.8074	4160.4872	5380.7189	(97)
Space heating kWh	2956.6461	2183.6714	1622.2224	799.3565	278.7440	0.0000	0.0000	0.0000	0.0000	985.7096	1919.7091	2970.2811	(98a)
Space heating requirement - total per year (kWh/year)												13716.3403	
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	2956.6461	2183.6714	1622.2224	799.3565	278.7440	0.0000	0.0000	0.0000	0.0000	985.7096	1919.7091	2970.2811	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												13716.3403	
Space heating per m2										(98c) / (4) =		45.1879	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
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Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	325.2651	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	65.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	2956.6461	2183.6714	1622.2224	799.3565	278.7440	0.0000	0.0000	0.0000	0.0000	985.7096	1919.7091	2970.2811	(98)
Space heating efficiency (main heating system 1)	325.2651	325.2651	325.2651	325.2651	325.2651	0.0000	0.0000	0.0000	0.0000	325.2651	325.2651	325.2651	(210)
Space heating fuel (main heating system)	908.9959	671.3514	498.7386	245.7554	85.6975	0.0000	0.0000	0.0000	0.0000	303.0481	590.1984	913.1879	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	365.7628	323.5102	343.0454	299.2320	288.6277	258.4361	253.4980	264.2406	267.9594	300.8315	322.4836	361.3846	(64)
Efficiency of water heater	164.3243	164.3243	164.3243	164.3243	164.3243	164.3243	164.3243	164.3243	164.3243	164.3243	164.3243	164.3243	(216)
Fuel for water heating, kWh/month	222.5860	196.8731	208.7613	182.0985	175.6452	157.2720	154.2669	160.8044	163.0675	183.0719	196.2483	219.9216	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	60.4356	48.4837	43.6542	31.9829	24.7045	20.1838	22.5363	29.2935	38.0494	49.9229	56.3878	62.1153	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-42.5390	-63.8886	-95.3037	-109.5179	-118.6747	-108.7271	-107.5798	-99.8217	-86.5507	-73.6809	-47.8763	-36.4115	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4216.9732	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												164.3243	
Water heating fuel used												2220.6167	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	487.7499	(232)

Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-990.5719	(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	5934.7678	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4216.9732	16.4900	695.3789 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2220.6167	16.4900	366.1797 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	487.7499	16.4900	80.4300 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-990.5719	16.4900	-163.3453
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-163.3453 (252)
Total energy cost			978.6432 (255)

11a. SAP rating - Individual heating systems

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Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.0108 (257)
SAP value		83.6146
SAP rating (Section 12)		84 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4216.9732	0.1559	657.5288 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2220.6167	0.1411	313.2260 (264)
Space and water heating			970.7548 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	487.7499	0.1443	70.3974 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-990.5719	0.1342	-132.9764
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-132.9764 (269)
Total CO2, kg/year			908.1757 (272)
CO2 emissions per m2			2.9900 (273)
EI value			96.5084
EI rating			97 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Basement floor	45.8300 (1a)	x 2.2100 (2a)	= 101.2843 (1a) -
Ground floor	146.6100 (1b)	x 2.7000 (2b)	= 395.8470 (1b) -
First floor	111.1000 (1c)	x 2.9000 (2c)	= 322.1900 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	303.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	819.3213 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	1 * 20 = 20.0000 (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	5 * 10 = 50.0000 (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) =	70.0000 / (5) = 0.0854 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3354 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3354 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.2000	4.2000	3.8000	3.8000	3.4000	3.5000	3.3000	3.5000	3.8000	3.7000	4.0000 (22)
Wind factor	1.1000	1.0500	1.0500	0.9500	0.9500	0.8500	0.8750	0.8250	0.8750	0.9500	0.9250	1.0000 (22a)
Adj infilt rate	0.3690	0.3522	0.3522	0.3187	0.3187	0.2851	0.2935	0.2767	0.2935	0.3187	0.3103	0.3354 (22b)
Effective ac	0.5681	0.5620	0.5620	0.5508	0.5508	0.5406	0.5431	0.5383	0.5431	0.5508	0.5481	0.5563 (25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Window (Uw = 1.40)			56.3200	1.3258	74.6667		(27)
Half Glazed Door			2.1600	1.2000	2.5920		(26a)
Solid Door			2.3200	1.0000	2.3200		(26)
Dormer Windows (Uw = 1.40)			4.1500	1.3258	5.5019		(27)
N			0.7600	1.3258	1.0076		(27a)
Basement Floor`			45.8300	0.1300	5.9579	110.0000	5041.3000 (28)
Ground Floor			100.7800	0.1300	13.1014	110.0000	11085.8000 (28a)
External Cavity wall	268.9700	59.9800	208.9900	0.1400	29.2586	150.0000	31348.5000 (29a)
External Timber Wall	20.6700	4.9700	15.7000	0.1400	2.1980	9.0000	141.3000 (29a)
Basement wall	61.1300		61.1300	0.1300	7.9469	110.0000	6724.3000 (29a)
Secondary wall	8.7600		8.7600	0.3300	2.8908	9.0000	78.8400 (29a)
Dormer wall	8.7700		8.7700	0.1600	1.4032	9.0000	78.9300 (29a)
External Slope Roof	167.3000	0.7600	166.5400	0.1100	18.3194	9.0000	1498.8600 (30)
External Flat Roof	11.8600		11.8600	0.1100	1.3046	9.0000	106.7400 (30)
Secondary Plane	1.5100		1.5100	0.0800	0.1208	9.0000	13.5900 (30)
Total net area of external elements Aum(A, m2)			695.5800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 168.5897		(33)
Internal Wall			430.0000			9.0000	3870.0000 (32c)
First Floor			111.1000			18.0000	1999.8000 (32d)
Ground Floor Ceiling			111.1000			9.0000	999.9000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 62987.8600 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 207.5109 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	34.5200	0.0500	1.7260
E3 Sill	19.8100	0.0500	0.9905
E4 Jamb	64.4600	0.0500	3.2230
E5 Ground floor (normal)	55.1500	0.1600	8.8240
E6 Intermediate floor within a dwelling	91.2600	0.0700	6.3882
E11 Eaves (insulation at rafter level)	26.9100	0.0400	1.0764
E13 Gable (insulation at rafter level)	30.3000	0.0800	2.4240
E14 Flat roof	16.9900	0.0800	1.3592
E16 Corner (normal)	67.1700	0.0900	6.0453
E17 Corner (inverted - internal area greater than external area)	18.6900	-0.0900	-1.6821
R1 Head of roof window	0.9800	0.0800	0.0784
R2 Sill of roof window	0.9800	0.0600	0.0588
R3 Jamb of roof window	1.5600	0.0800	0.1248

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 30.6365 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 199.2262 (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	153.5934	151.9582	151.9582	148.9160	148.9160	146.1780	146.8340	145.5410	146.8340	148.9160	148.2030	150.3991 (38)
Heat transfer coeff	352.8196	351.1844	351.1844	348.1422	348.1422	345.4042	346.0602	344.7673	346.0602	348.1422	347.4292	349.6253 (39)
Average = Sum(39)m / 12 =												348.2468
HLP	1.1623	1.1570	1.1570	1.1469	1.1469	1.1379	1.1401	1.1358	1.1401	1.1469	1.1446	1.1518 (40)
HLP (average)												1.1473
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.1365 (42)
Hot water usage for mixer showers	115.2138	113.4824	110.9594	106.1320	102.5695	98.5966	96.3384	98.8424	101.5872	105.8528	110.7839	114.7724 (42a)	
Hot water usage for baths	33.1537	32.6613	31.9680	30.6895	29.7322	28.6707	28.0974	28.7859	29.5356	30.6714	31.9762	33.0416 (42b)	
Hot water usage for other uses	46.7512	45.0512	43.3511	41.6511	39.9510	38.2510	38.2510	39.9510	41.6511	43.3511	45.0512	46.7512 (42c)	
Average daily hot water use (litres/day)												179.4631 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	195.1188	191.1949	186.2784	178.4726	172.2527	165.5183	162.6868	167.5793	172.7738	179.8753	187.8113	194.5653 (44)	
Energy content (annual)	309.0204	272.2590	286.3030	244.3200	231.8853	203.5241	196.7556	207.4982	213.0474	244.0891	267.5716	304.6422 (45)	
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		2980.9159	
	46.3531	40.8389	42.9455	36.6480	34.7828	30.5286	29.5133	31.1247	31.9571	36.6134	40.1357	45.6963 (46)	
Water storage loss:													
Store volume												200.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):												2.0000 (48)	
Temperature factor from Table 2b												0.5400 (49)	
Enter (49) or (54) in (55)												1.0800 (55)	
Total storage loss	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (56)	
If cylinder contains dedicated solar storage	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)	
Total heat required for water heating calculated for each month													

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WWhRS	365.7628	323.5102	343.0454	299.2320	288.6277	258.4361	253.4980	264.2406	267.9594	300.8315	322.4836	361.3846 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Solar input	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (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	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)
	365.7628	323.5102	343.0454	299.2320	288.6277	258.4361	253.4980	264.2406	267.9594	300.8315	322.4836	361.3846 (64)
Electric shower(s)	Total per year (kWh/year) = Sum(64)m = 3649.0119 (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)
Heat gains from water heating, kWh/month	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)											
	148.1432	131.5271	140.5897	125.1660	122.4958	111.6014	110.8151	114.3871	114.7679	126.5536	132.8971	146.6874 (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	188.1919	188.1919	188.1919	188.1919	188.1919	188.1919	188.1919	188.1919	188.1919	188.1919	188.1919	188.1919 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	69.0460	61.3261	49.8737	37.7576	28.2243	23.8281	25.7471	33.4671	44.9194	57.0355	66.5689	70.9650 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	688.2459	695.3878	677.3906	639.0767	590.7122	545.2565	514.8892	507.7474	525.7446	564.0585	612.4230	657.8787 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.9557	56.9557	56.9557	56.9557	56.9557	56.9557	56.9557	56.9557	56.9557	56.9557	56.9557	56.9557 (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)	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613	-125.4613 (71)
Water heating gains (Table 5)	199.1172	195.7248	188.9646	173.8417	164.6449	155.0019	148.9451	153.7461	159.3998	170.0989	184.5794	197.1605 (72)
Total internal gains	1076.0956	1072.1250	1035.9153	970.3623	903.2677	843.7728	809.2678	814.6469	849.7502	910.8793	983.2576	1045.6907 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	7.0400	12.7500	0.7600	0.7000	0.7700	33.0923 (74)
East	28.8100	23.7835	0.7600	0.7000	0.7700	252.6176 (76)
West	20.4700	23.7835	0.7600	0.7000	0.7700	179.4892 (80)
North	0.7600	18.1387	0.7600	0.7000	1.0000	6.6005 (82)
East	2.1500	23.7835	0.7600	0.7000	0.7700	18.8521 (76)
West	2.0000	23.7835	0.7600	0.7000	0.7700	17.5368 (80)

Solar gains	508.1884	882.2709	1421.5332	2134.9340	2555.7090	2792.5182	2627.9435	2285.7349	1767.1234	1104.9060	623.7449	420.7418 (83)
Total gains	1584.2840	1954.3960	2457.4485	3105.2963	3458.9767	3636.2910	3437.2113	3100.3817	2616.8736	2015.7853	1607.0025	1466.4324 (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, n1,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	49.5909	49.8218	49.8218	50.2571	50.2571	50.6555	50.5595	50.7491	50.5595	50.2571	50.3603	50.0439
alpha	4.3061	4.3215	4.3215	4.3505	4.3505	4.3770	4.3706	4.3833	4.3706	4.3505	4.3574	4.3363
util living area	0.9972	0.9928	0.9744	0.9024	0.7555	0.5239	0.3790	0.4273	0.7476	0.9573	0.9936	0.9979 (86)
Living	19.6553	19.8260	20.1579	20.5504	20.8017	20.9098	20.9255	20.9234	20.8394	20.4645	19.9921	19.6332
Non living	18.3692	18.5905	19.0105	19.4940	19.7684	19.8691	19.8764	19.8794	19.8168	19.4032	18.8112	18.3475
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	7	0	0	0	0	0	0	0	0	0	0	0
16 / 9	24	16	0	0	0	0	0	0	0	0	0	31
MIT	20.4104	20.1169	20.1579	20.5504	20.8017	20.9098	20.9255	20.9234	20.8394	20.4645	19.9921	20.2259 (87)
Th 2	19.9502	19.9546	19.9546	19.9627	19.9627	19.9700	19.9682	19.9717	19.9682	19.9627	19.9646	19.9587 (88)
util rest of house	0.9963	0.9907	0.9666	0.8748	0.6953	0.4365	0.2780	0.3179	0.6643	0.9394	0.9913	0.9973 (89)
MIT 2	19.4100	19.0259	19.0105	19.4940	19.7684	19.8691	19.8764	19.8794	19.8168	19.4032	18.8112	19.2475 (90)
Living area fraction	fLA = Living area / (4) = 0.1639 (91)											
MIT	19.5739	19.2047	19.1985	19.6671	19.9377	20.0397	20.0484	20.0505	19.9844	19.5772	19.0047	19.4079 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.5739	19.2047	19.1985	19.6671	19.9377	20.0397	20.0484	20.0505	19.9844	19.5772	19.0047	19.4079 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9960	0.9887	0.9593	0.8655	0.6938	0.4426	0.2859	0.3264	0.6657	0.9306	0.9883	0.9969 (94)
Ext temp.	1577.9053	1932.4051	2357.3540	2687.5154	2399.6878	1609.3631	982.7149	1012.0555	1742.1003	1875.9226	1588.1318	1461.8804 (95)
	4.7000	5.2000	7.0000	9.4000	12.3000	15.3000	17.2000	17.1000	14.5000	11.1000	7.6000	4.7000 (96)

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Heat loss rate W	5247.8168	4918.2427	4283.9341	3574.4244	2659.0131	1637.1133	985.7115	1017.2355	1897.9482	2951.2630	3962.3292	5142.2540 (97)
Space heating kWh	2730.4142	2006.4829	1433.3756	638.5745	192.9380	0.0000	0.0000	0.0000	0.0000	800.0533	1709.4221	2738.1980 (98a)
Space heating requirement - total per year (kWh/year)												12249.4585
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	2730.4142	2006.4829	1433.3756	638.5745	192.9380	0.0000	0.0000	0.0000	0.0000	800.0533	1709.4221	2738.1980 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												12249.4585
Space heating per m2										(98c) / (4) =		40.3553 (99)

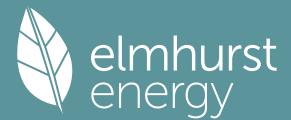
9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												323.3451 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	2730.4142	2006.4829	1433.3756	638.5745	192.9380	0.0000	0.0000	0.0000	0.0000	800.0533	1709.4221	2738.1980 (98)
Space heating efficiency (main heating system 1)	323.3451	323.3451	323.3451	323.3451	323.3451	0.0000	0.0000	0.0000	0.0000	323.3451	323.3451	323.3451 (210)
Space heating fuel (main heating system)	844.4272	620.5391	443.2959	197.4901	59.6694	0.0000	0.0000	0.0000	0.0000	247.4301	528.6680	846.8345 (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	365.7628	323.5102	343.0454	299.2320	288.6277	258.4361	253.4980	264.2406	267.9594	300.8315	322.4836	361.3846 (64)
Efficiency of water heater	164.3083	164.3083	164.3083	164.3083	164.3083	164.3083	164.3083	164.3083	164.3083	164.3083	164.3083	164.3083 (216)
Fuel for water heating, kWh/month	222.6077	196.8922	208.7816	182.1162	175.6623	157.2873	154.2819	160.8200	163.0833	183.0897	196.2674	219.9430 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	60.4356	48.4837	43.6542	31.9829	24.7045	20.1838	22.5363	29.2935	38.0494	49.9229	56.3878	62.1153 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-49.3310	-66.4076	-96.7211	-112.6081	-119.4111	-115.2688	-113.2376	-106.5296	-92.6490	-79.4644	-54.4724	-42.5006 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												3788.3544 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												164.3083
Water heating fuel used												2220.8325 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												487.7499 (232)
Energy saving/generation technologies (Appendices M, N and Q)												
PV generation												-1048.6012 (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												5448.3355 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3788.3544	21.5100	814.8750 (240)

Full SAP Calculation Printout



Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2220.8325	21.5100	477.7011 (247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	487.7499	21.5100	104.9150 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1048.6012	21.5100	-225.5541
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-225.5541 (252)
Total energy cost			1171.9370 (255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3788.3544	0.1564	592.3830 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2220.8325	0.1411	313.2565 (264)
Space and water heating			905.6395 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	487.7499	0.1443	70.3974 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1048.6012	0.1344	-140.9259
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-140.9259 (269)
Total CO2, kg/year			835.1109 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3788.3544	1.5789	5981.3897 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2220.8325	1.5216	3379.1587 (278)
Space and water heating			9360.5485 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	487.7499	1.5338	748.1270 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1048.6012	1.4967	-1569.4244
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1569.4244 (283)
Total Primary energy kWh/year			8539.2511 (286)

Predicted Energy Assessment



Meadow View, Blagrove Lane, Caversham, Reading,
RG47DX

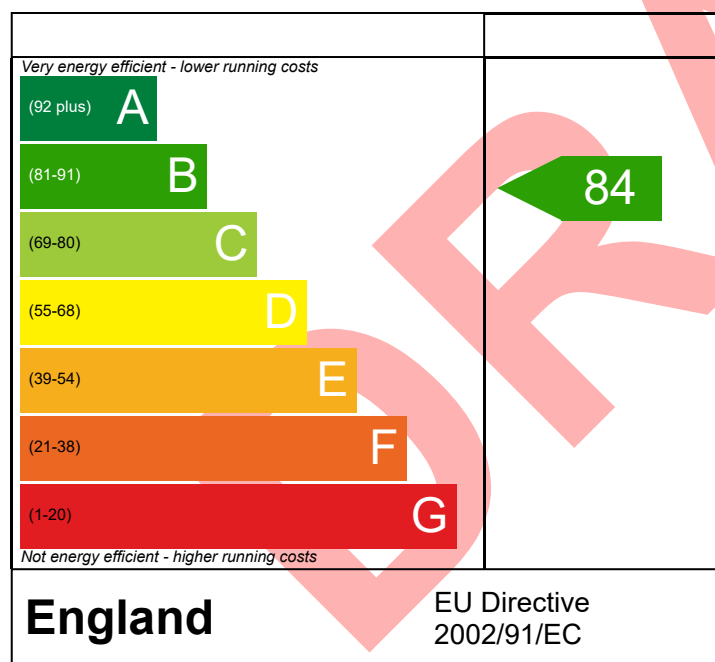
Dwelling type:
Date of assessment:
Produced by:
Total floor area:
DRRN:

House, Detached
08/08/2023
Kyle Jones
303.54 m²

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

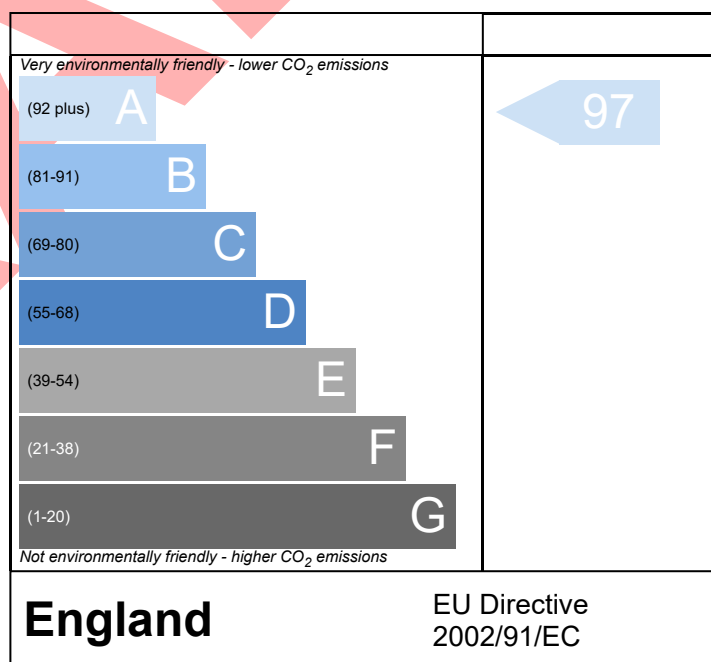
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) emissions.

Energy Efficiency Rating



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

Environmental Impact (CO₂) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.