

Building Regulations England Part L (BREL) Compliance Report

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

Date: Fri 15 Nov 2024 10:34:33

Project Information			
Assessed By	Victoria Gartside	Building Type	House, Semi-detached
OCDEA Registration	EES/026678	Assessment Date	2024-11-15

Dwelling Details			
Assessment Type	As designed	Total Floor Area	93 m ²
Site Reference	SAP VG 21-0282	Plot Reference	Plot 19
Address			

Client Details	
Name	Newett Homes
Company	Newett Homes
Address	Thorp Arch Grange , Thorp Arch, Wetherby , Wetherby

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	Mains gas		
Target carbon dioxide emission rate	12.38 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	12.27 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	64.9 kWh _{PE} /m ²		
Dwelling primary energy	64.51 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	40.0 kWh/m ²		
Dwelling fabric energy efficiency	39.7 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	0.18	Walls (3) (0.23)	OK
Party walls	0.2	0	Party Wall (1) (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	0.13	Heatloss Floor 1 (0.13)	OK
Roofs	0.16	0.13	Roof (2) (0.18)	OK
Windows, doors, and roof windows	1.6	1.28	Front Windows (1.3)	OK
Rooflights	2.2	N/A	N/A	N/A

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	Net area [m ²]	U-Value [W/m ² K]
Exposed wall: Walls (1)	82.22	0.19
Exposed wall: Walls (2)	24.61	0.11 (!)
Exposed wall: Walls (3)	12.92	0.23
Party wall: Party Wall (1)	55.15	0 (!)
Ground floor: Heatloss Floor 1, Heatloss Floor 1	35.97	0.13
Exposed roof: Roof (1)	11.9	0.09 (!)
Exposed roof: Roof (2)	11.84	0.18
Exposed roof: Roof (3)	14.71	0.11

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
Front door, Front door	2.14	West	N/A	1.1 (!)
Front Windows, Windows	5.79	West	0.7	1.3
Side Windows, Windows	1.42	North	0.7	1.3
Rear Windows, Windows	7.42	East	0.7	1.3
Roof light , Rooflight	0.95	East	0.7	1.3
Side Window, Windows	0.71	North	0.7	1.3

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	0.024 (!)	MFF-150-E2-02
External wall	E3: Sill	Calculated by person with suitable expertise	0.022 (!)	RCD E3.01
External wall	E4: Jamb	Calculated by person with suitable expertise	0.017 (!)	
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.092	Manufacturer Declaration
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.001 (!)	RCD E6.01
External wall	E11: Eaves (insulation at rafter level)	Calculated by person with suitable expertise	0.068	SMRF-E11-0.16
External wall	E13: Gable (insulation at rafter level)	Calculated by person with suitable expertise	0.094	SMRF-E13-0.16
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.046	RCD E16.01
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.04	SMRF-P05-0.16
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.069	Manufacturer Declaration
Party wall	P2: Intermediate floor within a dwelling	SAP table default	0 (!)	
Party wall	P5: Roof (insulation at rafter level)	SAP table default	0.48	
Roof	R1: Head of roof window	Calculated by person with suitable expertise	0.115	SMRF-R01-0.16
Roof	R2: Sill of roof window	Calculated by person with suitable expertise	0.113	SMRF-R02-0.16
Roof	R3: Jamb of roof window	Calculated by person with suitable expertise	0.041	SMRF-R03-0.16
Roof	R4: Ridge (vaulted ceiling)	Calculated by person with suitable expertise	0.044	SMRF-R04-0.16

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

Maximum permitted air permeability at 50Pa	8 m ³ /hm ²	
Dwelling air permeability at 50Pa	4 m ³ /hm ² , Design value	OK
Air permeability test certificate reference		

4 Space heating

Main heating system 1: Boiler with radiators or underfloor heating - Mains gas

Efficiency	88.7%
Emitter type	Radiators
Flow temperature	
System type	Combi boiler
Manufacturer	Vaillant
Model	ecoFIT sustain 835
Commissioning	

Secondary heating system: N/A

Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water

Cylinder/store - type: N/A

Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
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: N/A		
Manufacturer		
Model		
7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	85 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	2.02 kWp	
Orientation	East	
Pitch	30°	
Overshading	None or very little	
Manufacturer	PV	
MCS certificate		
Technology type: Photovoltaic system (2)		
Peak power	0.25 kWp	
Orientation	West	
Pitch	30°	
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		

Summary for Input Data



Property Reference	SAP VG 21-0282	Issued on Date	15/11/2024
Assessment Reference	Plot 19	Prop Type Ref	SAP VG 21-0282
Property			

SAP Rating	92 A	DER	12.27	TER	12.38
Environmental	89 B	% DER < TER			0.89
CO ₂ Emissions (t/year)	1.1	DFEE	39.75	TFEE	39.96
Compliance Check	See BREL	% DFEE < TFEE			0.52
% DPER < TPER	0.60	DPER	64.51	TPER	64.90

Assessor Details	Miss Victoria Gartside	Assessor ID	AL30-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	West	
Property Tenture	ND	
Transaction Type	6	
Terrain Type	Suburban	
1.0 Property Type	House, Semi-Detached	
Which Floor	0	
2.0 Number of Storeys	3	
3.0 Date Built	2023	
3.0 Property Age Band	L	
4.0 Sheltered Sides	1	
5.0 Sunlight/Shade	Average or unknown	
6.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	215.14	kJ/m²K
7.0 Electricity Tariff	Standard	
Smart electricity meter fitted	Yes	
Smart gas meter fitted	Yes	

7.0 Measurements	Ground floor:	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	1st Storey:	16.97 m	35.97 m ²	2.40 m
	2nd Storey:	16.97 m	35.97 m ²	2.63 m
		16.84 m	21.25 m ²	2.61 m

8.0 Living Area	12.52	m ²
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9.0 External Walls	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area (m ²)	Shelter Res	Shelter	Openings	Area Calculation Type
	Brick wall	Cavity Wall	Cavity wall; plasterboard on dabs or battens, lightweight aggregate block, filled cavity, any outside structure	0.19	110.00	98.99	82.22	0.00	None	16.77	Enter Gross Area
	Stud wall (0.72)	Timber Frame	Timber framed wall (one layer of plasterboard)	0.11	9.00	24.61	24.61	0.00	None	0.00	Enter Gross Area
	Spandrel wall	Timber Frame	Other	0.23	0.00	13.63	12.92	0.00	None	0.71	Enter Gross Area

9.1 Party Walls	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)	Shelter Res	Shelter
	Party Wall 1	Filled Cavity with Edge Sealing	Single plasterboard on dabs on both sides, dense blocks, cavity or cavity fill	0.00	70.00	55.15	0.00	None

9.2 Internal Walls	Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
	Internal Wall 2	Plasterboard on timber frame	9.00	119.67

10.0 External Roofs	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area (m ²)	Shelter Code	Shelter Factor	Calculation Type	Openings
	Plane roof	External Plane Roof	Plasterboard, insulated at ceiling level	0.09	9.00	11.90	11.90	None	0.00	Enter Gross Area	0.00

Summary for Input Data



Sloping roof	External Slope	Plasterboard, insulated slope	0.18	9.00	12.79	11.84	None	0.00	Enter Gross Area	0.95
Roof behind studs (0.72)	External Plane Roof	Plasterboard, insulated at ceiling level	0.11	9.00	14.71	14.71	None	0.00	Enter Gross Area	0.00

10.2 Internal Ceilings

Description	Storey	Construction	Area (m²)
Internal Ceiling 1	+1	Plasterboard ceiling, carpeted chipboard floor	57.16

11.0 Heat Loss Floors

Description	Type	Storey Index	Construction	U-Value (W/m²K)	Shelter Code	Shelter Factor	Kappa (kJ/m²K)	Area (m²)
Heatloss Floor 1	Ground Floor - Solid	Lowest occupied	Slab on ground, screed over insulation	0.13	None	0.00	110.00	35.97

11.2 Internal Floors

Description	Storey Index	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor		Plasterboard ceiling, carpeted chipboard floor	9.00	57.16

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Front door	Manufacturer	Solid Door				0.00			1.10
Windows	Manufacturer	Window	Double Low-E Soft 0.05			0.73		0.70	1.30
Rooflight	Manufacturer	Roof Window	Double Low-E Soft 0.05			0.73		0.70	1.30

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
Front door	Front door	Brick wall	West	2.14	0
Front Windows	Windows	Brick wall	West	5.79	0
Side Windows	Windows	Brick wall	North	1.42	0
Rear Windows	Windows	Brick wall	East	7.42	0
Roof light	Rooflight	Sloping roof	East	0.95	0
Side Window	Windows	Spandrel wall	North	0.71	0

14.0 Conservatory

15.0 Draught Proofing

 %

16.0 Draught Lobby

17.0 Thermal Bridging

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E2 Other lintels (including other steel lintels)	Independently assessed	11.43	0.02	0.02 MFF-150-E2-02	No
E3 Sill	Independently assessed	8.60	0.02	0.02 RCD E3.01	No
E4 Jamb	Independently assessed	27.60	0.02	0.02	No
E5 Ground floor (normal)	Independently assessed	16.97	0.09	0.09 Manufacturer Declaration	No
E6 Intermediate floor within a dwelling	Independently assessed	33.94	0.00	0.00 RCD E6.01	No
E11 Eaves (insulation at rafter level)	Independently assessed	8.74	0.07	0.07 SMRF-E11-0.16	No
E13 Gable (insulation at rafter level)	Independently assessed	11.25	0.09	0.09 SMRF-E13-0.16	No
E16 Corner (normal)	Independently assessed	10.90	0.05	0.05 RCD E16.01	No
E18 Party wall between dwellings	Independently assessed	10.90	0.04	0.04 SMRF-P05-0.16	No
P1 Party wall - Ground floor	Independently assessed	8.23	0.07	0.07 Manufacturer Declaration	No
P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	16.46	0.00	0.00	No
P5 Party wall - Roof (insulation at rafter level)	Table K1 - Default	11.25	0.48	0.48	No
R1 Head of roof window	Independently assessed	0.95	0.12	0.12 SMRF-R01-0.16	No
R2 Sill of roof window	Independently assessed	0.95	0.11	0.11 SMRF-R02-0.16	No
R3 Jamb of roof window	Independently assessed	2.06	0.04	0.04 SMRF-R03-0.16	No
R4 Ridge (vaulted ceiling)	Independently assessed	4.37	0.04	0.04 SMRF-R04-0.16	No

Y-value W/m²K

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present

20.0 Fans, Open Fireplaces, Flues

Number of open chimneys	0
Number of open flues	0
Number of chimneys/flues attached to closed fire	0
Number of flues attached to solid fuel boiler	0
Number of flues attached to other heater	0
Number of blocked chimneys	0
Number of intermittent extract fans	4
Number of passive vents	0
Number of flueless gas fires	0

Summary for Input Data

21.0 Fixed Cooling System	No									
22.0 Pressure Testing	Yes									
Designed AP ₅₀	4.00	m ² /(h.m ²) @ 50 Pa								
Property Tested?	Yes									
Test Method	Blower Door									
22.0 Lighting	No									
No Fixed Lighting	No									
	Name Lighting	Efficacy 85.00	Power 10.00	Capacity 850.00	Count 18					
24.0 Main Heating 1	Database									
Description	Gas Boiler									
Percentage of Heat	100.00 %									
Database Ref. No.	17960									
Fuel Type	Mains gas									
SAP Code	0									
In Winter	88.70									
In Summer	76.40									
Model Name	ecoFIT sustain 835									
Manufacturer	Vaillant									
System Type	Combi boiler									
Controls SAP Code	2110									
Delayed Start Stat	Yes									
Burner Control	Modulating									
HETAS approved System	No									
Flue Type	Balanced									
Fan Assisted Flue	Yes									
Is MHS Pumped	Pump in heated space									
Heating Pump Age	2013 or later									
Heat Emitter	Radiators									
Underfloor Heating	Yes - Pipes in thin screed									
Flow Temperature	Unknown									
Boiler Interlock	Yes									
Combi boiler type	Standard Combi									
25.0 Main Heating 2	None									
26.0 Heat Networks	None									
	Heat Source	Fuel Type	Heating Use	Efficiency	Percentage Of Heat	Heat	Heat Power Ratio	Electrical	Fuel Factor	Efficiency type
Heat source 1	None									
Heat source 2	None									
Heat source 3	None									
Heat source 4	None									
Heat source 5	None									
27.0 Secondary Heating	None									
28.0 Water Heating	Main Heating 1									
Water Heating	Main Heating 1									
SAP Code	901									
Flue Gas Heat Recovery System	No									
Waste Water Heat Recovery Instantaneous System 1	No									
Waste Water Heat Recovery Instantaneous System 2	No									

Summary for Input Data

Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
Summer Immersion	No
Cold Water Source	From mains
Bath Count	1
Supplementary Immersion	No
Immersion Only Heating Hot Water	No

28.1 Showers

Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To
Shower	Combi boiler or unvented hot water system	8.00		No	
Shower	Combi boiler or unvented hot water system	8.00		No	

28.3 Waste Water Heat Recovery System

29.0 Hot Water Cylinder	None
Cylinder Stat	No
Cylinder In Heated Space	No
Independent Time Control	No
In Airing Cupboard	No

31.0 Thermal Store

None

32.0 Photovoltaic Unit

0 Photovoltaic Unit	One Dwelling
Export Capable Meter?	Yes
Connected To Dwelling	Yes
Diverter	No
Battery Capacity [kWh]	0.00

PV Cells kWp	Orientation	Elevation	Overshading	FGHRS	MCS Certificate	Overshading Factor	MCS Certificate Reference	Panel Manufacturer
2.02	East	30°	None Or Little	No	No	1.00		PV
0.25	West	30°	None Or Little	No	No	1.00		

34.0 Small-scale Hydro

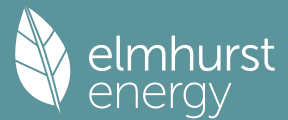
0.0 Small-scale Hydro	None	
Electricity Generated	0.00	
Apportioned	0.00	kWh/Year
Connected to dwelling's electricity meter	Yes	
Electricity Generation	Annual	

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Recommendations

Lower cost measures	None
Further measures to achieve even higher standards	None

Full SAP Calculation Printout



Property Reference	SAP VG 21-0282				Issued on Date	15/11/2024	
Assessment Reference	Plot 19			Prop Type Ref	SAP VG 21-0282		
Property							
SAP Rating	92 A	DER	12.27	TER	12.38		
Environmental	89 B	% DER < TER				0.89	
CO ₂ Emissions (t/year)	1.1	DFEE	39.75	TFEE	39.96		
Compliance Check	See BREL	% DFEE < TFEE				0.52	
% DPER < TPER	0.60	DPER	64.51	TPER	64.90		
Assessor Details	Miss Victoria Gartside				Assessor ID	AL30-0001	
Client							

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.9700 (1b)	x 2.4000 (2b)	= 86.3280 (1b) - (3b)
First floor	35.9700 (1c)	x 2.6300 (2c)	= 94.6011 (1c) - (3c)
Second floor	21.2500 (1d)	x 2.6100 (2d)	= 55.4625 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.1900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	236.3916 (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) = 0.1692 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.3692 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3415 (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	0.4354	0.4269	0.4184	0.3757	0.3671	0.3244	0.3244	0.3159	0.3415	0.3671	0.3842	0.4013 (22b)
Effective ac	0.5948	0.5911	0.5875	0.5706	0.5674	0.5526	0.5526	0.5499	0.5583	0.5674	0.5738	0.5805 (25)

3. Heat losses and heat loss parameter

Element	Gross 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
Front door			2.1400	1.1000	2.3540		(26)
Windows (Uw = 1.30)			15.3400	1.2357	18.9563		(27)
Roof light			0.9500	1.2357	1.1740		(27a)
Heatloss Floor 1			35.9700	0.1300	4.6761	110.0000	3956.7000 (28a)
Brick wall		16.7700	82.2200	0.1900	15.6218	110.0000	9044.2000 (29a)
Stud wall (0.72)	24.6100		24.6100	0.1100	2.7071	9.0000	221.4900 (29a)
Spandrel wall	13.6300	0.7100	12.9200	0.2300	2.9716	0.0000	0.0000 (29a)
Plane roof	11.9000		11.9000	0.0900	1.0710	9.0000	107.1000 (30)
Sloping roof	12.7900	0.9500	11.8400	0.1800	2.1312	9.0000	106.5600 (30)
Roof behind studs (0.72)	14.7100		14.7100	0.1100	1.6181	9.0000	132.3900 (30)
Total net area of external elements A _{um} (A, m ²)			212.6000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	53.2811		(33)
Party Wall 1			55.1500	0.0000	0.0000	70.0000	3860.5000 (32)
Internal Wall 2			119.6700			9.0000	1077.0300 (32c)
Internal Floor			57.1600			18.0000	1028.8800 (32d)
Internal Ceiling 1			57.1600			9.0000	514.4400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20049.2900 (34)

Full SAP Calculation Printout



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

215.1442 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	11.4300	0.0240	0.2743
E2 Other lintels (including other steel lintels)	8.6000	0.0220	0.1892
E3 Sill	27.6000	0.0170	0.4692
E4 Jamb	16.9700	0.0920	1.5612
E5 Ground floor (normal)	33.9400	0.0010	0.0339
E6 Intermediate floor within a dwelling	8.7400	0.0680	0.5943
E11 Eaves (insulation at rafter level)	11.2500	0.0940	1.0575
E13 Gable (insulation at rafter level)	10.9000	0.0460	0.5014
E16 Corner (normal)	10.9000	0.0400	0.4360
E18 Party wall between dwellings	8.2300	0.0690	0.5679
P1 Party wall - Ground floor	16.4600	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	11.2500	0.4800	5.4000
P5 Party wall - Roof (insulation at rafter level)	0.9500	0.1150	0.1092
R1 Head of roof window	0.9500	0.1130	0.1074
R2 Sill of roof window	2.0600	0.0410	0.0845
R3 Jamb of roof window	4.3700	0.0440	0.1923
R4 Ridge (vaulted ceiling)			

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

Point Thermal bridges

11.5783 (36)

Total fabric heat loss

(33) + (36) + (36a) = 64.8595 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	46.4001	46.1130	45.8315	44.5093	44.2619	43.1104	43.1104	42.8971	43.5540	44.2619	44.7624	45.2855 (38)
Heat transfer coeff	111.2596	110.9724	110.6909	109.3688	109.1214	107.9698	107.9698	107.7566	108.4134	109.1214	109.6218	110.1450 (39)
Average = Sum(39)m / 12 =												109.3676

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1939	1.1908	1.1878	1.1736	1.1710	1.1586	1.1586	1.1563	1.1634	1.1710	1.1763	1.1819 (40)
HLP (average)												1.1736
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy

2.6669 (42)

Hot water usage for mixer showers

68.9352 67.8992 66.3896 63.5013 61.3697 58.9927 57.6416 59.1397 60.7820 63.3342 66.2846 68.6710 (42a)

Hot water usage for baths

29.7676 29.3255 28.7030 27.5551 26.6956 25.7425 25.2277 25.8459 26.5190 27.5388 28.7103 29.6670 (42b)

Hot water usage for other uses

41.9419 40.4167 38.8916 37.3664 35.8412 34.3161 34.3161 35.8412 37.3664 38.8916 40.4167 41.9419 (42c)

Average daily hot water use (litres/day)

129.2842 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	140.6446	137.6414	133.9841	128.4227	123.9065	119.0512	117.1853	120.8269	124.6674	129.7646	135.4117	140.2799 (44)
Energy conte	222.7467	195.9996	205.9286	175.8043	166.8020	146.3874	141.7255	149.6089	153.7274	176.0894	192.9188	219.6444 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m	33.4120	29.3999	30.8893	26.3706	25.0203	21.9581	21.2588	22.4413	23.0591	26.4134	28.9378	32.9467 (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

0.6420 0.5885 0.6484 0.5927 0.5924 0.5484 0.5415 0.5498 0.5413 0.5842 0.5964 0.6363 (61)

Total heat required for water heating calculated for each month

223.3887 196.5880 206.5770 176.3970 167.3944 146.9357 142.2670 150.1587 154.2687 176.6735 193.5152 220.2807 (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

223.3887 196.5880 206.5770 176.3970 167.3944 146.9357 142.2670 150.1587 154.2687 176.6735 193.5152 220.2807 (64)

12Total per year (kWh/year)

Total per year (kWh/year) = Sum(64)m = 2154.4446 (64)

Electric shower(s)

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)

Heat gains from water heating, kWh/month

74.2238 65.3170 68.6334 58.6031 55.6098 48.8109 47.2591 49.8824 51.2497 58.6958 64.2946 73.1908 (65)

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

Metabolic gains (Table 5), Watts

(66)m 133.3458 133.3458 133.3458 133.3458 133.3458 133.3458 133.3458 133.3458 133.3458 133.3458 133.3458 133.3458 (66)

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

126.4826 140.0343 126.4826 130.6987 126.4826 130.6987 126.4826 126.4826 130.6987 126.4826 130.6987 126.4826 (67)

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

244.8256 247.3662 240.9641 227.3349 210.1306 193.9608 183.1585 180.6180 187.0200 200.6492 217.8536 234.0233 (68)

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

36.3346 36.3346 36.3346 36.3346 36.3346 36.3346 36.3346 36.3346 36.3346 36.3346 36.3346 36.3346 (69)

Pumps, fans

3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

-106.6766 -106.6766 -106.6766 -106.6766 -106.6766 -106.6766 -106.6766 -106.6766 -106.6766 -106.6766 -106.6766 -106.6766 (71)

Water heating gains (Table 5)

99.7632 97.1979 92.2491 81.3932 74.7443 67.7929 63.5203 67.0462 71.1801 78.8921 89.2980 98.3748 (72)

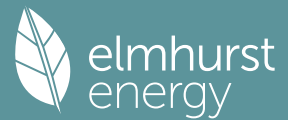
Total internal gains

537.0751 550.6021 525.6996 505.4306 477.3612 455.4562 436.1651 437.1505 451.9025 472.0277 503.8540 524.8844 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
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North			2.1300		10.6334		0.7300		0.7000		0.7700		8.0206 (74)
East			7.4200		19.6403		0.7300		0.7000		0.7700		51.6066 (76)
West			5.7900		19.6403		0.7300		0.7000		0.7700		40.2699 (80)
East			0.9500		26.0000		0.7300		0.7000		1.0000		11.3595 (82)

Solar gains	111.2566	218.6505	363.9779	539.0546	669.2862	689.2829	654.4993	556.1728	425.8073	260.3460	138.8714	91.4161 (83)
Total gains	648.3317	769.2525	889.6775	1044.4851	1146.6474	1144.7391	1090.6644	993.3233	877.7098	732.3737	642.7255	616.3005 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	50.0563	50.1859	50.3135	50.9217	51.0372	51.5815	51.5815	51.6836	51.3705	51.0372	50.8042	50.5629
alpha	4.3371	4.3457	4.3542	4.3948	4.4025	4.4388	4.4388	4.4456	4.4247	4.4025	4.3869	4.3709
util living area	0.9932	0.9852	0.9643	0.8967	0.7620	0.5764	0.4294	0.4874	0.7452	0.9431	0.9868	0.9945 (86)
MIT	19.4444	19.6810	20.0416	20.5024	20.8184	20.9598	20.9913	20.9851	20.8789	20.4282	19.8562	19.4105 (87)
Th 2	19.9249	19.9274	19.9298	19.9412	19.9433	19.9533	19.9533	19.9551	19.9494	19.9433	19.9390	19.9345 (88)
util rest of house	0.9913	0.9810	0.9541	0.8685	0.7050	0.4926	0.3303	0.3822	0.6651	0.9212	0.9823	0.9929 (89)
MIT 2	18.1233	18.4254	18.8800	19.4452	19.7927	19.9299	19.9503	19.9494	19.8660	19.3736	18.6584	18.0867 (90)
Living area fraction									FLA = Living area / (4) =			
MIT	18.3008	18.5941	19.0361	19.5872	19.9305	20.0682	20.0901	20.0886	20.0021	19.5152	18.8194	18.2646 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1508	18.4441	18.8861	19.4372	19.7805	19.9182	19.9401	19.9386	19.8521	19.3652	18.6694	18.1146 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9863	0.9727	0.9407	0.8523	0.6953	0.4896	0.3290	0.3805	0.6567	0.9053	0.9743	0.9888 (94)
Useful gains	639.4565	748.2254	836.9540	890.2606	797.2243	560.5034	358.8519	377.9569	576.4280	662.9985	626.2275	609.3762 (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	1541.0351	1503.0195	1371.0263	1152.4434	881.7598	574.2103	360.6317	381.3047	623.6038	956.4761	1268.2534	1532.6220 (97)
Space heating kWh	670.7744	507.2216	397.3498	188.7716	62.8944	0.0000	0.0000	0.0000	0.0000	218.3474	462.2587	686.8949 (98a)
Space heating requirement - total per year (kWh/year)												3194.5128
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	670.7744	507.2216	397.3498	188.7716	62.8944	0.0000	0.0000	0.0000	0.0000	218.3474	462.2587	686.8949 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3194.5128
Space heating per m2										(98c) / (4) =		34.2796 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	88.7000 (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	670.7744	507.2216	397.3498	188.7716	62.8944	0.0000	0.0000	0.0000	0.0000	218.3474	462.2587	686.8949 (98)
Space heating efficiency (main heating system 1)	88.7000	88.7000	88.7000	88.7000	88.7000	0.0000	0.0000	0.0000	0.0000	88.7000	88.7000	88.7000 (210)
Space heating fuel (main heating system)	756.2282	571.8395	447.9705	212.8203	70.9069	0.0000	0.0000	0.0000	0.0000	246.1639	521.1484	774.4024 (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	223.3887	196.5880	206.5770	176.3970	167.3944	146.9357	142.2670	150.1587	154.2687	176.6735	193.5152	220.2807 (64)
Efficiency of water heater (217)m	85.2703	84.8829	84.0703	82.2996	79.4073	76.4000	76.4000	76.4000	76.4000	82.7421	84.6771	76.4000 (216)
Fuel for water heating, kWh/month	261.9772	231.5991	245.7193	214.3351	210.8048	192.3243	186.2133	196.5428	201.9224	213.5230	228.5331	258.0519 (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	25.7434	20.6523	18.5951	13.6236	10.5233	8.5977	12.4780	16.2077	21.2654	24.0192	26.4589	26.4589 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-25.7282	-40.6454	-65.8429	-81.1908	-91.8988	-87.1420	-85.6050	-78.3155	-65.5377	-49.1937	-29.4668	-21.5540 (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	-10.2209	-24.9999	-59.7371	-105.0532	-152.2644	-158.3094	-154.3478	-122.2305	-78.7289	-38.5906	-14.3197	-7.7397 (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												3601.4801 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												76.4000

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Water heating fuel used	2641.5462 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	207.7642 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1648.6633 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4888.1272 (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	3601.4801	0.2100	756.3108 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2641.5462	0.2100	554.7247 (264)
Space and water heating			1311.0355 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	207.7642	0.1443	29.9868 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-722.1209	0.1328	-95.8911
PV Unit electricity exported	-926.5424	0.1222	-113.2012
Total			-209.0924 (269)
Total CO2, kg/year			1143.8592 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			12.2700 (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	3601.4801	1.1300	4069.6725 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2641.5462	1.1300	2984.9472 (278)
Space and water heating			7054.6197 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	207.7642	1.5338	318.6756 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-722.1209	1.4907	-1076.4498
PV Unit electricity exported	-926.5424	0.4483	-415.3580
Total			-1491.8079 (283)
Total Primary energy kWh/year			6011.5883 (286)
Dwelling Primary energy Rate (DPER)			64.5100 (287)

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

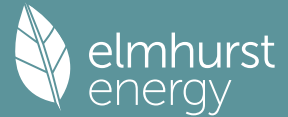
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	35.9700 (1b)	x 2.4000 (2b)	= 86.3280 (1b) - (3b)
First floor	35.9700 (1c)	x 2.6300 (2c)	= 94.6011 (1c) - (3c)
Second floor	21.2500 (1d)	x 2.6100 (2d)	= 55.4625 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.1900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 236.3916 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1269 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3769 (18)
Number of sides sheltered	1 (19)

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Shelter factor
Infiltration rate adjusted to include shelter factor

$$(20) = 1 - [0.075 \times (19)] = 0.9250 \quad (20)$$
$$(21) = (18) \times (20) = 0.3486 \quad (21)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
Effective ac	0.4445	0.4358	0.4271	0.3835	0.3748	0.3312	0.3312	0.3225	0.3486	0.3748	0.3922	0.4097	(22b)
	0.5988	0.5950	0.5912	0.5735	0.5702	0.5548	0.5548	0.5520	0.5608	0.5702	0.5769	0.5839	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1400	1.0000	2.1400			(26)
TER Opening Type (Uw = 1.20)			15.3400	1.1450	17.5649			(27)
Roof light			0.9500	1.5918	1.5122			(27a)
Heatloss Floor 1			35.9700	0.1300	4.6761			(28a)
Brick wall	98.9900	16.7700	82.2200	0.1800	14.7996			(29a)
Stud wall (0.72)	24.6100		24.6100	0.1800	4.4298			(29a)
Spandrel wall	13.6300	0.7100	12.9200	0.1800	2.3256			(29a)
Plane roof	11.9000		11.9000	0.1100	1.3090			(30)
Sloping roof	12.7900	0.9500	11.8400	0.1100	1.3024			(30)
Roof behind studs (0.72)	14.7100		14.7100	0.1100	1.6181			(30)
Total net area of external elements Aum(A, m2)			212.6000					(31)
Fabric heat loss, W/K = Sum (A x U)								(33)
Party Wall 1			55.1500	0.0000	0.0000			(32)

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

215.1442 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	11.4300	0.0500	0.5715	
E3 Sill	8.6000	0.0500	0.4300	
E4 Jamb	27.6000	0.0500	1.3800	
E5 Ground floor (normal)	16.9700	0.1600	2.7152	
E6 Intermediate floor within a dwelling	33.9400	0.0000	0.0000	
E11 Eaves (insulation at rafter level)	8.7400	0.0400	0.3496	
E13 Gable (insulation at rafter level)	11.2500	0.0800	0.9000	
E16 Corner (normal)	10.9000	0.0900	0.9810	
E18 Party wall between dwellings	10.9000	0.0600	0.6540	
P1 Party wall - Ground floor	8.2300	0.0800	0.6584	
P2 Party wall - Intermediate floor within a dwelling	16.4600	0.0000	0.0000	
P5 Party wall - Roof (insulation at rafter level)	11.2500	0.0800	0.9000	
R1 Head of roof window	0.9500	0.0800	0.0760	
R2 Sill of roof window	0.9500	0.0600	0.0570	
R3 Jamb of roof window	2.0600	0.0800	0.1648	
R4 Ridge (vaulted ceiling)	4.3700	0.0800	0.3496	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				10.1871 (36)
Point Thermal bridges				0.0000 (36a)
Total fabric heat loss				61.8648 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.7117	46.4124	46.1191	44.7412	44.4834	43.2834	43.2834	43.0611	43.7456	44.4834	45.0049	45.5502	(38)
Heat transfer coeff	108.5765	108.2772	107.9838	106.6060	106.3482	105.1481	105.1481	104.9259	105.6104	106.3482	106.8697	107.4149	(39)
Average = Sum(39)m / 12 =												106.6048	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1651	1.1619	1.1587	1.1440	1.1412	1.1283	1.1283	1.1259	1.1333	1.1412	1.1468	1.1526	(40)
HLP (average)												1.1440	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.6669 (42)
Hot water usage for mixer showers													
68.9352	67.8992	66.3896	63.5013	61.3697	58.9927	57.6416	59.1397	60.7820	63.3342	66.2846	68.6710	68.6710	(42a)
Hot water usage for baths													
29.7676	29.3255	28.7030	27.5551	26.6956	25.7425	25.2277	25.8459	26.5190	27.5388	28.7103	29.6670	29.6670	(42b)
Hot water usage for other uses													
41.9419	40.4167	38.8916	37.3664	35.8412	34.3161	34.3161	35.8412	37.3664	38.8916	40.4167	41.9419	41.9419	(42c)
Average daily hot water use (litres/day)													129.2842 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.6446	137.6414	133.9841	128.4227	123.9065	119.0512	117.1853	120.8269	124.6674	129.7646	135.4117	140.2799	(44)
Energy conte	222.7467	195.9996	205.9286	175.8043	166.8020	146.3874	141.7255	149.6089	153.7274	176.0894	192.9188	219.6444	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m													2147.3829
33.4120	29.3999	30.8893	26.3706	25.0203	21.9581	21.2588	22.4413	23.0591	26.4134	28.9378	32.9467	32.9467	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
273.7056	242.0270	256.8875	225.1194	217.7609	195.7025	192.6844	200.5678	203.0424	227.0483	242.2338	270.6033	270.6033	(62)
WWHRS	-31.5143	-27.8715	-29.1854	-24.1667	-22.5225	-19.2726	-18.0650	-19.2103	-19.9402	-23.5073	-26.6309	-30.9307	(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	242.1914	214.1555	227.7021	200.9527	195.2384	176.4298	174.6194	181.3574	183.1022	203.5409	215.6029	239.6726	(64)
Total per year (kWh/year)													2454.5654 (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	86.8030	76.6767	81.2110	70.7837	68.2014	61.0026	59.8634	62.4847	63.4431	71.2894	76.4743	85.7715	(65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	133.3458	133.3458	133.3458	133.3458	133.3458	133.3458	133.3458	133.3458	133.3458	133.3458	133.3458	133.3458 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	126.4826	140.0343	126.4826	130.6987	126.4826	130.6987	126.4826	126.4826	130.6987	126.4826	130.6987	126.4826 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.8256	247.3662	240.9641	227.3349	210.1306	193.9608	183.1585	180.6180	187.0200	200.6492	217.8536	234.0233 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3346	36.3346	36.3346	36.3346	36.3346	36.3346	36.3346	36.3346	36.3346	36.3346	36.3346	36.3346 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766 (71)
Water heating gains (Table 5)	116.6707	114.1022	109.1546	98.3107	91.6685	84.7258	80.4616	83.9848	88.1154	95.8191	106.2142	115.2843 (72)
Total internal gains	553.9827	567.5064	542.6050	522.3481	494.2854	472.3891	453.1064	454.0891	468.8379	488.9547	520.7702	541.7939 (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	2.1300		10.6334		0.6300		0.7000		0.7700		6.9219 (74)	
East	7.4200		19.6403		0.6300		0.7000		0.7700		44.5372 (76)	
West	5.7900		19.6403		0.6300		0.7000		0.7700		34.7534 (80)	
East	0.9500		26.0000		0.6300		0.7000		1.0000		9.8034 (82)	
Solar gains	96.0159	188.6983	314.1179	465.2115	577.6032	594.8606	564.8419	479.9847	367.4775	224.6822	119.8479	78.8933 (83)
Total gains	649.9986	756.2048	856.7229	987.5596	1071.8886	1067.2497	1017.9483	934.0738	836.3154	713.6368	640.6182	620.6872 (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	51.2933	51.4351	51.5748	52.2414	52.3680	52.9657	52.9657	53.0779	52.7339	52.3680	52.1125	51.8480
alpha	4.4196	4.4290	4.4383	4.4828	4.4912	4.5310	4.5310	4.5385	4.5156	4.4912	4.4742	4.4565
util living area	0.9931	0.9858	0.9676	0.9079	0.7835	0.5993	0.4474	0.5039	0.7582	0.9455	0.9867	0.9943 (86)
MIT	19.4950	19.7132	20.0492	20.4909	20.8068	20.9567	20.9907	20.9845	20.8773	20.4414	19.8960	19.4658 (87)
Th 2	19.9480	19.9506	19.9531	19.9651	19.9673	19.9778	19.9778	19.9797	19.9737	19.9673	19.9628	19.9581 (88)
util rest of house	0.9911	0.9818	0.9583	0.8821	0.7289	0.5154	0.3470	0.3982	0.6802	0.9245	0.9822	0.9927 (89)
MIT 2	18.2036	18.4825	18.9070	19.4527	19.8047	19.9521	19.9745	19.9737	19.8881	19.4082	18.7254	18.1733 (90)
Living area fraction	18.3771	18.6478	19.0605	19.5922	19.9393	20.0871	20.1110	20.1095	20.0210	19.5470	18.8827	18.3469 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3771	18.6478	19.0605	19.5922	19.9393	20.0871	20.1110	20.1095	20.0210	19.5470	18.8827	18.3469 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9867	0.9749	0.9478	0.8710	0.7273	0.5248	0.3603	0.4121	0.6842	0.9135	0.9755	0.9890 (94)
Useful gains	641.3793	737.1931	811.9714	860.1503	779.5876	560.0614	366.7933	384.9144	572.1820	651.9047	624.9282	613.8447 (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	1528.4446	1488.5748	1356.3262	1139.8511	876.2353	576.9537	369.1773	389.2200	625.3146	951.4993	1259.2091	1519.5895 (97)
Space heating kWh	659.9766	504.9285	404.9999	201.3845	71.9058	0.0000	0.0000	0.0000	0.0000	222.8984	456.6822	673.8741 (98a)
Space heating requirement - total per year (kWh/year)												3196.6501
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	659.9766	504.9285	404.9999	201.3845	71.9058	0.0000	0.0000	0.0000	0.0000	222.8984	456.6822	673.8741 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3196.6501
Space heating per m2										(98c) / (4) =		34.3025 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.4000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	659.9766	504.9285	404.9999	201.3845	71.9058	0.0000	0.0000	0.0000	0.0000	222.8984	456.6822	673.8741 (98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000 (210)
Space heating fuel (main heating system)	714.2604	546.4594	438.3116	217.9486	77.8202	0.0000	0.0000	0.0000	0.0000	241.2320	494.2448	729.3010 (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)

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Water heating													
Water heating requirement	242.1914	214.1555	227.7021	200.9527	195.2384	176.4298	174.6194	181.3574	183.1022	203.5409	215.6029	239.6726	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.4155	86.1521	85.6007	84.3860	82.4468	80.3000	80.3000	80.3000	80.3000	84.5766	85.9480	86.4704	(217)
Fuel for water heating, kWh/month	280.2639	248.5783	266.0051	238.1350	236.8054	219.7133	217.4587	225.8499	228.0227	240.6588	250.8528	277.1731	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	(231)
Lighting	26.2806	21.0833	18.9831	13.9079	10.7428	8.7770	9.8000	12.7384	16.5459	21.7091	24.5204	27.0110	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-35.0837	-50.2191	-73.2719	-83.6520	-91.2622	-85.5378	-84.4568	-79.1986	-70.1116	-57.9709	-38.8286	-30.2417	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-17.5835	-37.2255	-74.4350	-112.4575	-149.3535	-150.3295	-148.5888	-125.5348	-91.6306	-53.4885	-23.5562	-13.8892	(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												3459.5780	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												2929.5169	(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)												212.0994	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1777.9074	(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												4909.2869	(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	3459.5780	0.2100	726.5114	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2929.5169	0.2100	615.1986	(264)
Space and water heating			1341.7099	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	212.0994	0.1443	30.6125	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-779.8349	0.1343	-104.7128	
PV Unit electricity exported	-998.0725	0.1257	-125.4757	
Total			-230.1885	(269)
Total CO2, kg/year			1154.0632	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.3800	(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	3459.5780	1.1300	3909.3231	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2929.5169	1.1300	3310.3542	(278)
Space and water heating			7219.6773	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	212.0994	1.5338	325.3251	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-779.8349	1.4962	-1166.8221	
PV Unit electricity exported	-998.0725	0.4615	-460.5734	
Total			-1627.3955	(283)
Total Primary energy kWh/year			6047.7076	(286)
Target Primary Energy Rate (TPER)			64.9000	(287)

Full SAP Calculation Printout



Property Reference	SAP VG 21-0282				Issued on Date	15/11/2024	
Assessment Reference	Plot 19			Prop Type Ref	SAP VG 21-0282		
Property							
SAP Rating	92 A	DER	12.27	TER	12.38		
Environmental	89 B	% DER < TER				0.89	
CO ₂ Emissions (t/year)	1.1	DFEE	39.75	TFEE	39.96		
Compliance Check	See BREL	% DFEE < TFEE				0.52	
% DPER < TPER	0.60	DPER	64.51	TPER	64.90		
Assessor Details	Miss Victoria Gartside				Assessor ID	AL30-0001	
Client							

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.9700 (1b)	x 2.4000 (2b)	= 86.3280 (1b) - (3b)
First floor	35.9700 (1c)	x 2.6300 (2c)	= 94.6011 (1c) - (3c)
Second floor	21.2500 (1d)	x 2.6100 (2d)	= 55.4625 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.1900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	236.3916 (5)

2. Ventilation rate

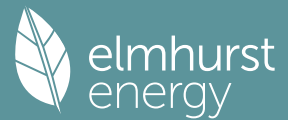
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1269 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.3269 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3024 (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	0.3855	0.3780	0.3704	0.3326	0.3251	0.2873	0.2873	0.2797	0.3024	0.3251	0.3402	0.3553 (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	0.5743	0.5714	0.5686	0.5553	0.5528	0.5413	0.5413	0.5391	0.5457	0.5528	0.5579	0.5631 (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
Front door			2.1400	1.1000	2.3540		(26)
Windows (Uw = 1.30)			15.3400	1.2357	18.9563		(27)
Roof light			0.9500	1.2357	1.1740		(27a)
Heatloss Floor 1			35.9700	0.1300	4.6761	110.0000	3956.7000 (28a)
Brick wall	98.9900	16.7700	82.2200	0.1900	15.6218	110.0000	9044.2000 (29a)
Stud wall (0.72)	24.6100		24.6100	0.1100	2.7071	9.0000	221.4900 (29a)
Spandrel wall	13.6300	0.7100	12.9200	0.2300	2.9716	0.0000	0.0000 (29a)
Plane roof	11.9000		11.9000	0.0900	1.0710	9.0000	107.1000 (30)
Sloping roof	12.7900	0.9500	11.8400	0.1800	2.1312	9.0000	106.5600 (30)
Roof behind studs (0.72)	14.7100		14.7100	0.1100	1.6181	9.0000	132.3900 (30)
Total net area of external elements Aum(A, m ²)			212.6000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	53.2811		(33)
Party Wall 1			55.1500	0.0000	0.0000	70.0000	3860.5000 (32)
Internal Wall 2			119.6700			9.0000	1077.0300 (32c)
Internal Floor			57.1600			18.0000	1028.8800 (32d)
Internal Ceiling 1			57.1600			9.0000	514.4400 (32e)

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Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) = 20049.2900 (34)			
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K				215.1442 (35)			
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				11.4300	0.0240	0.2743	
E3 Sill				8.6000	0.0220	0.1892	
E4 Jamb				27.6000	0.0170	0.4692	
E5 Ground floor (normal)				16.9700	0.0920	1.5612	
E6 Intermediate floor within a dwelling				33.9400	0.0010	0.0339	
E11 Eaves (insulation at rafter level)				8.7400	0.0680	0.5943	
E13 Gable (insulation at rafter level)				11.2500	0.0940	1.0575	
E16 Corner (normal)				10.9000	0.0460	0.5014	
E18 Party wall between dwellings				10.9000	0.0400	0.4360	
P1 Party wall - Ground floor				8.2300	0.0690	0.5679	
P2 Party wall - Intermediate floor within a dwelling				16.4600	0.0000	0.0000	
P5 Party wall - Roof (insulation at rafter level)				11.2500	0.4800	5.4000	
R1 Head of roof window				0.9500	0.1150	0.1092	
R2 Sill of roof window				0.9500	0.1130	0.1074	
R3 Jamb of roof window				2.0600	0.0410	0.0845	
R4 Ridge (vaulted ceiling)				4.3700	0.0440	0.1923	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							
Point Thermal bridges				(36a) = 0.0000			
Total fabric heat loss				(33) + (36) + (36a) = 64.8595 (37)			

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	44.8025	44.5774	44.3567	43.3202	43.1262	42.2234	42.2234	42.0563	42.5712	43.1262	43.5186	43.9287 (38)
Heat transfer coeff	109.6620	109.4368	109.2162	108.1796	107.9857	107.0829	107.0829	106.9157	107.4306	107.9857	108.3780	108.7882 (39)
Average = Sum(39)m / 12 =												108.1787
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1768	1.1743	1.1720	1.1609	1.1588	1.1491	1.1491	1.1473	1.1528	1.1588	1.1630	1.1674 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.6669 (42)
Hot water usage for mixer showers												0.0000 (42a)
Hot water usage for baths												29.6670 (42b)
Hot water usage for other uses												41.9419 (42c)
Average daily hot water use (litres/day)												65.7282 (43)
Daily hot water use												
Energy conte	71.7095	69.7422	67.5945	64.9215	62.5368	60.0586	59.5438	61.6871	63.8854	66.4304	69.1270	71.6088 (44)
Energy content (annual)	113.5703	99.3120	103.8903	88.8743	84.1865	73.8490	72.0130	76.3815	78.7771	90.1454	98.4842	112.1221 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1091.6057
Water storage loss:												0.0000 (46)
If cylinder contains dedicated solar storage												0.0000 (57)
Primary loss												0.0000 (59)
Combi loss												0.0000 (61)
Total heat required for water heating calculated for each month												
WWHRS	96.5347	84.4152	88.3067	75.5431	71.5586	62.7717	61.2111	64.9243	66.9605	76.6236	83.7115	95.3038 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	96.5347	84.4152	88.3067	75.5431	71.5586	62.7717	61.2111	64.9243	66.9605	76.6236	83.7115	95.3038 (64)
Total per year (kWh/year)												927.8648 (64)
Electric shower(s)												55.2056 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												627.9603 (64a)
Heat gains from water heating, kWh/month												
	37.9351	33.4010	35.5047	31.7000	30.9443	28.1458	28.1707	29.2857	29.5543	32.5839	34.1034	37.6274 (65)

5. Internal gains (see Table 5 and 5a)												
Metabolic gains (Table 5), Watts												
(66)m	133.3458	133.3458	133.3458	133.3458	133.3458	133.3458	133.3458	133.3458	133.3458	133.3458	133.3458	133.3458 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	126.4826	140.0343	126.4826	130.6987	126.4826	130.6987	126.4826	126.4826	130.6987	126.4826	130.6987	126.4826 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	244.8256	247.3662	240.9641	227.3349	210.1306	193.9608	183.1585	180.6180	187.0200	200.6492	217.8536	234.0233 (68)
Pumps, fans	36.3346	36.3346	36.3346	36.3346	36.3346	36.3346	36.3346	36.3346	36.3346	36.3346	36.3346	36.3346 (69)
Losses e.g. evaporation (negative values) (Table 5)												
Water heating gains (Table 5)	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766 (71)
Total internal gains	50.9880	49.7038	47.7214	44.0277	41.5918	39.0914	37.8639	39.3625	41.0477	43.7956	47.3658	50.5744 (72)
	485.3000	500.1080	478.1718	465.0651	441.2087	426.7546	410.5087	409.4668	421.7701	433.9311	458.9218	474.0840 (73)

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

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		W/m2	or Table 6b	or Table 6c	Table 6d	

North	2.1300	10.6334	0.7300	0.7000	0.7700	8.0206 (74)
East	7.4200	19.6403	0.7300	0.7000	0.7700	51.6066 (76)
West	5.7900	19.6403	0.7300	0.7000	0.7700	40.2699 (80)
East	0.9500	26.0000	0.7300	0.7000	1.0000	11.3595 (82)

Solar gains	111.2566	218.6505	363.9779	539.0546	669.2862	689.2829	654.4993	556.1728	425.8073	260.3460	138.8714	91.4161 (83)
Total gains	596.5566	718.7585	842.1497	1004.1197	1110.4949	1116.0376	1065.0080	965.6396	847.5774	694.2771	597.7933	565.5001 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	50.7856	50.8901	50.9929	51.4815	51.5739	52.0087	52.0087	52.0901	51.8404	51.5739	51.3872	51.1935
alpha	4.3857	4.3927	4.3995	4.4321	4.4383	4.4672	4.4672	4.4727	4.4560	4.4383	4.4258	4.4129
util living area	0.9951	0.9884	0.9699	0.9058	0.7729	0.5852	0.4359	0.4968	0.7582	0.9513	0.9898	0.9961 (86)
MIT	19.4086	19.6473	20.0131	20.4847	20.8116	20.9584	20.9910	20.9843	20.8725	20.4030	19.8206	19.3712 (87)
Th 2	19.9386	19.9406	19.9425	19.9514	19.9531	19.9610	19.9610	19.9624	19.9579	19.9531	19.9497	19.9462 (88)
util rest of house	0.9936	0.9850	0.9611	0.8794	0.7170	0.5012	0.3362	0.3907	0.6793	0.9319	0.9863	0.9950 (89)
MIT 2	18.4958	18.7340	19.0947	19.5483	19.8305	19.9420	19.9585	19.9577	19.8887	19.4847	18.9144	18.4643 (90)
Living area fraction	FLA = Living area / (4) =											
MIT	18.6184	18.8567	19.2181	19.6741	19.9623	20.0785	20.0972	20.0956	20.0209	19.6081	19.0361	18.5861 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.6184	18.8567	19.2181	19.6741	19.9623	20.0785	20.0972	20.0956	20.0209	19.6081	19.0361	18.5861 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9911	0.9804	0.9533	0.8711	0.7175	0.5111	0.3495	0.4047	0.6846	0.9237	0.9821	0.9928 (94)
Useful gains	591.2212	704.6362	802.8291	874.7143	796.7983	570.4407	372.2088	390.8006	580.2575	641.3282	587.0753	561.4398 (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	1570.1825	1527.3739	1389.0174	1165.5347	892.2122	586.6547	374.4943	395.1227	636.0879	972.7415	1293.6123	1565.0410 (97)
Space heating kWh	728.3472	552.8797	436.1241	209.3906	70.9879	0.0000	0.0000	0.0000	0.0000	246.5715	508.7066	746.6793 (98a)
Space heating requirement - total per year (kWh/year)	3499.6871											
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	728.3472	552.8797	436.1241	209.3906	70.9879	0.0000	0.0000	0.0000	0.0000	246.5715	508.7066	746.6793 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	3499.6871											
Space heating per m2	(98c) / (4) = 37.5543 (99)											

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1006.5793	792.4135	812.5595	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.8904	0.9377	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	896.2706	743.0125	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1237.5613	1181.2575	1069.9831	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	245.7293	326.0543	246.1000	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction	fc = cooled area / (4) =											
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	61.4323	81.5136	61.5250	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling requirement	204.4709 (107)											
Energy for space heating	37.5543 (99)											
Energy for space cooling	2.1941 (108)											
Total	39.7484 (109)											
Fabric Energy Efficiency (DFEE)	39.7 (109)											

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	35.9700 (1b)	x 2.4000 (2b)	= 86.3280 (1b) - (3b)
First floor	35.9700 (1c)	x 2.6300 (2c)	= 94.6011 (1c) - (3c)
Second floor	21.2500 (1d)	x 2.6100 (2d)	= 55.4625 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.1900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 236.3916 (5)

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2. Ventilation rate

											m3 per hour	
Number of open chimneys											0 * 80 =	0.0000 (6a)
Number of open flues											0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire											0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler											0 * 20 =	0.0000 (6d)
Number of flues attached to other heater											0 * 35 =	0.0000 (6e)
Number of blocked chimneys											0 * 20 =	0.0000 (6f)
Number of intermittent extract fans											3 * 10 =	30.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
											Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											30.0000 / (5) =	0.1269 (8)
Pressure test											Yes	
Pressure Test Method											Blower Door	
Measured/design AP50											5.0000 (17)	
Infiltration rate											0.3769 (18)	
Number of sides sheltered											1 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.3486 (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	0.4445	0.4358	0.4271	0.3835	0.3748	0.3312	0.3312	0.3225	0.3486	0.3748	0.3922	0.4097 (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	0.5988	0.5950	0.5912	0.5735	0.5702	0.5548	0.5548	0.5520	0.5608	0.5702	0.5769	0.5839 (25)

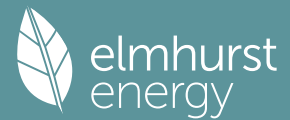
3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1400	1.0000	2.1400			(26)
TER Opening Type (Uw = 1.20)			15.3400	1.1450	17.5649			(27)
Roof light			0.9500	1.5918	1.5122			(27a)
Heatloss Floor 1			35.9700	0.1300	4.6761			(28a)
Brick wall	98.9900	16.7700	82.2200	0.1800	14.7996			(29a)
Stud wall (0.72)	24.6100		24.6100	0.1800	4.4298			(29a)
Spandrel wall	13.6300	0.7100	12.9200	0.1800	2.3256			(29a)
Plane roof	11.9000		11.9000	0.1100	1.3090			(30)
Sloping roof	12.7900	0.9500	11.8400	0.1100	1.3024			(30)
Roof behind studs (0.72)	14.7100		14.7100	0.1100	1.6181			(30)
Total net area of external elements Aum(A, m2)			212.6000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	51.6777			(33)
Party Wall 1			55.1500	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								215.1442 (35)
List of Thermal Bridges								
K1 Element				Length	Psi-value	Total		
E2 Other lintels (including other steel lintels)				11.4300	0.0500	0.5715		
E3 Sill				8.6000	0.0500	0.4300		
E4 Jamb				27.6000	0.0500	1.3800		
E5 Ground floor (normal)				16.9700	0.1600	2.7152		
E6 Intermediate floor within a dwelling				33.9400	0.0000	0.0000		
E11 Eaves (insulation at rafter level)				8.7400	0.0400	0.3496		
E13 Gable (insulation at rafter level)				11.2500	0.0800	0.9000		
E16 Corner (normal)				10.9000	0.0900	0.9810		
E18 Party wall between dwellings				10.9000	0.0600	0.6540		
P1 Party wall - Ground floor				8.2300	0.0800	0.6584		
P2 Party wall - Intermediate floor within a dwelling				16.4600	0.0000	0.0000		
P5 Party wall - Roof (insulation at rafter level)				11.2500	0.0800	0.9000		
R1 Head of roof window				0.9500	0.0800	0.0760		
R2 Sill of roof window				0.9500	0.0600	0.0570		
R3 Jamb of roof window				2.0600	0.0800	0.1648		
R4 Ridge (vaulted ceiling)				4.3700	0.0800	0.3496		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								10.1871 (36)
Point Thermal bridges								(36a) = 0.0000
Total fabric heat loss								(33) + (36) + (36a) = 61.8648 (37)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6669 (42)
Hot water usage for mixer showers												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	29.7676	29.3255	28.7030	27.5551	26.6956	25.7425	25.2277	25.8459	26.5190	27.5388	28.7103	29.6670 (42b)
Hot water usage for other uses	41.9419	40.4167	38.8916	37.3664	35.8412	34.3161	34.3161	35.8412	37.3664	38.8916	40.4167	41.9419 (42c)
Average daily hot water use (litres/day)												65.7282 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	71.7095	69.7422	67.5945	64.9215	62.5368	60.0586	59.5438	61.6871	63.8854	66.4304	69.1270	71.6088 (44)
Energy content (annual)	113.5703	99.3120	103.8903	88.8743	84.1865	73.8490	72.0130	76.3815	78.7771	90.1454	98.4842	112.1221 (45)
												Total = Sum(45)m = 1091.6057

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Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	96.5347	84.4152	88.3067	75.5431	71.5586	62.7717	61.2111	64.9243	66.9605	76.6236	83.7115	95.3038 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	96.5347	84.4152	88.3067	75.5431	71.5586	62.7717	61.2111	64.9243	66.9605	76.6236	83.7115	95.3038 (64)
12Total per year (kWh/year)												927.8648 (64)
Electric shower(s)	55.2056	49.1886	53.7121	51.2568	52.2186	49.8115	51.4719	52.2186	51.2568	53.7121	52.7021	55.2056 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												627.9603 (64a)
Heat gains from water heating, kWh/month	37.9351	33.4010	35.5047	31.7000	30.9443	28.1458	28.1707	29.2857	29.5543	32.5839	34.1034	37.6274 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3458	133.3458	133.3458	133.3458	133.3458	133.3458	133.3458	133.3458	133.3458	133.3458	133.3458	133.3458	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	126.4826	140.0343	126.4826	130.6987	126.4826	130.6987	126.4826	126.4826	130.6987	126.4826	130.6987	126.4826	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.8256	247.3662	240.9641	227.3349	210.1306	193.9608	183.1585	180.6180	187.0200	200.6492	217.8536	234.0233	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3346	36.3346	36.3346	36.3346	36.3346	36.3346	36.3346	36.3346	36.3346	36.3346	36.3346	36.3346	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	(71)
Water heating gains (Table 5)	50.9880	49.7038	47.7214	44.0277	41.5918	39.0914	37.8639	39.3625	41.0477	43.7956	47.3658	50.5744	(72)
Total internal gains	485.3000	500.1080	478.1718	465.0651	441.2087	426.7546	410.5087	409.4668	421.7701	433.9311	458.9218	474.0840	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				2.1300	10.6334		0.6300		0.7000		0.7700		6.9219 (74)
East				7.4200	19.6403		0.6300		0.7000		0.7700		44.5372 (76)
West				5.7900	19.6403		0.6300		0.7000		0.7700		34.7534 (80)
East				0.9500	26.0000		0.6300		0.7000		1.0000		9.8034 (82)
Solar gains	96.0159	188.6983	314.1179	465.2115	577.6032	594.8606	564.8419	479.9847	367.4775	224.6822	119.8479	78.8933	(83)
Total gains	581.3159	688.8064	792.2898	930.2766	1018.8118	1021.6152	975.3506	889.4516	789.2476	658.6133	578.7698	552.9774	(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	51.2933	51.4351	51.5748	52.2414	52.3680	52.9657	52.9657	53.0779	52.7339	52.3680	52.1125	51.8480	
alpha	4.4196	4.4290	4.4383	4.4828	4.4912	4.5310	4.5310	4.5385	4.5156	4.4912	4.4742	4.4565	
util living area	0.9955	0.9900	0.9754	0.9227	0.8056	0.6211	0.4657	0.5266	0.7846	0.9581	0.9910	0.9964	(86)
MIT	19.4090	19.6313	19.9767	20.4414	20.7820	20.9501	20.9891	20.9815	20.8580	20.3848	19.8203	19.3803	(87)
Th 2	19.9480	19.9506	19.9531	19.9651	19.9673	19.9778	19.9778	19.9797	19.9737	19.9673	19.9628	19.9581	(88)
util rest of house	0.9942	0.9871	0.9680	0.8999	0.7530	0.5359	0.3618	0.4174	0.7088	0.9411	0.9878	0.9954	(89)
MIT 2	18.5032	18.7258	19.0681	19.5218	19.8222	19.9544	19.9747	19.9740	19.8948	19.4799	18.9241	18.4822	(90)
Living area fraction									FLA = Living area / (4) =			0.1343	(91)
MIT	18.6249	18.8475	19.1902	19.6453	19.9512	20.0882	20.1110	20.1094	20.0242	19.6015	19.0445	18.6029	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6249	18.8475	19.1902	19.6453	19.9512	20.0882	20.1110	20.1094	20.0242	19.6015	19.0445	18.6029	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	576.5923	677.0635	761.3439	829.2379	766.2581	557.3588	366.3526	384.0135	562.7550	614.6608	569.4591	549.3381	(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	1555.3459	1510.1938	1370.3350	1145.5156	877.4984	577.0711	369.1770	389.2096	625.6548	957.2881	1276.5051	1547.0819	(97)
Space heating kWh	728.1926	559.8635	453.0894	227.7200	82.7628	0.0000	0.0000	0.0000	0.0000	254.9147	509.0731	742.3213	(98a)
Space heating requirement - total per year (kWh/year)												3557.9374	
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	728.1926	559.8635	453.0894	227.7200	82.7628	0.0000	0.0000	0.0000	0.0000	254.9147	509.0731	742.3213	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3557.9374	
Space heating per m ²												38.1794	(99)

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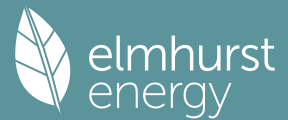


8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
	0.0000	0.0000	0.0000	0.0000	0.0000	988.3924	778.0961	797.4368	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8692	0.9240	0.8934	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	859.0897	718.9936	712.4255	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1129.2185	1078.3728	982.5185	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	194.4927	267.3781	200.9492	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	48.6232	66.8445	50.2373	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												165.7050 (107)
Energy for space heating												38.1794 (99)
Energy for space cooling												1.7781 (108)
Total												39.9575 (109)
Fabric Energy Efficiency (TFEE)												40.0 (109)

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Property Reference	SAP VG 21-0282				Issued on Date	15/11/2024	
Assessment Reference	Plot 19			Prop Type Ref	SAP VG 21-0282		
Property							
SAP Rating	92 A	DER	12.27	TER	12.38		
Environmental	89 B	% DER < TER				0.89	
CO ₂ Emissions (t/year)	1.1	DFEE	39.75	TFEE	39.96		
Compliance Check	See BREL	% DFEE < TFEE				0.52	
% DPER < TPER	0.60	DPER	64.51	TPER	64.90		
Assessor Details	Miss Victoria Gartside				Assessor ID	AL30-0001	
Client							

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.9700 (1b)	x 2.4000 (2b)	= 86.3280 (1b) - (3b)
First floor	35.9700 (1c)	x 2.6300 (2c)	= 94.6011 (1c) - (3c)
Second floor	21.2500 (1d)	x 2.6100 (2d)	= 55.4625 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.1900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	236.3916 (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) = 0.1692 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.3692 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3415 (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	0.4354	0.4269	0.4184	0.3757	0.3671	0.3244	0.3244	0.3159	0.3415	0.3671	0.3842	0.4013 (22b)
Effective ac	0.5948	0.5911	0.5875	0.5706	0.5674	0.5526	0.5526	0.5499	0.5583	0.5674	0.5738	0.5805 (25)

3. Heat losses and heat loss parameter

Element	Gross 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
Front door			2.1400	1.1000	2.3540		(26)
Windows (Uw = 1.30)			15.3400	1.2357	18.9563		(27)
Roof light			0.9500	1.2357	1.1740		(27a)
Heatloss Floor 1			35.9700	0.1300	4.6761	110.0000	3956.7000 (28a)
Brick wall	98.9900	16.7700	82.2200	0.1900	15.6218	110.0000	9044.2000 (29a)
Stud wall (0.72)	24.6100		24.6100	0.1100	2.7071	9.0000	221.4900 (29a)
Spandrel wall	13.6300	0.7100	12.9200	0.2300	2.9716	0.0000	0.0000 (29a)
Plane roof	11.9000		11.9000	0.0900	1.0710	9.0000	107.1000 (30)
Sloping roof	12.7900	0.9500	11.8400	0.1800	2.1312	9.0000	106.5600 (30)
Roof behind studs (0.72)	14.7100		14.7100	0.1100	1.6181	9.0000	132.3900 (30)
Total net area of external elements A _{um} (A, m ²)			212.6000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	53.2811		(33)
Party Wall 1			55.1500	0.0000	0.0000	70.0000	3860.5000 (32)
Internal Wall 2			119.6700			9.0000	1077.0300 (32c)
Internal Floor			57.1600			18.0000	1028.8800 (32d)
Internal Ceiling 1			57.1600			9.0000	514.4400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20049.2900 (34)

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

215.1442 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	11.4300	0.0240	0.2743
E2 Other lintels (including other steel lintels)	8.6000	0.0220	0.1892
E3 Sill	27.6000	0.0170	0.4692
E4 Jamb	16.9700	0.0920	1.5612
E5 Ground floor (normal)	33.9400	0.0010	0.0339
E6 Intermediate floor within a dwelling	8.7400	0.0680	0.5943
E11 Eaves (insulation at rafter level)	11.2500	0.0940	1.0575
E13 Gable (insulation at rafter level)	10.9000	0.0460	0.5014
E16 Corner (normal)	10.9000	0.0400	0.4360
E18 Party wall between dwellings	8.2300	0.0690	0.5679
P1 Party wall - Ground floor	16.4600	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	11.2500	0.4800	5.4000
P5 Party wall - Roof (insulation at rafter level)	0.9500	0.1150	0.1092
R1 Head of roof window	0.9500	0.1130	0.1074
R2 Sill of roof window	2.0600	0.0410	0.0845
R3 Jamb of roof window	4.3700	0.0440	0.1923
R4 Ridge (vaulted ceiling)			

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

Point Thermal bridges	(36a) =	11.5783 (36)
Total fabric heat loss	(33) + (36) + (36a) =	64.8595 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.4001	46.1130	45.8315	44.5093	44.2619	43.1104	43.1104	42.8971	43.5540	44.2619	44.7624	45.2855	(38)
Heat transfer coeff	111.2596	110.9724	110.6909	109.3688	109.1214	107.9698	107.9698	107.7566	108.4134	109.1214	109.6218	110.1450	(39)
Average = Sum(39)m / 12 =												109.3676	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1939	1.1908	1.1878	1.1736	1.1710	1.1586	1.1586	1.1563	1.1634	1.1710	1.1763	1.1819	(40)
HLP (average)												1.1736	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy

2.6669 (42)

Hot water usage for mixer showers

68.9352	67.8992	66.3896	63.5013	61.3697	58.9927	57.6416	59.1397	60.7820	63.3342	66.2846	68.6710	(42a)
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Hot water usage for baths

29.7676	29.3255	28.7030	27.5551	26.6956	25.7425	25.2277	25.8459	26.5190	27.5388	28.7103	29.6670	(42b)
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Hot water usage for other uses

41.9419	40.4167	38.8916	37.3664	35.8412	34.3161	34.3161	35.8412	37.3664	38.8916	40.4167	41.9419	(42c)
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Average daily hot water use (litres/day)

129.2842 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.6446	137.6414	133.9841	128.4227	123.9065	119.0512	117.1853	120.8269	124.6674	129.7646	135.4117	140.2799	(44)
Energy conte	222.7467	195.9996	205.9286	175.8043	166.8020	146.3874	141.7255	149.6089	153.7274	176.0894	192.9188	219.6444	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m	33.4120	29.3999	30.8893	26.3706	25.0203	21.9581	21.2588	22.4413	23.0591	26.4134	28.9378	32.9467	(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)
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If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
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Primary loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
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Combi loss

0.6420	0.5885	0.6484	0.5927	0.5924	0.5484	0.5415	0.5498	0.5413	0.5842	0.5964	0.6363	(61)
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Total heat required for water heating calculated for each month

223.3887	196.5880	206.5770	176.3970	167.3944	146.9357	142.2670	150.1587	154.2687	176.6735	193.5152	220.2807	(62)
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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)
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PV diverter

-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
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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)
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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)
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Output from w/h

223.3887	196.5880	206.5770	176.3970	167.3944	146.9357	142.2670	150.1587	154.2687	176.6735	193.5152	220.2807	(64)
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Total per year (kWh/year) = Sum(64)m = 2154.4446 (64)

2154 (64)

Heat gains from water heating, kWh/month

74.2238	65.3170	68.6334	58.6031	55.6098	48.8109	47.2591	49.8824	51.2497	58.6958	64.2946	73.1908	(65)
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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	--

(66)m	133.3458	133.3458	133.3458	133.3458	133.3458	133.3458	133.3458	133.3458	133.3458	133.3458	133.3458	133.3458	(66)
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Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

126.4826	140.0343	126.4826	130.6987	126.4826	130.6987	126.4826	126.4826	130.6987	126.4826	130.6987	126.4826	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

244.8256	247.3662	240.9641	227.3349	210.1306	193.9608	183.1585	180.6180	187.0200	200.6492	217.8536	234.0233	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

36.3346	36.3346	36.3346	36.3346	36.3346	36.3346	36.3346	36.3346	36.3346	36.3346	36.3346	36.3346	(69)
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Pumps, fans

3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
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Losses e.g. evaporation (negative values) (Table 5)

-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	(71)
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Water heating gains (Table 5)

99.7632	97.1979	92.2491	81.3932	74.7443	67.7929	63.5203	67.0462	71.1801	78.8921	89.2980	98.3748	(72)
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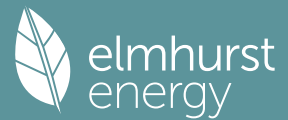
Total internal gains

537.0751	550.6021	525.6996	505.4306	477.3612	455.4562	436.1651	437.1505	451.9025	472.0277	503.8540	524.8844	(73)
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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
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North			2.1300		10.6334		0.7300		0.7000		0.7700		8.0206 (74)
East			7.4200		19.6403		0.7300		0.7000		0.7700		51.6066 (76)
West			5.7900		19.6403		0.7300		0.7000		0.7700		40.2699 (80)
East			0.9500		26.0000		0.7300		0.7000		1.0000		11.3595 (82)

Solar gains	111.2566	218.6505	363.9779	539.0546	669.2862	689.2829	654.4993	556.1728	425.8073	260.3460	138.8714	91.4161 (83)
Total gains	648.3317	769.2525	889.6775	1044.4851	1146.6474	1144.7391	1090.6644	993.3233	877.7098	732.3737	642.7255	616.3005 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	50.0563	50.1859	50.3135	50.9217	51.0372	51.5815	51.5815	51.6836	51.3705	51.0372	50.8042	50.5629	
alpha	4.3371	4.3457	4.3542	4.3948	4.4025	4.4388	4.4388	4.4456	4.4247	4.4025	4.3869	4.3709	
util living area	0.9932	0.9852	0.9643	0.8967	0.7620	0.5764	0.4294	0.4874	0.7452	0.9431	0.9868	0.9945 (86)	
MIT	19.4444	19.6810	20.0416	20.5024	20.8184	20.9598	20.9913	20.9851	20.8789	20.4282	19.8562	19.4105 (87)	
Th 2	19.9249	19.9274	19.9298	19.9412	19.9433	19.9533	19.9533	19.9551	19.9494	19.9433	19.9390	19.9345 (88)	
util rest of house	0.9913	0.9810	0.9541	0.8685	0.7050	0.4926	0.3303	0.3822	0.6651	0.9212	0.9823	0.9929 (89)	
MIT 2	18.1233	18.4254	18.8800	19.4452	19.7927	19.9299	19.9503	19.9494	19.8660	19.3736	18.6584	18.0867 (90)	
Living area fraction									fLA = Living area / (4) =				0.1343 (91)
MIT	18.3008	18.5941	19.0361	19.5872	19.9305	20.0682	20.0901	20.0886	20.0021	19.5152	18.8194	18.2646 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	18.1508	18.4441	18.8861	19.4372	19.7805	19.9182	19.9401	19.9386	19.8521	19.3652	18.6694	18.1146 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9863	0.9727	0.9407	0.8523	0.6953	0.4896	0.3290	0.3805	0.6567	0.9053	0.9743	0.9888 (94)
Useful gains	639.4565	748.2254	836.9540	890.2606	797.2243	560.5034	358.8519	377.9569	576.4280	662.9985	626.2275	609.3762 (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	1541.0351	1503.0195	1371.0263	1152.4434	881.7598	574.2103	360.6317	381.3047	623.6038	956.4761	1268.2534	1532.6220 (97)
Space heating kWh	670.7744	507.2216	397.3498	188.7716	62.8944	0.0000	0.0000	0.0000	0.0000	218.3474	462.2587	686.8949 (98a)
Space heating requirement - total per year (kWh/year)												3194.5128
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	670.7744	507.2216	397.3498	188.7716	62.8944	0.0000	0.0000	0.0000	0.0000	218.3474	462.2587	686.8949 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3194.5128
Space heating per m2										(98c) / (4) =		34.2796 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												88.7000 (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	670.7744	507.2216	397.3498	188.7716	62.8944	0.0000	0.0000	0.0000	0.0000	218.3474	462.2587	686.8949 (98)
Space heating efficiency (main heating system 1)	88.7000	88.7000	88.7000	88.7000	88.7000	0.0000	0.0000	0.0000	0.0000	88.7000	88.7000	88.7000 (210)
Space heating fuel (main heating system)	756.2282	571.8395	447.9705	212.8203	70.9069	0.0000	0.0000	0.0000	0.0000	246.1639	521.1484	774.4024 (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	223.3887	196.5880	206.5770	176.3970	167.3944	146.9357	142.2670	150.1587	154.2687	176.6735	193.5152	220.2807 (64)
Efficiency of water heater (217)m	85.2703	84.8829	84.0703	82.2996	79.4073	76.4000	76.4000	76.4000	76.4000	82.7421	84.6771	76.4000 (216)
Fuel for water heating, kWh/month	261.9772	231.5991	245.7193	214.3351	210.8048	192.3243	186.2133	196.5428	201.9224	213.5230	228.5331	258.0519 (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	25.7434	20.6523	18.5951	13.6236	10.5233	8.5977	12.4780	16.2077	21.2654	24.0192	26.4589	26.4589 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-25.7282	-40.6454	-65.8429	-81.1908	-91.8988	-87.1420	-85.6050	-78.3155	-65.5377	-49.1937	-29.4668	-21.5540 (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	-10.2209	-24.9999	-59.7371	-105.0532	-152.2644	-158.3094	-154.3478	-122.2305	-78.7289	-38.5906	-14.3197	-7.7397 (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												3601.4801 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												76.4000

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Water heating fuel used	2641.5462 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	207.7642 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1648.6633 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4888.1272 (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	3601.4801	0.2100	756.3108 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2641.5462	0.2100	554.7247 (264)
Space and water heating			1311.0355 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	207.7642	0.1443	29.9868 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-722.1209	0.1328	-95.8911
PV Unit electricity exported	-926.5424	0.1222	-113.2012
Total			-209.0924 (269)
Total CO2, kg/year			1143.8592 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			12.2700 (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	3601.4801	1.1300	4069.6725 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2641.5462	1.1300	2984.9472 (278)
Space and water heating			7054.6197 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	207.7642	1.5338	318.6756 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-722.1209	1.4907	-1076.4498
PV Unit electricity exported	-926.5424	0.4483	-415.3580
Total			-1491.8079 (283)
Total Primary energy kWh/year			6011.5883 (286)
Dwelling Primary energy Rate (DPER)			64.5100 (287)

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

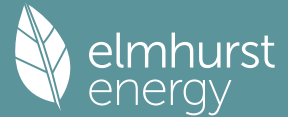
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	35.9700 (1b)	x 2.4000 (2b)	= 86.3280 (1b) - (3b)
First floor	35.9700 (1c)	x 2.6300 (2c)	= 94.6011 (1c) - (3c)
Second floor	21.2500 (1d)	x 2.6100 (2d)	= 55.4625 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.1900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 236.3916 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1269 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3769 (18)
Number of sides sheltered	1 (19)

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Shelter factor
Infiltration rate adjusted to include shelter factor

$$(20) = 1 - [0.075 \times (19)] = 0.9250 \quad (20)$$
$$(21) = (18) \times (20) = 0.3486 \quad (21)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
Effective ac	0.4445	0.4358	0.4271	0.3835	0.3748	0.3312	0.3312	0.3225	0.3486	0.3748	0.3922	0.4097	(22b)
	0.5988	0.5950	0.5912	0.5735	0.5702	0.5548	0.5548	0.5520	0.5608	0.5702	0.5769	0.5839	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1400	1.0000	2.1400			(26)
TER Opening Type (Uw = 1.20)			15.3400	1.1450	17.5649			(27)
Roof light			0.9500	1.5918	1.5122			(27a)
Heatloss Floor 1			35.9700	0.1300	4.6761			(28a)
Brick wall	98.9900	16.7700	82.2200	0.1800	14.7996			(29a)
Stud wall (0.72)	24.6100		24.6100	0.1800	4.4298			(29a)
Spandrel wall	13.6300	0.7100	12.9200	0.1800	2.3256			(29a)
Plane roof	11.9000		11.9000	0.1100	1.3090			(30)
Sloping roof	12.7900	0.9500	11.8400	0.1100	1.3024			(30)
Roof behind studs (0.72)	14.7100		14.7100	0.1100	1.6181			(30)
Total net area of external elements Aum(A, m2)			212.6000					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	51.6777		(33)
Party Wall 1			55.1500	0.0000	0.0000			(32)

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

215.1442 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element	11.4300	0.0500	0.5715	
E2 Other lintels (including other steel lintels)	8.6000	0.0500	0.4300	
E3 Sill	27.6000	0.0500	1.3800	
E4 Jamb	16.9700	0.1600	2.7152	
E5 Ground floor (normal)	33.9400	0.0000	0.0000	
E6 Intermediate floor within a dwelling	8.7400	0.0400	0.3496	
E11 Eaves (insulation at rafter level)	11.2500	0.0800	0.9000	
E13 Gable (insulation at rafter level)	10.9000	0.0900	0.9810	
E16 Corner (normal)	10.9000	0.0600	0.6540	
E18 Party wall between dwellings	8.2300	0.0800	0.6584	
P1 Party wall - Ground floor	16.4600	0.0000	0.0000	
P2 Party wall - Intermediate floor within a dwelling	11.2500	0.0800	0.9000	
P5 Party wall - Roof (insulation at rafter level)	0.9500	0.0800	0.0760	
R1 Head of roof window	0.9500	0.0600	0.0570	
R2 Sill of roof window	2.0600	0.0800	0.1648	
R3 Jamb of roof window	4.3700	0.0800	0.3496	
R4 Ridge (vaulted ceiling)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				10.1871 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	61.8648 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.7117	46.4124	46.1191	44.7412	44.4834	43.2834	43.2834	43.0611	43.7456	44.4834	45.0049	45.5502	(38)
Heat transfer coeff	108.5765	108.2772	107.9838	106.6060	106.3482	105.1481	105.1481	104.9259	105.6104	106.3482	106.8697	107.4149	(39)
Average = Sum(39)m / 12 =												106.6048	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1651	1.1619	1.1587	1.1440	1.1412	1.1283	1.1283	1.1259	1.1333	1.1412	1.1468	1.1526	(40)
HLP (average)												1.1440	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.6669 (42)
Hot water usage for mixer showers	68.9352	67.8992	66.3896	63.5013	61.3697	58.9927	57.6416	59.1397	60.7820	63.3342	66.2846	68.6710	(42a)
Hot water usage for baths	29.7676	29.3255	28.7030	27.5551	26.6956	25.7425	25.2277	25.8459	26.5190	27.5388	28.7103	29.6670	(42b)
Hot water usage for other uses	41.9419	40.4167	38.8916	37.3664	35.8412	34.3161	34.3161	35.8412	37.3664	38.8916	40.4167	41.9419	(42c)
Average daily hot water use (litres/day)												129.2842	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	140.6446	137.6414	133.9841	128.4227	123.9065	119.0512	117.1853	120.8269	124.6674	129.7646	135.4117	140.2799	(44)
Energy content (annual)	222.7467	195.9996	205.9286	175.8043	166.8020	146.3874	141.7255	149.6089	153.7274	176.0894	192.9188	219.6444	(45)
Distribution loss (46)m = 0.15 x (45)m	33.4120	29.3999	30.8893	26.3706	25.0203	21.9581	21.2588	22.4413	23.0591	26.4134	28.9378	32.9467	(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	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	273.7056	242.0270	256.8875	225.1194	217.7609	195.7025	192.6844	200.5678	203.0424	227.0483	242.2338	270.6033	(62)
WWHRS	-31.5143	-27.8715	-29.1854	-24.1667	-22.5225	-19.2726	-18.0650	-19.2103	-19.9402	-23.5073	-26.6309	-30.9307	(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	242.1914	214.1555	227.7021	200.9527	195.2384	176.4298	174.6194	181.3574	183.1022	203.5409	215.6029	239.6726	(64)
Total per year (kWh/year)												2454.5654	(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	86.8030	76.6767	81.2110	70.7837	68.2014	61.0026	59.8634	62.4847	63.4431	71.2894	76.4743	85.7715	(65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	133.3458	133.3458	133.3458	133.3458	133.3458	133.3458	133.3458	133.3458	133.3458	133.3458	133.3458	133.3458 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	126.4826	140.0343	126.4826	130.6987	126.4826	130.6987	126.4826	126.4826	130.6987	126.4826	130.6987	126.4826 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.8256	247.3662	240.9641	227.3349	210.1306	193.9608	183.1585	180.6180	187.0200	200.6492	217.8536	234.0233 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3346	36.3346	36.3346	36.3346	36.3346	36.3346	36.3346	36.3346	36.3346	36.3346	36.3346	36.3346 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766 (71)
Water heating gains (Table 5)	116.6707	114.1022	109.1546	98.3107	91.6685	84.7258	80.4616	83.9848	88.1154	95.8191	106.2142	115.2843 (72)
Total internal gains	553.9827	567.5064	542.6050	522.3481	494.2854	472.3891	453.1064	454.0891	468.8379	488.9547	520.7702	541.7939 (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	2.1300		10.6334		0.6300		0.7000		0.7700		6.9219 (74)	
East	7.4200		19.6403		0.6300		0.7000		0.7700		44.5372 (76)	
West	5.7900		19.6403		0.6300		0.7000		0.7700		34.7534 (80)	
East	0.9500		26.0000		0.6300		0.7000		1.0000		9.8034 (82)	
Solar gains	96.0159	188.6983	314.1179	465.2115	577.6032	594.8606	564.8419	479.9847	367.4775	224.6822	119.8479	78.8933 (83)
Total gains	649.9986	756.2048	856.7229	987.5596	1071.8886	1067.2497	1017.9483	934.0738	836.3154	713.6368	640.6182	620.6872 (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	51.2933	51.4351	51.5748	52.2414	52.3680	52.9657	52.9657	53.0779	52.7339	52.3680	52.1125	51.8480
alpha	4.4196	4.4290	4.4383	4.4828	4.4912	4.5310	4.5310	4.5385	4.5156	4.4912	4.4742	4.4565
util living area	0.9931	0.9858	0.9676	0.9079	0.7835	0.5993	0.4474	0.5039	0.7582	0.9455	0.9867	0.9943 (86)
MIT	19.4950	19.7132	20.0492	20.4909	20.8068	20.9567	20.9907	20.9845	20.8773	20.4414	19.8960	19.4658 (87)
Th 2	19.9480	19.9506	19.9531	19.9651	19.9673	19.9778	19.9778	19.9797	19.9737	19.9673	19.9628	19.9581 (88)
util rest of house	0.9911	0.9818	0.9583	0.8821	0.7289	0.5154	0.3470	0.3982	0.6802	0.9245	0.9822	0.9927 (89)
MIT 2	18.2036	18.4825	18.9070	19.4527	19.8047	19.9521	19.9745	19.9737	19.8881	19.4082	18.7254	18.1733 (90)
Living area fraction	18.3771	18.6478	19.0605	19.5922	19.9393	20.0871	20.1110	20.1095	20.0210	19.5470	18.8827	18.3469 (92)
MIT	18.3771	18.6478	19.0605	19.5922	19.9393	20.0871	20.1110	20.1095	20.0210	19.5470	18.8827	18.3469 (93)
Temperature adjustment												0.0000
adjusted MIT	18.3771	18.6478	19.0605	19.5922	19.9393	20.0871	20.1110	20.1095	20.0210	19.5470	18.8827	18.3469 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9867	0.9749	0.9478	0.8710	0.7273	0.5248	0.3603	0.4121	0.6842	0.9135	0.9755	0.9890 (94)
Useful gains	641.3793	737.1931	811.9714	860.1503	779.5876	560.0614	366.7933	384.9144	572.1820	651.9047	624.9282	613.8447 (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	1528.4446	1488.5748	1356.3262	1139.8511	876.2353	576.9537	369.1773	389.2200	625.3146	951.4993	1259.2091	1519.5895 (97)
Space heating kWh	659.9766	504.9285	404.9999	201.3845	71.9058	0.0000	0.0000	0.0000	0.0000	222.8984	456.6822	673.8741 (98a)
Space heating requirement - total per year (kWh/year)												3196.6501
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	659.9766	504.9285	404.9999	201.3845	71.9058	0.0000	0.0000	0.0000	0.0000	222.8984	456.6822	673.8741 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3196.6501
Space heating per m2										(98c) / (4) =		34.3025 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.4000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	659.9766	504.9285	404.9999	201.3845	71.9058	0.0000	0.0000	0.0000	0.0000	222.8984	456.6822	673.8741 (98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000 (210)
Space heating fuel (main heating system)	714.2604	546.4594	438.3116	217.9486	77.8202	0.0000	0.0000	0.0000	0.0000	241.2320	494.2448	729.3010 (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)

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Water heating													
Water heating requirement	242.1914	214.1555	227.7021	200.9527	195.2384	176.4298	174.6194	181.3574	183.1022	203.5409	215.6029	239.6726	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.4155	86.1521	85.6007	84.3860	82.4468	80.3000	80.3000	80.3000	80.3000	84.5766	85.9480	86.4704	(217)
Fuel for water heating, kWh/month	280.2639	248.5783	266.0051	238.1350	236.8054	219.7133	217.4587	225.8499	228.0227	240.6588	250.8528	277.1731	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	(231)
Lighting	26.2806	21.0833	18.9831	13.9079	10.7428	8.7770	9.8000	12.7384	16.5459	21.7091	24.5204	27.0110	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-35.0837	-50.2191	-73.2719	-83.6520	-91.2622	-85.5378	-84.4568	-79.1986	-70.1116	-57.9709	-38.8286	-30.2417	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-17.5835	-37.2255	-74.4350	-112.4575	-149.3535	-150.3295	-148.5888	-125.5348	-91.6306	-53.4885	-23.5562	-13.8892	(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												3459.5780	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												2929.5169	(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)												212.0994	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1777.9074	(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												4909.2869	(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	3459.5780	0.2100	726.5114	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2929.5169	0.2100	615.1986	(264)
Space and water heating			1341.7099	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	212.0994	0.1443	30.6125	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-779.8349	0.1343	-104.7128	
PV Unit electricity exported	-998.0725	0.1257	-125.4757	
Total			-230.1885	(269)
Total CO2, kg/year			1154.0632	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.3800	(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	3459.5780	1.1300	3909.3231	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2929.5169	1.1300	3310.3542	(278)
Space and water heating			7219.6773	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	212.0994	1.5338	325.3251	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-779.8349	1.4962	-1166.8221	
PV Unit electricity exported	-998.0725	0.4615	-460.5734	
Total			-1627.3955	(283)
Total Primary energy kWh/year			6047.7076	(286)
Target Primary Energy Rate (TPER)			64.9000	(287)

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Property Reference	SAP VG 21-0282				Issued on Date	15/11/2024	
Assessment Reference	Plot 19			Prop Type Ref	SAP VG 21-0282		
Property							
SAP Rating	92 A	DER	12.27	TER	12.38		
Environmental	89 B	% DER < TER				0.89	
CO ₂ Emissions (t/year)	1.1	DFEE	39.75	TFEE	39.96		
Compliance Check	See BREL	% DFEE < TFEE				0.52	
% DPER < TPER	0.60	DPER	64.51	TPER	64.90		
Assessor Details	Miss Victoria Gartside				Assessor ID	AL30-0001	
Client							

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)
Ground floor	35.9700 (1b)	x 2.4000 (2b)	= 86.3280 (1b) - (3b)
First floor	35.9700 (1c)	x 2.6300 (2c)	= 94.6011 (1c) - (3c)
Second floor	21.2500 (1d)	x 2.6100 (2d)	= 55.4625 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.1900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	236.3916 (5)

2. Ventilation rate

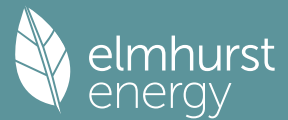
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
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) = 0.1692 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.3692 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3415 (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	0.4354	0.4269	0.4184	0.3757	0.3671	0.3244	0.3244	0.3159	0.3415	0.3671	0.3842	0.4013 (22b)
Effective ac	0.5948	0.5911	0.5875	0.5706	0.5674	0.5526	0.5526	0.5499	0.5583	0.5674	0.5738	0.5805 (25)

3. Heat losses and heat loss parameter

Element	Gross 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
Front door			2.1400	1.1000	2.3540		(26)
Windows (Uw = 1.30)			15.3400	1.2357	18.9563		(27)
Roof light			0.9500	1.2357	1.1740		(27a)
Heatloss Floor 1			35.9700	0.1300	4.6761	110.0000	3956.7000 (28a)
Brick wall	98.9900	16.7700	82.2200	0.1900	15.6218	110.0000	9044.2000 (29a)
Stud wall (0.72)	24.6100		24.6100	0.1100	2.7071	9.0000	221.4900 (29a)
Spandrel wall	13.6300	0.7100	12.9200	0.2300	2.9716	0.0000	0.0000 (29a)
Plane roof	11.9000		11.9000	0.0900	1.0710	9.0000	107.1000 (30)
Sloping roof	12.7900	0.9500	11.8400	0.1800	2.1312	9.0000	106.5600 (30)
Roof behind studs (0.72)	14.7100		14.7100	0.1100	1.6181	9.0000	132.3900 (30)
Total net area of external elements Aum(A, m ²)			212.6000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	53.2811		(33)
Party Wall 1			55.1500	0.0000	0.0000	70.0000	3860.5000 (32)
Internal Wall 2			119.6700			9.0000	1077.0300 (32c)
Internal Floor			57.1600			18.0000	1028.8800 (32d)
Internal Ceiling 1			57.1600			9.0000	514.4400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20049.2900 (34)

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

215.1442 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	11.4300	0.0240	0.2743
E2 Other lintels (including other steel lintels)	8.6000	0.0220	0.1892
E3 Sill	27.6000	0.0170	0.4692
E4 Jamb	16.9700	0.0920	1.5612
E5 Ground floor (normal)	33.9400	0.0010	0.0339
E6 Intermediate floor within a dwelling	8.7400	0.0680	0.5943
E11 Eaves (insulation at rafter level)	11.2500	0.0940	1.0575
E13 Gable (insulation at rafter level)	10.9000	0.0460	0.5014
E16 Corner (normal)	10.9000	0.0400	0.4360
E18 Party wall between dwellings	8.2300	0.0690	0.5679
P1 Party wall - Ground floor	16.4600	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	11.2500	0.4800	5.4000
P5 Party wall - Roof (insulation at rafter level)	0.9500	0.1150	0.1092
R1 Head of roof window	0.9500	0.1130	0.1074
R2 Sill of roof window	2.0600	0.0410	0.0845
R3 Jamb of roof window	4.3700	0.0440	0.1923
R4 Ridge (vaulted ceiling)			

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

Point Thermal bridges	(36a) =	11.5783 (36)
Total fabric heat loss	(33) + (36) + (36a) =	64.8595 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	46.4001	46.1130	45.8315	44.5093	44.2619	43.1104	43.1104	42.8971	43.5540	44.2619	44.7624	45.2855 (38)
Heat transfer coeff	111.2596	110.9724	110.6909	109.3688	109.1214	107.9698	107.9698	107.7566	108.4134	109.1214	109.6218	110.1450 (39)
Average = Sum(39)m / 12 =												109.3676

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1939	1.1908	1.1878	1.1736	1.1710	1.1586	1.1586	1.1563	1.1634	1.1710	1.1763	1.1819 (40)
HLP (average)												1.1736
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy

2.6669 (42)

Hot water usage for mixer showers

68.9352	67.8992	66.3896	63.5013	61.3697	58.9927	57.6416	59.1397	60.7820	63.3342	66.2846	68.6710 (42a)
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Hot water usage for baths

29.7676	29.3255	28.7030	27.5551	26.6956	25.7425	25.2277	25.8459	26.5190	27.5388	28.7103	29.6670 (42b)
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Hot water usage for other uses

41.9419	40.4167	38.8916	37.3664	35.8412	34.3161	34.3161	35.8412	37.3664	38.8916	40.4167	41.9419 (42c)
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Average daily hot water use (litres/day)

129.2842 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	140.6446	137.6414	133.9841	128.4227	123.9065	119.0512	117.1853	120.8269	124.6674	129.7646	135.4117	140.2799 (44)
Energy conte	222.7467	195.9996	205.9286	175.8043	166.8020	146.3874	141.7255	149.6089	153.7274	176.0894	192.9188	219.6444 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m	33.4120	29.3999	30.8893	26.3706	25.0203	21.9581	21.2588	22.4413	23.0591	26.4134	28.9378	32.9467 (46)

Water storage loss:

Total storage loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
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If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
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Primary loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
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Combi loss

0.6420	0.5885	0.6484	0.5927	0.5924	0.5484	0.5415	0.5498	0.5413	0.5842	0.5964	0.6363 (61)
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Total heat required for water heating calculated for each month

223.3887	196.5880	206.5770	176.3970	167.3944	146.9357	142.2670	150.1587	154.2687	176.6735	193.5152	220.2807 (62)
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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)
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PV diverter

-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
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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)
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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)
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Output from w/h

223.3887	196.5880	206.5770	176.3970	167.3944	146.9357	142.2670	150.1587	154.2687	176.6735	193.5152	220.2807 (64)
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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)
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Heat gains from water heating, kWh/month

74.2238	65.3170	68.6334	58.6031	55.6098	48.8109	47.2591	49.8824	51.2497	58.6958	64.2946	73.1908 (65)
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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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(66)m	160.0149	160.0149	160.0149	160.0149	160.0149	160.0149	160.0149	160.0149	160.0149	160.0149	160.0149	160.0149 (66)
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Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

29.4112	26.1227	21.2444	16.0834	12.0225	10.1499	10.9674	14.2558	19.1341	24.2951	28.3560	30.2286 (67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

365.4114	369.2032	359.6480	339.3059	313.6277	289.4938	273.3709	269.5791	279.1343	299.4764	325.1546	349.2885 (68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

53.6684	53.6684	53.6684	53.6684	53.6684	53.6684	53.6684	53.6684	53.6684	53.6684	53.6684	53.6684 (69)
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Pumps, fans

3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
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Losses e.g. evaporation (negative values) (Table 5)

-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766 (71)
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Water heating gains (Table 5)

99.7632	97.1979	92.2491	81.3932	74.7443	67.7929	63.5203	67.0462	71.1801	78.8921	89.2980	98.3748 (72)
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Total internal gains

604.5925	602.5306	583.1482	546.7892	510.4013	474.4434	454.8652	457.8878	476.4552	512.6704	552.8154	587.8986 (73)
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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	2.1300	10.6334	0.7300	0.7000	0.7700	8.0206 (74)

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East	7.4200	19.6403	0.7300	0.7000	0.7700	51.6066 (76)
West	5.7900	19.6403	0.7300	0.7000	0.7700	40.2699 (80)
East	0.9500	26.0000	0.7300	0.7000	1.0000	11.3595 (82)

Solar gains	111.2566	218.6505	363.9779	539.0546	669.2862	689.2829	654.4993	556.1728	425.8073	260.3460	138.8714	91.4161 (83)
Total gains	715.8490	821.1810	947.1262	1085.8438	1179.6875	1163.7263	1109.3646	1014.0606	902.2625	773.0164	691.6868	679.3147 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	50.0563	50.1859	50.3135	50.9217	51.0372	51.5815	51.5815	51.6836	51.3705	51.0372	50.8042	50.5629
alpha	4.3371	4.3457	4.3542	4.3948	4.4025	4.4388	4.4388	4.4456	4.4247	4.4025	4.3869	4.3709
util living area	0.9901	0.9813	0.9562	0.8853	0.7489	0.5684	0.4225	0.4782	0.7322	0.9327	0.9827	0.9920 (86)
MIT	19.5275	19.7425	20.1027	20.5342	20.8309	20.9619	20.9918	20.9861	20.8873	20.4673	19.9147	19.4889 (87)
Th 2	19.9249	19.9274	19.9298	19.9412	19.9433	19.9533	19.9533	19.9551	19.9494	19.9433	19.9390	19.9345 (88)
util rest of house	0.9873	0.9761	0.9440	0.8552	0.6911	0.4852	0.3248	0.3747	0.6514	0.9079	0.9770	0.9898 (89)
MIT 2	18.2288	18.5025	18.9545	19.4806	19.8042	19.9312	19.9505	19.9499	19.8726	19.4184	18.7317	18.1863 (90)
Living area fraction	18.4032	18.6691	19.1088	19.6221	19.9421	20.0697	20.0904	20.0891	20.0089	19.5593	18.8906	18.3613 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.2532	18.5191	18.9588	19.4721	19.7921	19.9197	19.9404	19.9391	19.8589	19.4093	18.7406	18.2113 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9809	0.9665	0.9296	0.8393	0.6820	0.4824	0.3236	0.3730	0.6436	0.8916	0.9676	0.9843 (94)
Useful gains	702.1951	793.6565	880.4321	911.3318	804.5824	561.4252	358.9934	378.2674	580.7128	689.2122	669.2842	668.6538 (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	1552.4320	1511.3464	1379.0731	1156.2597	883.0256	574.3657	360.6578	381.3607	624.3429	961.2875	1276.0679	1543.2764 (97)
Space heating kWh	632.5762	482.2876	370.9889	176.3481	58.3618	0.0000	0.0000	0.0000	0.0000	202.4240	436.8843	650.7192 (98a)
Space heating requirement - total per year (kWh/year)												3010.5902
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	632.5762	482.2876	370.9889	176.3481	58.3618	0.0000	0.0000	0.0000	0.0000	202.4240	436.8843	650.7192 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3010.5902
Space heating per m2										(98c) / (4) =		32.3059 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												88.7000 (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	632.5762	482.2876	370.9889	176.3481	58.3618	0.0000	0.0000	0.0000	0.0000	202.4240	436.8843	650.7192 (98)
Space heating efficiency (main heating system 1)	88.7000	88.7000	88.7000	88.7000	88.7000	0.0000	0.0000	0.0000	0.0000	88.7000	88.7000	88.7000 (210)
Space heating fuel (main heating system)	713.1637	543.7290	418.2513	198.8141	65.7968	0.0000	0.0000	0.0000	0.0000	228.2120	492.5414	733.6181 (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	223.3887	196.5880	206.5770	176.3970	167.3944	146.9357	142.2670	150.1587	154.2687	176.6735	193.5152	220.2807 (64)
Efficiency of water heater (217)m	85.1234	84.7489	83.8705	82.0910	79.2407	76.4000	76.4000	76.4000	76.4000	82.5094	84.5228	76.4000 (216)
Fuel for water heating, kWh/month	262.4292	231.9652	246.3047	214.8798	211.2482	192.3243	186.2133	196.5428	201.9224	214.1254	228.9503	258.4552 (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	25.7434	20.6523	18.5951	13.6236	10.5233	8.5976	9.5997	12.4780	16.2077	21.2654	24.0192	26.4589 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-25.7282	-40.6454	-65.8429	-81.1908	-91.8988	-87.1420	-85.6050	-78.3155	-65.5377	-49.1937	-29.4668	-21.5540 (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	-10.2209	-24.9999	-59.7371	-105.0532	-152.2644	-158.3094	-154.3478	-122.2305	-78.7289	-38.5906	-14.3197	-7.7397 (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												3394.1265 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												76.4000
Water heating fuel used												2645.3606 (219)

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Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	207.7642 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1648.6633 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4684.5880 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3394.1265	3.6400	123.5462 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2645.3606	3.6400	96.2911 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814 (249)
Energy for lighting	207.7642	16.4900	34.2603 (250)
Additional standing charges			92.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-722.1209	16.4900	-119.0777
PV Unit electricity exported	-926.5424	5.5900	-51.7937
Total			-170.8715 (252)
Total energy cost			189.4076 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600 (256)
Energy cost factor (ECF)	0.4934 (257)
SAP value	92.0015
SAP rating (Section 12)	92 (258)
SAP band	A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3394.1265	0.2100	712.7666 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2645.3606	0.2100	555.5257 (264)
Space and water heating			1268.2923 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	207.7642	0.1443	29.9868 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-722.1209	0.1328	-95.8911
PV Unit electricity exported	-926.5424	0.1222	-113.2012
Total			-209.0924 (269)
Total CO2, kg/year			1101.1160 (272)
CO2 emissions per m2			11.8200 (273)
EI value			89.3227
EI rating			89 (274)
EI band			B

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	35.9700 (1b)	x 2.4000 (2b)	= 86.3280 (1b) - (3b)
First floor	35.9700 (1c)	x 2.6300 (2c)	= 94.6011 (1c) - (3c)
Second floor	21.2500 (1d)	x 2.6100 (2d)	= 55.4625 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.1900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 236.3916 (5)

2. Ventilation rate

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

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Number of flues attached to other heater
Number of blocked chimneys
Number of intermittent extract fans
Number of passive vents
Number of flueless gas fires

0 * 35 = 0.0000 (6e)
0 * 20 = 0.0000 (6f)
4 * 10 = 40.0000 (7a)
0 * 10 = 0.0000 (7b)
0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =
Pressure test
Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Air changes per hour
40.0000 / (5) = 0.1692 (8)
Yes
Blower Door
4.0000 (17)
0.3692 (18)
1 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3415 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
Effective ac	0.4354	0.4269	0.4184	0.3757	0.3671	0.3244	0.3244	0.3159	0.3415	0.3671	0.3842	0.4013	(22b)
	0.5948	0.5911	0.5875	0.5706	0.5674	0.5526	0.5526	0.5499	0.5583	0.5674	0.5738	0.5805	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Front door			2.1400	1.1000	2.3540			(26)
Windows (Uw = 1.30)			15.3400	1.2357	18.9563			(27)
Roof light			0.9500	1.2357	1.1740			(27a)
Heatloss Floor 1			35.9700	0.1300	4.6761	110.0000	3956.7000	(28a)
Brick wall	98.9900	16.7700	82.2200	0.1900	15.6218	110.0000	9044.2000	(29a)
Stud wall (0.72)	24.6100		24.6100	0.1100	2.7071	9.0000	221.4900	(29a)
Spandrel wall	13.6300	0.7100	12.9200	0.2300	2.9716	0.0000	0.0000	(29a)
Plane roof	11.9000		11.9000	0.0900	1.0710	9.0000	107.1000	(30)
Sloping roof	12.7900	0.9500	11.8400	0.1800	2.1312	9.0000	106.5600	(30)
Roof behind studs (0.72)	14.7100		14.7100	0.1100	1.6181	9.0000	132.3900	(30)
Total net area of external elements Aum(A, m2)			212.6000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	53.2811			(33)
Party Wall 1			55.1500	0.0000	0.0000	70.0000	3860.5000	(32)
Internal Wall 2			119.6700			9.0000	1077.0300	(32c)
Internal Floor			57.1600			18.0000	1028.8800	(32d)
Internal Ceiling 1			57.1600			9.0000	514.4400	(32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
(28)...(30) + (32) + (32a)...(32e) = 20049.2900 (34)
List of Thermal Bridges
215.1442 (35)

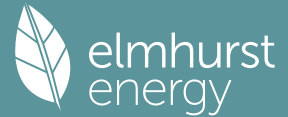
	Length	Psi-value	Total	
K1 Element	11.4300	0.0240	0.2743	
E2 Other lintels (including other steel lintels)	8.6000	0.0220	0.1892	
E3 Sill	27.6000	0.0170	0.4692	
E4 Jamb	16.9700	0.0920	1.5612	
E6 Intermediate floor within a dwelling	33.9400	0.0010	0.0339	
E11 Eaves (insulation at rafter level)	8.7400	0.0680	0.5943	
E13 Gable (insulation at rafter level)	11.2500	0.0940	1.0575	
E16 Corner (normal)	10.9000	0.0460	0.5014	
E18 Party wall between dwellings	10.9000	0.0400	0.4360	
P1 Party wall - Ground floor	8.2300	0.0690	0.5679	
P2 Party wall - Intermediate floor within a dwelling	16.4600	0.0000	0.0000	
P5 Party wall - Roof (insulation at rafter level)	11.2500	0.4800	5.4000	
R1 Head of roof window	0.9500	0.1150	0.1092	
R2 Sill of roof window	0.9500	0.1130	0.1074	
R3 Jamb of roof window	2.0600	0.0410	0.0845	
R4 Ridge (vaulted ceiling)	4.3700	0.0440	0.1923	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			11.5783	(36)
Point Thermal Bridges			0.0000	(36a) =
Total fabric heat loss			64.8595	(33) + (36) + (36a) =

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	46.4001	46.1130	45.8315	44.5093	44.2619	43.1104	43.1104	42.8971	43.5540	44.2619	44.7624	45.2855	(38)
Average = Sum(39)m / 12 =	111.2596	110.9724	110.6909	109.3688	109.1214	107.9698	107.9698	107.7566	108.4134	109.1214	109.6218	110.1450	(39)
												109.3676	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1939	1.1908	1.1878	1.1736	1.1710	1.1586	1.1586	1.1563	1.1634	1.1710	1.1763	1.1819	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.6669 (42)
Hot water usage for mixer showers													
Hot water usage for baths	68.9352	67.8992	66.3896	63.5013	61.3697	58.9927	57.6416	59.1397	60.7820	63.3342	66.2846	68.6710	(42a)
Hot water usage for other uses	29.7676	29.3255	28.7030	27.5551	26.6956	25.7425	25.2277	25.8459	26.5190	27.5388	28.7103	29.6670	(42b)
Average daily hot water use (litres/day)	41.9419	40.4167	38.8916	37.3664	35.8412	34.3161	34.3161	35.8412	37.3664	38.8916	40.4167	41.9419	(42c)
												129.2842	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	140.6446	137.6414	133.9841	128.4227	123.9065	119.0512	117.1853	120.8269	124.6674	129.7646	135.4117	140.2799	(44)
Energy content (annual)	222.7467	195.9996	205.9286	175.8043	166.8020	146.3874	141.7255	149.6089	153.7274	176.0894	192.9188	219.6444	(45)
Distribution loss (46)m = 0.15 x (45)m													
Water storage loss:	33.4120	29.3999	30.8893	26.3706	25.0203	21.9581	21.2588	22.4413	23.0591	26.4134	28.9378	32.9467	(46)
Total storage loss													
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	(56)

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Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.6420	0.5885	0.6484	0.5927	0.5924	0.5484	0.5415	0.5498	0.5413	0.5842	0.5964	0.6363	0.6363 (61)
Total heat required for water heating calculated for each month													
223.3887	196.5880	206.5770	176.3970	167.3944	146.9357	142.2670	150.1587	154.2687	176.6735	193.5152	220.2807	220.2807	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	223.3887	196.5880	206.5770	176.3970	167.3944	146.9357	142.2670	150.1587	154.2687	176.6735	193.5152	220.2807	(64)
Total per year (kWh/year) = Sum(64)m =												2154.4446	(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	0.0000 (64a)
Heat gains from water heating, kWh/month													
74.2238	65.3170	68.6334	58.6031	55.6098	48.8109	47.2591	49.8824	51.2497	58.6958	64.2946	73.1908	73.1908	(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	160.0149	160.0149	160.0149	160.0149	160.0149	160.0149	160.0149	160.0149	160.0149	160.0149	160.0149	160.0149	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	29.4112	26.1227	21.2444	16.0834	12.0225	10.1499	10.9674	14.2558	19.1341	24.2951	28.3560	30.2286	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	365.4114	369.2032	359.6480	339.3059	313.6277	289.4938	273.3709	269.5791	279.1343	299.4764	325.1546	349.2885	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6684	53.6684	53.6684	53.6684	53.6684	53.6684	53.6684	53.6684	53.6684	53.6684	53.6684	53.6684	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	(71)
Water heating gains (Table 5)	99.7632	97.1979	92.2491	81.3932	74.7443	67.7929	63.5203	67.0462	71.1801	78.8921	89.2980	98.3748	(72)
Total internal gains	604.5925	602.5306	583.1482	546.7892	510.4013	474.4434	454.8652	457.8878	476.4552	512.6704	552.8154	587.8986	(73)

6. Solar gains

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

North			2.1300	10.6334	0.7300	0.7000	0.7700	8.0206 (74)				
East			7.4200	19.6403	0.7300	0.7000	0.7700	51.6066 (76)				
West			5.7900	19.6403	0.7300	0.7000	0.7700	40.2699 (80)				
East			0.9500	26.0000	0.7300	0.7000	1.0000	11.3595 (82)				

Solar gains	111.2566	218.6505	363.9779	539.0546	669.2862	689.2829	654.4993	556.1728	425.8073	260.3460	138.8714	91.4161 (83)
Total gains	715.8490	821.1810	947.1262	1085.8438	1179.6875	1163.7263	1109.3646	1014.0606	902.2625	773.0164	691.6868	679.3147 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	50.0563	50.1859	50.3135	50.9217	51.0372	51.5815	51.5815	51.6836	51.3705	51.0372	50.8042	50.5629	
alpha	4.3371	4.3457	4.3542	4.3948	4.4025	4.4388	4.4388	4.4456	4.4247	4.4025	4.3869	4.3709	
util living area	0.9901	0.9813	0.9562	0.8853	0.7489	0.5684	0.4225	0.4782	0.7322	0.9327	0.9827	0.9920	(86)
MIT	19.5275	19.7425	20.1027	20.5342	20.8309	20.9619	20.9918	20.9861	20.8873	20.4673	19.9147	19.4889	(87)
Th 2	19.9249	19.9274	19.9298	19.9412	19.9433	19.9533	19.9533	19.9533	19.9494	19.9433	19.9390	19.9345	(88)
util rest of house	0.9873	0.9761	0.9440	0.8552	0.6911	0.4852	0.3248	0.3747	0.6514	0.9079	0.9770	0.9898	(89)
MIT 2	18.2288	18.5025	18.9545	19.4806	19.8042	19.9312	19.9505	19.9499	19.8726	19.4184	18.7317	18.1863	(90)
Living area fraction	18.4032	18.6691	19.1088	19.6221	19.9421	20.0697	20.0904	20.0891	20.0089	19.5593	18.8906	18.3613	(91)
MIT	18.4032	18.6691	19.1088	19.6221	19.9421	20.0697	20.0904	20.0891	20.0089	19.5593	18.8906	18.3613	(92)
Temperature adjustment	18.2532	18.5191	18.9588	19.4721	19.7921	19.9197	19.9404	19.9391	19.8589	19.4093	18.7406	18.2113	(93)
adjusted MIT	18.2532	18.5191	18.9588	19.4721	19.7921	19.9197	19.9404	19.9391	19.8589	19.4093	18.7406	18.2113	(93)

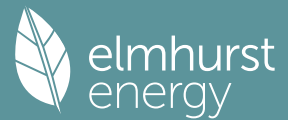
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9809	0.9665	0.9296	0.8393	0.6820	0.4824	0.3236	0.3730	0.6436	0.8916	0.9676	0.9843	(94)
Useful gains	702.1951	793.6565	880.4321	911.3318	804.5824	561.4252	358.9934	378.2674	580.7128	689.2122	669.2842	668.6538	(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	1552.4320	1511.3464	1379.0731	1156.2597	883.0256	574.3657	360.6578	381.3607	624.3429	961.2875	1276.0679	1543.2764	(97)
Space heating kWh	632.5762	482.2876	370.9889	176.3481	58.3618	0.0000	0.0000	0.0000	0.0000	202.4240	436.8843	650.7192	(98a)
Space heating requirement - total per year (kWh/year)												3010.5902	
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	632.5762	482.2876	370.9889	176.3481	58.3618	0.0000	0.0000	0.0000	0.0000	202.4240	436.8843	650.7192	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3010.5902	
Space heating per m2												32.3059	(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)

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Efficiency of main space heating system 1 (in %)												88.7000	(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	632.5762	482.2876	370.9889	176.3481	58.3618	0.0000	0.0000	0.0000	0.0000	202.4240	436.8843	650.7192	(98)
Space heating efficiency (main heating system 1)	88.7000	88.7000	88.7000	88.7000	88.7000	0.0000	0.0000	0.0000	0.0000	88.7000	88.7000	88.7000	(210)
Space heating fuel (main heating system)	713.1637	543.7290	418.2513	198.8141	65.7968	0.0000	0.0000	0.0000	0.0000	228.2120	492.5414	733.6181	(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	223.3887	196.5880	206.5770	176.3970	167.3944	146.9357	142.2670	150.1587	154.2687	176.6735	193.5152	220.2807	(64)
Efficiency of water heater	85.1234	84.7489	83.8705	82.0910	79.2407	76.4000	76.4000	76.4000	76.4000	82.5094	84.5228	85.2297	(216)
Fuel for water heating, kWh/month	262.4292	231.9652	246.3047	214.8798	211.2482	192.3243	186.2133	196.5428	201.9224	214.1254	228.9503	258.4552	(217)
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	25.7434	20.6523	18.5951	13.6236	10.5233	8.5976	9.5997	12.4780	16.2077	21.2654	24.0192	26.4589	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-25.7282	-40.6454	-65.8429	-81.1908	-91.8988	-87.1420	-85.6050	-78.3155	-65.5377	-49.1937	-29.4668	-21.5540	(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)	-10.2209	-24.9999	-59.7371	-105.0532	-152.2644	-158.3094	-154.3478	-122.2305	-78.7289	-38.5906	-14.3197	-7.7397	(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													3394.1265 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													76.4000
Water heating fuel used													2645.3606 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
central heating pump													41.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													86.0000 (231)
Electricity for lighting (calculated in Appendix L)													207.7642 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-1648.6633 (233)
Wind generation													0.0000 (234)
Hydro-electric generation (Appendix N)													0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)													0.0000 (235)
Appendix Q - special features													
Energy saved or generated													-0.0000 (236)
Energy used													0.0000 (237)
Total delivered energy for all uses													4684.5880 (238)

10a. Fuel costs - using BEDF prices (554)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3394.1265	5.6000	190.0711	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2645.3606	5.6000	148.1402	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	26.0600	22.4116	(249)
Energy for lighting	207.7642	26.0600	54.1433	(250)
Additional standing charges			99.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-722.1209	26.0600	-188.1847	
PV Unit electricity exported	-926.5424	5.8100	-53.8321	
Total			-242.0168	(252)
Total energy cost			271.7494	(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	3394.1265	0.2100	712.7666	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2645.3606	0.2100	555.5257	(264)
Space and water heating			1268.2923	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	207.7642	0.1443	29.9868	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-722.1209	0.1328	-95.8911	
PV Unit electricity exported	-926.5424	0.1222	-113.2012	
Total			-209.0924	(269)
Total CO2, kg/year			1101.1160	(272)

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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	3394.1265	1.1300	3835.3629 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2645.3606	1.1300	2989.2575 (278)
Space and water heating			6824.6204 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	207.7642	1.5338	318.6756 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-722.1209	1.4907	-1076.4498
PV Unit electricity exported	-926.5424	0.4483	-415.3580
Total			-1491.8079 (283)
Total Primary energy kWh/year			5781.5890 (286)

SAP 10 EPC IMPROVEMENTS

Plot 19

Current energy efficiency rating: A 92
Current environmental impact rating: B 89

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 + 0.6 -£ 23 -148 kg (13.4%)

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

Potential energy efficiency rating: A 92
Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 554 TEST (31 Oct 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, East Pennines):

	Current	Potential	Saving
Electricity	£77	£77	£0
Mains gas	£437	£437	£0
Space heating	£311	£311	£0
Water heating	£148	£148	£0
Lighting	£54	£54	£0
Generated (PV)	-£242	-£242	£0
Total cost of fuels	£272	£272	£0
Total cost of uses	£271	£271	£0
Delivered energy	50 kWh/m²	50 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.1 tonnes	1.1 tonnes	0.0 tonnes
CO2 emissions per m²	12 kg/m²	12 kg/m²	0 kg/m²
Primary energy	62 kWh/m²	62 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

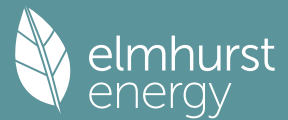
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	35.9700 (1b)	x 2.4000 (2b)	= 86.3280 (1b) - (3b)
First floor	35.9700 (1c)	x 2.6300 (2c)	= 94.6011 (1c) - (3c)
Second floor	21.2500 (1d)	x 2.6100 (2d)	= 55.4625 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.1900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 236.3916 (5)

2. Ventilation rate

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

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Number of blocked chimneys
Number of intermittent extract fans
Number of passive vents
Number of flueless gas fires

0 * 20 = 0.0000 (6f)
4 * 10 = 40.0000 (7a)
0 * 10 = 0.0000 (7b)
0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =
Pressure Test
Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Air changes per hour
40.0000 / (5) = 0.1692 (8)
Yes
Blower Door
4.0000 (17)
0.3692 (18)
1 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3415 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
Effective ac	0.4354	0.4269	0.4184	0.3757	0.3671	0.3244	0.3244	0.3159	0.3415	0.3671	0.3842	0.4013	(22b)
	0.5948	0.5911	0.5875	0.5706	0.5674	0.5526	0.5526	0.5499	0.5583	0.5674	0.5738	0.5805	(25)

3. Heat losses and heat loss parameter

Element	Gross 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	
Front door			2.1400	1.1000	2.3540			(26)
Windows (Uw = 1.30)			15.3400	1.2357	18.9563			(27)
Roof light			0.9500	1.2357	1.1740			(27a)
Heatloss Floor 1			35.9700	0.1300	4.6761	110.0000	3956.7000	(28a)
Brick wall	98.9900	16.7700	82.2200	0.1900	15.6218	110.0000	9044.2000	(29a)
Stud wall (0.72)	24.6100		24.6100	0.1100	2.7071	9.0000	221.4900	(29a)
Spandrel wall	13.6300	0.7100	12.9200	0.2300	2.9716	0.0000	0.0000	(29a)
Plane roof	11.9000		11.9000	0.0900	1.0710	9.0000	107.1000	(30)
Sloping roof	12.7900	0.9500	11.8400	0.1800	2.1312	9.0000	106.5600	(30)
Roof behind studs (0.72)	14.7100		14.7100	0.1100	1.6181	9.0000	132.3900	(30)
Total net area of external elements Aum(A, m ²)			212.6000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	53.2811			(33)
Party Wall 1			55.1500	0.0000	0.0000	70.0000	3860.5000	(32)
Internal Wall 2			119.6700			9.0000	1077.0300	(32c)
Internal Floor			57.1600			18.0000	1028.8800	(32d)
Internal Ceiling 1			57.1600			9.0000	514.4400	(32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
List of Thermal Bridges (28)...(30) + (32) + (32a)...(32e) = 20049.2900 (34)
215.1442 (35)

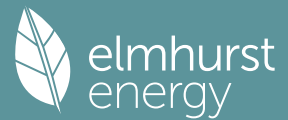
	Length	Psi-value	Total	
K1 Element	11.4300	0.0240	0.2743	
E2 Other lintels (including other steel lintels)	8.6000	0.0220	0.1892	
E3 Sill	27.6000	0.0170	0.4692	
E4 Jamb	16.9700	0.0920	1.5612	
E6 Intermediate floor within a dwelling	33.9400	0.0010	0.0339	
E11 Eaves (insulation at rafter level)	8.7400	0.0680	0.5943	
E13 Gable (insulation at rafter level)	11.2500	0.0940	1.0575	
E16 Corner (normal)	10.9000	0.0460	0.5014	
E18 Party wall between dwellings	10.9000	0.0400	0.4360	
P1 Party wall - Ground floor	8.2300	0.0690	0.5679	
P2 Party wall - Intermediate floor within a dwelling	16.4600	0.0000	0.0000	
P5 Party wall - Roof (insulation at rafter level)	11.2500	0.4800	5.4000	
R1 Head of roof window	0.9500	0.1150	0.1092	
R2 Sill of roof window	0.9500	0.1130	0.1074	
R3 Jamb of roof window	2.0600	0.0410	0.0845	
R4 Ridge (vaulted ceiling)	4.3700	0.0440	0.1923	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			11.5783	(36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	64.8595 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	46.4001	46.1130	45.8315	44.5093	44.2619	43.1104	43.1104	42.8971	43.5540	44.2619	44.7624	45.2855	(38)
Heat transfer coeff	111.2596	110.9724	110.6909	109.3688	109.1214	107.9698	107.9698	107.7566	108.4134	109.1214	109.6218	110.1450	(39)
Average = Sum(39)m / 12 =												109.3676	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1939	1.1908	1.1878	1.1736	1.1710	1.1586	1.1586	1.1563	1.1634	1.1710	1.1763	1.1819	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.6669 (42)
Hot water usage for mixer showers													
	68.9352	67.8992	66.3896	63.5013	61.3697	58.9927	57.6416	59.1397	60.7820	63.3342	66.2846	68.6710	(42a)
Hot water usage for baths													
	29.7676	29.3255	28.7030	27.5551	26.6956	25.7425	25.2277	25.8459	26.5190	27.5388	28.7103	29.6670	(42b)
Hot water usage for other uses													
	41.9419	40.4167	38.8916	37.3664	35.8412	34.3161	34.3161	35.8412	37.3664	38.8916	40.4167	41.9419	(42c)
Average daily hot water use (litres/day)													129.2842 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	140.6446	137.6414	133.9841	128.4227	123.9065	119.0512	117.1853	120.8269	124.6674	129.7646	135.4117	140.2799	(44)
Energy conte	222.7467	195.9996	205.9286	175.8043	166.8020	146.3874	141.7255	149.6089	153.7274	176.0894	192.9188	219.6444	(45)
Energy content (annual)										Total = Sum(45)m =		2147.3829	
Distribution loss (46)m = 0.15 x (45)m													
	33.4120	29.3999	30.8893	26.3706	25.0203	21.9581	21.2588	22.4413	23.0591	26.4134	28.9378	32.9467	(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)

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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	0.6420	0.5885	0.6484	0.5927	0.5924	0.5484	0.5415	0.5498	0.5413	0.5842	0.5964	0.6363 (61)
Total heat required for water heating calculated for each month												
	223.3887	196.5880	206.5770	176.3970	167.3944	146.9357	142.2670	150.1587	154.2687	176.6735	193.5152	220.2807 (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	223.3887	196.5880	206.5770	176.3970	167.3944	146.9357	142.2670	150.1587	154.2687	176.6735	193.5152	220.2807 (64)
Total per year (kWh/year) = Sum(64)m =												2154.4446 (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	74.2238	65.3170	68.6334	58.6031	55.6098	48.8109	47.2591	49.8824	51.2497	58.6958	64.2946	73.1908 (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	160.0149	160.0149	160.0149	160.0149	160.0149	160.0149	160.0149	160.0149	160.0149	160.0149	160.0149	160.0149	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	29.4112	26.1227	21.2444	16.0834	12.0225	10.1499	10.9674	14.2558	19.1341	24.2951	28.3560	30.2286	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	365.4114	369.2032	359.6480	339.3059	313.6277	289.4938	273.3709	269.5791	279.1343	299.4764	325.1546	349.2885	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6684	53.6684	53.6684	53.6684	53.6684	53.6684	53.6684	53.6684	53.6684	53.6684	53.6684	53.6684	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	(71)
Water heating gains (Table 5)	99.7632	97.1979	92.2491	81.3932	74.7443	67.7929	63.5203	67.0462	71.1801	78.8921	89.2980	98.3748	(72)
Total internal gains	604.5925	602.5306	583.1482	546.7892	510.4013	474.4434	454.8652	457.8878	476.4552	512.6704	552.8154	587.8986	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				2.1300	10.6334		0.7300		0.7000		0.7700		8.0206 (74)
East				7.4200	19.6403		0.7300		0.7000		0.7700		51.6066 (76)
West				5.7900	19.6403		0.7300		0.7000		0.7700		40.2699 (80)
East				0.9500	26.0000		0.7300		0.7000		1.0000		11.3595 (82)
Solar gains	111.2566	218.6505	363.9779	539.0546	669.2862	689.2829	654.4993	556.1728	425.8073	260.3460	138.8714		91.4161 (83)
Total gains	715.8490	821.1810	947.1262	1085.8438	1179.6875	1163.7263	1109.3646	1014.0606	902.2625	773.0164	691.6868		679.3147 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	50.0563	50.1859	50.3135	50.9217	51.0372	51.5815	51.5815	51.6836	51.3705	51.0372	50.8042	50.5629	
alpha	4.3371	4.3457	4.3542	4.3948	4.4025	4.4388	4.4388	4.4456	4.4247	4.4025	4.3869	4.3709	
util living area	0.9901	0.9813	0.9562	0.8853	0.7489	0.5684	0.4225	0.4782	0.7322	0.9327	0.9827	0.9920	(86)
MIT	19.5275	19.7425	20.1027	20.5342	20.8309	20.9619	20.9918	20.9861	20.8873	20.4673	19.9147	19.4889	(87)
Th 2	19.9249	19.9274	19.9298	19.9412	19.9433	19.9533	19.9533	19.9551	19.9494	19.9433	19.9390	19.9345	(88)
util rest of house	0.9873	0.9761	0.9440	0.8552	0.6911	0.4852	0.3248	0.3747	0.6514	0.9079	0.9770	0.9898	(89)
MIT 2	18.2288	18.5025	18.9545	19.4806	19.8042	19.9312	19.9505	19.9499	19.8726	19.4184	18.7317	18.1863	(90)
Living area fraction	18.4032	18.6691	19.1088	19.6221	19.9421	20.0697	20.0904	20.0891	20.0089	19.5593	18.8906	18.3613	(91)
MIT	18.2532	18.5191	18.9588	19.4721	19.7921	19.9197	19.9404	19.9391	19.8589	19.4093	18.7406	18.2113	(93)
Temperature adjustment													
adjusted MIT													

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9809	0.9665	0.9296	0.8393	0.6820	0.4824	0.3236	0.3730	0.6436	0.8916	0.9676	0.9843	(94)
Useful gains	702.1951	793.6565	880.4321	911.3318	804.5824	561.4252	358.9934	378.2674	580.7128	689.2122	669.2842	668.6538	(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	1552.4320	1511.3464	1379.0731	1156.2597	883.0256	574.3657	360.6578	381.3607	624.3429	961.2875	1276.0679	1543.2764	(97)
Space heating kWh	632.5762	482.2876	370.9889	176.3481	58.3618	0.0000	0.0000	0.0000	0.0000	202.4240	436.8843	650.7192	(98a)
Space heating requirement - total per year (kWh/year)												3010.5902	
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	632.5762	482.2876	370.9889	176.3481	58.3618	0.0000	0.0000	0.0000	0.0000	202.4240	436.8843	650.7192	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3010.5902	
Space heating per m ²												32.3059	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	88.7000	(206)

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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	632.5762	482.2876	370.9889	176.3481	58.3618	0.0000	0.0000	0.0000	0.0000	202.4240	436.8843	650.7192 (98)
Space heating efficiency (main heating system 1)	88.7000	88.7000	88.7000	88.7000	88.7000	0.0000	0.0000	0.0000	0.0000	88.7000	88.7000	88.7000 (210)
Space heating fuel (main heating system)	713.1637	543.7290	418.2513	198.8141	65.7968	0.0000	0.0000	0.0000	0.0000	228.2120	492.5414	733.6181 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	223.3887	196.5880	206.5770	176.3970	167.3944	146.9357	142.2670	150.1587	154.2687	176.6735	193.5152	220.2807 (64)
Efficiency of water heater	85.1234	84.7489	83.8705	82.0910	79.2407	76.4000	76.4000	76.4000	76.4000	82.5094	84.5228	76.4000 (216)
Fuel for water heating, kWh/month	262.4292	231.9652	246.3047	214.8798	211.2482	192.3243	186.2133	196.5428	201.9224	214.1254	228.9503	85.2297 (217)
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	258.4552 (219)
(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	25.7434	20.6523	18.5951	13.6236	10.5233	8.5976	9.5997	12.4780	16.2077	21.2654	24.0192	26.4589 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-25.7282	-40.6454	-65.8429	-81.1908	-91.8988	-87.1420	-85.6050	-78.3155	-65.5377	-49.1937	-29.4668	-21.5540 (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)	-10.2209	-24.9999	-59.7371	-105.0532	-152.2644	-158.3094	-154.3478	-122.2305	-78.7289	-38.5906	-14.3197	-7.7397 (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												3394.1265 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												76.4000
Water heating fuel used												2645.3606 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
central heating pump												41.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												86.0000 (231)
Electricity for lighting (calculated in Appendix L)												207.7642 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												-1648.6633 (233)
PV generation												0.0000 (234)
Wind generation												0.0000 (235a)
Hydro-electric generation (Appendix N)												0.0000 (235)
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												4684.5880 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3394.1265	3.6400	123.5462 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2645.3606	3.6400	96.2911 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814 (249)
Energy for lighting	207.7642	16.4900	34.2603 (250)
Additional standing charges			92.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-722.1209	16.4900	-119.0777
PV Unit electricity exported	-926.5424	5.5900	-51.7937
Total			-170.8715 (252)
Total energy cost			189.4076 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)		0.4934 (257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	92.0015
SAP rating (Section 12)		92 (258)
SAP band		A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3394.1265	0.2100	712.7666 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2645.3606	0.2100	555.5257 (264)
Space and water heating			1268.2923 (265)

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Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	207.7642	0.1443	29.9868 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-722.1209	0.1328	-95.8911
PV Unit electricity exported	-926.5424	0.1222	-113.2012
Total			-209.0924 (269)
Total CO ₂ , kg/year			1101.1160 (272)
CO ₂ emissions per m ²			11.8200 (273)
EI value			89.3227
EI rating			89 (274)
EI band			B

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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.9700 (1b)	x 2.4000 (2b)	= 86.3280 (1b) - (3b)
First floor	35.9700 (1c)	x 2.6300 (2c)	= 94.6011 (1c) - (3c)
Second floor	21.2500 (1d)	x 2.6100 (2d)	= 55.4625 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.1900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	236.3916 (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) =	0.1692 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	4.0000	(17)
Infiltration rate	0.3692	(18)
Number of sides sheltered	1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3415 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Effective ac	0.4354	0.4269	0.4184	0.3757	0.3671	0.3244	0.3244	0.3159	0.3415	0.3671	0.3842	0.4013 (22b)
	0.5948	0.5911	0.5875	0.5706	0.5674	0.5526	0.5526	0.5499	0.5583	0.5674	0.5738	0.5805 (25)

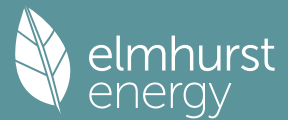
3. Heat losses and heat loss parameter

Element	Gross 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
Front door			2.1400	1.1000	2.3540		(26)
Windows (Uw = 1.30)			15.3400	1.2357	18.9563		(27)
Roof light			0.9500	1.2357	1.1740		(27a)
Heatloss Floor 1			35.9700	0.1300	4.6761	110.0000	3956.7000 (28a)
Brick wall	98.9900	16.7700	82.2200	0.1900	15.6218	110.0000	9044.2000 (29a)
Stud wall (0.72)	24.6100		24.6100	0.1100	2.7071	9.0000	221.4900 (29a)
Spandrel wall	13.6300	0.7100	12.9200	0.2300	2.9716	0.0000	0.0000 (29a)
Plane roof	11.9000		11.9000	0.0900	1.0710	9.0000	107.1000 (30)
Sloping roof	12.7900	0.9500	11.8400	0.1800	2.1312	9.0000	106.5600 (30)
Roof behind studs (0.72)	14.7100		14.7100	0.1100	1.6181	9.0000	132.3900 (30)
Total net area of external elements Aum(A, m ²)			212.6000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	53.2811			(33)
Party Wall 1			55.1500	0.0000	0.0000	70.0000	3860.5000 (32)
Internal Wall 2			119.6700			9.0000	1077.0300 (32c)
Internal Floor			57.1600			18.0000	1028.8800 (32d)
Internal Ceiling 1			57.1600			9.0000	514.4400 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =	20049.2900			(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K				215.1442			(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	11.4300	0.0240	0.2743
E3 Sill	8.6000	0.0220	0.1892
E4 Jamb	27.6000	0.0170	0.4692
E5 Ground floor (normal)	16.9700	0.0920	1.5612
E6 Intermediate floor within a dwelling	33.9400	0.0010	0.0339
E11 Eaves (insulation at rafter level)	8.7400	0.0680	0.5943
E13 Gable (insulation at rafter level)	11.2500	0.0940	1.0575
E16 Corner (normal)	10.9000	0.0460	0.5014

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E18 Party wall between dwellings									10.9000	0.0400	0.4360	
P1 Party wall - Ground floor									8.2300	0.0690	0.5679	
P2 Party wall - Intermediate floor within a dwelling									16.4600	0.0000	0.0000	
P5 Party wall - Roof (insulation at rafter level)									11.2500	0.4800	5.4000	
R1 Head of roof window									0.9500	0.1150	0.1092	
R2 Sill of roof window									0.9500	0.1130	0.1074	
R3 Jamb of roof window									2.0600	0.0410	0.0845	
R4 Ridge (vaulted ceiling)									4.3700	0.0440	0.1923	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												11.5783 (36)
Point Thermal bridges												0.0000
Total fabric heat loss												(33) + (36) + (36a) = 64.8595 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	46.4001	46.1130	45.8315	44.5093	44.2619	43.1104	43.1104	42.8971	43.5540	44.2619	44.7624	45.2855 (38)
Average = Sum(39)m / 12 =	111.2596	110.9724	110.6909	109.3688	109.1214	107.9698	107.9698	107.7566	108.4134	109.1214	109.6218	110.1450 (39)
												109.3676
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1939	1.1908	1.1878	1.1736	1.1710	1.1586	1.1586	1.1563	1.1634	1.1710	1.1763	1.1819 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)												

Assumed occupancy												2.6669 (42)
Hot water usage for mixer showers												
	68.9352	67.8992	66.3896	63.5013	61.3697	58.9927	57.6416	59.1397	60.7820	63.3342	66.2846	68.6710 (42a)
Hot water usage for baths												
	29.7676	29.3255	28.7030	27.5551	26.6956	25.7425	25.2277	25.8459	26.5190	27.5388	28.7103	29.6670 (42b)
Hot water usage for other uses												
	41.9419	40.4167	38.8916	37.3664	35.8412	34.3161	34.3161	35.8412	37.3664	38.8916	40.4167	41.9419 (42c)
Average daily hot water use (litres/day)												129.2842 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	140.6446	137.6414	133.9841	128.4227	123.9065	119.0512	117.1853	120.8269	124.6674	129.7646	135.4117	140.2799 (44)
Energy conte	222.7467	195.9996	205.9286	175.8043	166.8020	146.3874	141.7255	149.6089	153.7274	176.0894	192.9188	219.6444 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 2147.3829
	33.4120	29.3999	30.8893	26.3706	25.0203	21.9581	21.2588	22.4413	23.0591	26.4134	28.9378	32.9467 (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	0.6420	0.5885	0.6484	0.5927	0.5924	0.5484	0.5415	0.5498	0.5413	0.5842	0.5964	0.6363 (61)
Total heat required for water heating calculated for each month												
	223.3887	196.5880	206.5770	176.3970	167.3944	146.9357	142.2670	150.1587	154.2687	176.6735	193.5152	220.2807 (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												
	223.3887	196.5880	206.5770	176.3970	167.3944	146.9357	142.2670	150.1587	154.2687	176.6735	193.5152	220.2807 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month												
	74.2238	65.3170	68.6334	58.6031	55.6098	48.8109	47.2591	49.8824	51.2497	58.6958	64.2946	73.1908 (65)

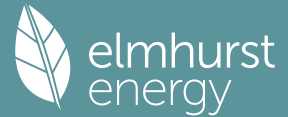
5. Internal gains (see Table 5 and 5a)												

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	160.0149	160.0149	160.0149	160.0149	160.0149	160.0149	160.0149	160.0149	160.0149	160.0149	160.0149	160.0149 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	29.4112	26.1227	21.2444	16.0834	12.0225	10.1499	10.9674	14.2558	19.1341	24.2951	28.3560	30.2286 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	365.4114	369.2032	359.6480	339.3059	313.6277	289.4938	273.3709	269.5791	279.1343	299.4764	325.1546	349.2885 (68)
Pumps, fans	53.6684	53.6684	53.6684	53.6684	53.6684	53.6684	53.6684	53.6684	53.6684	53.6684	53.6684	53.6684 (69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Water heating gains (Table 5)	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766	-106.6766 (71)
Total internal gains	99.7632	97.1979	92.2491	81.3932	74.7443	67.7929	63.5203	67.0462	71.1801	78.8921	89.2980	98.3748 (72)
	604.5925	602.5306	583.1482	546.7892	510.4013	474.4434	454.8652	457.8878	476.4552	512.6704	552.8154	587.8986 (73)

6. Solar gains												

[Jan]												
			Area	Solar flux	g	FF	Access	Gains				
			m2	Table 6a	Specific data	Specific data	factor	W				
				W/m2	or Table 6b	or Table 6c	Table 6d					
North			2.1300	10.6334	0.7300	0.7000	0.7700	8.0206 (74)				
East			7.4200	19.6403	0.7300	0.7000	0.7700	51.6066 (76)				
West			5.7900	19.6403	0.7300	0.7000	0.7700	40.2699 (80)				
East			0.9500	26.0000	0.7300	0.7000	1.0000	11.3595 (82)				
Solar gains	111.2566	218.6505	363.9779	539.0546	669.2862	689.2829	654.4993	556.1728	425.8073	260.3460	138.8714	91.4161 (83)
Total gains	715.8490	821.1810	947.1262	1085.8438	1179.6875	1163.7263	1109.3646	1014.0606	902.2625	773.0164	691.6868	679.3147 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	50.0563	50.1859	50.3135	50.9217	51.0372	51.5815	51.5815	51.6836	51.3705	51.0372	50.8042	50.5629
alpha	4.3371	4.3457	4.3542	4.3948	4.4025	4.4388	4.4388	4.4456	4.4247	4.4025	4.3869	4.3709
util living area	0.9901	0.9813	0.9562	0.8853	0.7489	0.5684	0.4225	0.4782	0.7322	0.9327	0.9827	0.9920 (86)
MIT	19.5275	19.7425	20.1027	20.5342	20.8309	20.9619	20.9918	20.9861	20.8873	20.4673	19.9147	19.4889 (87)
Th 2	19.9249	19.9274	19.9298	19.9412	19.9433	19.9533	19.9533	19.9551	19.9494	19.9433	19.9390	19.9345 (88)
util rest of house	0.9873	0.9761	0.9440	0.8552	0.6911	0.4852	0.3248	0.3747	0.6514	0.9079	0.9770	0.9898 (89)
MIT 2	18.2288	18.5025	18.9545	19.4806	19.8042	19.9312	19.9505	19.9499	19.8726	19.4184	18.7317	18.1863 (90)
Living area fraction									fLA =	Living area / (4) =		0.1343 (91)
MIT	18.4032	18.6691	19.1088	19.6221	19.9421	20.0697	20.0904	20.0891	20.0089	19.5593	18.8906	18.3613 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.2532	18.5191	18.9588	19.4721	19.7921	19.9197	19.9404	19.9391	19.8589	19.4093	18.7406	18.2113 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9809	0.9665	0.9296	0.8393	0.6820	0.4824	0.3236	0.3730	0.6436	0.8916	0.9676	0.9843 (94)
Useful gains	702.1951	793.6565	880.4321	911.3318	804.5824	561.4252	358.9934	378.2674	580.7128	689.2122	669.2842	668.6538 (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	1552.4320	1511.3464	1379.0731	1156.2597	883.0256	574.3657	360.6578	381.3607	624.3429	961.2875	1276.0679	1543.2764 (97)
Space heating kWh	632.5762	482.2876	370.9889	176.3481	58.3618	0.0000	0.0000	0.0000	0.0000	202.4240	436.8843	650.7192 (98a)
Space heating requirement - total per year (kWh/year)												3010.5902
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	632.5762	482.2876	370.9889	176.3481	58.3618	0.0000	0.0000	0.0000	0.0000	202.4240	436.8843	650.7192 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3010.5902
Space heating per m2										(98c) / (4) =		32.3059 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													88.7000 (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	632.5762	482.2876	370.9889	176.3481	58.3618	0.0000	0.0000	0.0000	0.0000	202.4240	436.8843	650.7192 (98)	
Space heating efficiency (main heating system 1)	88.7000	88.7000	88.7000	88.7000	88.7000	0.0000	0.0000	0.0000	0.0000	88.7000	88.7000	88.7000 (210)	
Space heating fuel (main heating system)	713.1637	543.7290	418.2513	198.8141	65.7968	0.0000	0.0000	0.0000	0.0000	228.2120	492.5414	733.6181 (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	223.3887	196.5880	206.5770	176.3970	167.3944	146.9357	142.2670	150.1587	154.2687	176.6735	193.5152	220.2807 (64)	
Efficiency of water heater (217)m	85.1234	84.7489	83.8705	82.0910	79.2407	76.4000	76.4000	76.4000	76.4000	82.5094	84.5228	76.4000 (216)	
Fuel for water heating, kWh/month	262.4292	231.9652	246.3047	214.8798	211.2482	192.3243	186.2133	196.5428	201.9224	214.1254	228.9503	258.4552 (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	25.7434	20.6523	18.5951	13.6236	10.5233	8.5976	9.5997	12.4780	16.2077	21.2654	24.0192	26.4589 (232)	
Electricity generated by PVs (Appendix M) (negative quantity)	-25.7282	-40.6454	-65.8429	-81.1908	-91.8988	-87.1420	-85.6050	-78.3155	-65.5377	-49.1937	-29.4668	-21.5540 (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)	-10.2209	-24.9999	-59.7371	-105.0532	-152.2644	-158.3094	-154.3478	-122.2305	-78.7289	-38.5906	-14.3197	-7.7397 (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													3394.1265 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													76.4000
Water heating fuel used													2645.3606 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
central heating pump													41.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													86.0000 (231)
Electricity for lighting (calculated in Appendix L)													207.7642 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-1648.6633 (233)
Wind generation													0.0000 (234)

Full SAP Calculation Printout



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	4684.5880 (238)

10a. Fuel costs - using BEDF prices (554)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3394.1265	5.6000	190.0711 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2645.3606	5.6000	148.1402 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	86.0000	26.0600	22.4116 (249)
Energy for lighting	207.7642	26.0600	54.1433 (250)
Additional standing charges			99.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-722.1209	26.0600	-188.1847
PV Unit electricity exported	-926.5424	5.8100	-53.8321
Total			-242.0168 (252)
Total energy cost			271.7494 (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	3394.1265	0.2100	712.7666 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2645.3606	0.2100	555.5257 (264)
Space and water heating			1268.2923 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	207.7642	0.1443	29.9868 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-722.1209	0.1328	-95.8911
PV Unit electricity exported	-926.5424	0.1222	-113.2012
Total			-209.0924 (269)
Total CO2, kg/year			1101.1160 (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	3394.1265	1.1300	3835.3629 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2645.3606	1.1300	2989.2575 (278)
Space and water heating			6824.6204 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	207.7642	1.5338	318.6756 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-722.1209	1.4907	-1076.4498
PV Unit electricity exported	-926.5424	0.4483	-415.3580
Total			-1491.8079 (283)
Total Primary energy kWh/year			5781.5890 (286)

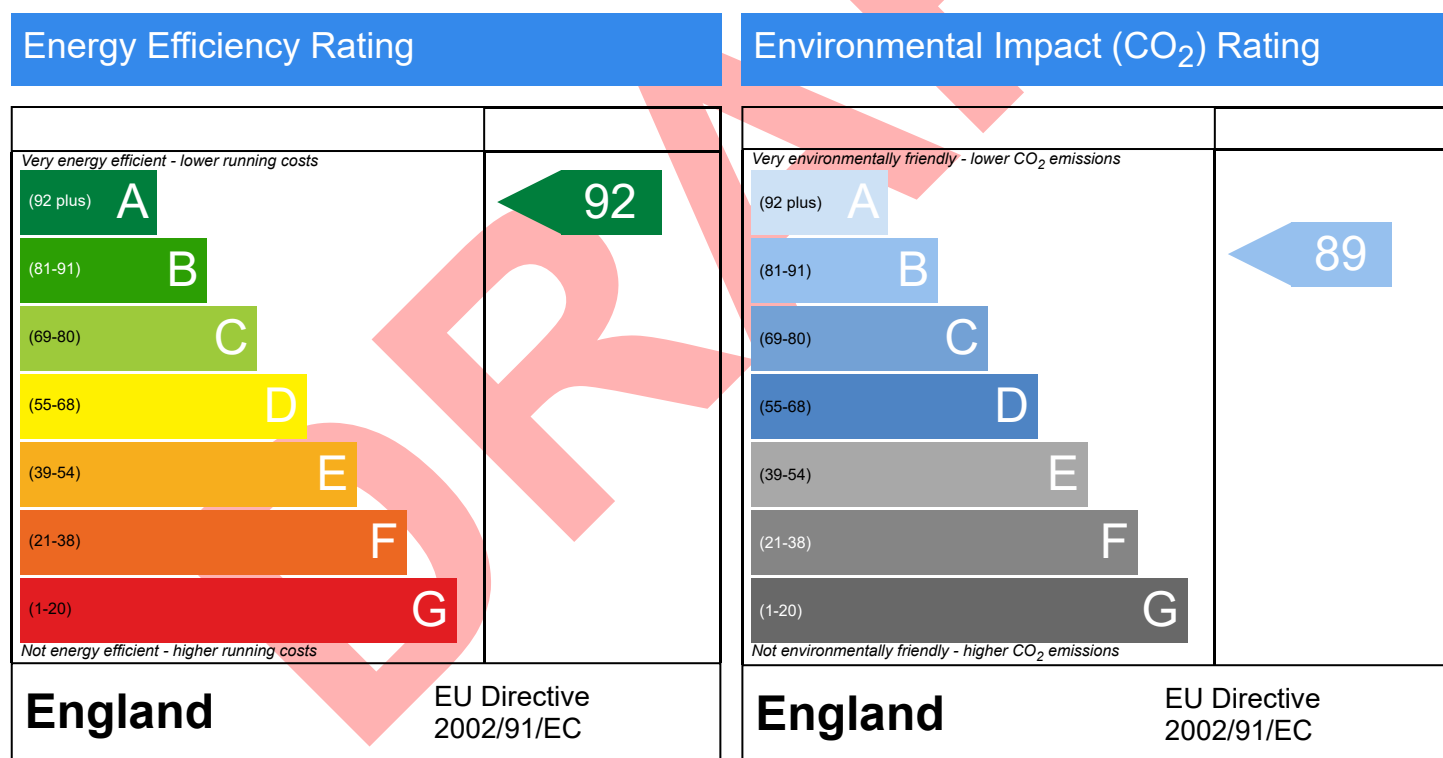
Predicted Energy Assessment



Dwelling type: House, Semi-Detached
Date of assessment: 15/11/2024
Produced by: Victoria Gartside
Total floor area: 93.19 m²
DRRN:

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

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



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

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