

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 10:34:21

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	112 m ²
Site Reference	SAP VG 21-0282	Plot Reference	Plot 66
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	12.4 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	12.36 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	65.11 kWh _{PE} /m ²		
Dwelling primary energy	65.09 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	43.3 kWh/m ²		
Dwelling fabric energy efficiency	39.8 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.18	Walls (1) (0.19)	OK
Party walls	0.2	0	Party Wall (1) (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	0.16	Exposed floor (0.2)	OK
Roofs	0.16	0.09	Roof (1) (0.09)	OK
Windows, doors, and roof windows	1.6	1.27	Front windows brick (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)	110.16	0.19
Exposed wall: Walls (2)	13.02	0.18
Sheltered wall: Walls (3)	23.03	0.14 (!)
Party wall: Party Wall (1)	61.49	0 (!)
Ground floor: Ground floor , Ground floor	25.12	0.13
Upper floor: Exposed floor , Exposed floor	18.51	0.2
Exposed roof: Roof (1)	43.63	0.09 (!)

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, Solid front door	2.14	West	N/A	1.1 (!)
Front windows brick, Windows	4.86	West	0.7	1.3
Side windows brick, Windows	1.42	South	0.7	1.3
Rear windows brick, Windows	7.21	East	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 (!)	MFF-150-E3-01
External wall	E4: Jamb	Calculated by person with suitable expertise	0.017 (!)	MFF-150-E4-01
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 (!)	MFF-150-E6-01
External wall	E10: Eaves (insulation at ceiling level)	Calculated by person with suitable expertise	0.06	MFF-150-E10-01
External wall	E12: Gable (insulation at ceiling level)	Calculated by person with suitable expertise	0.056	MFF-150-E12-01
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.046	MFF-150-E16-01
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	-0.088	MFF-150-E17-01
External wall	E20: Exposed floor (normal)	Calculated by person with suitable expertise	0.069	MFF-150-E20-01
External wall	E21: Exposed floor (inverted)	SAP table default	0.32	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.038 (!)	MFF-150-E18-04
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.086	Manufacturer Declaration
Party wall	P2: Intermediate floor within a dwelling	SAP table default	0 (!)	
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.101	MFF-150-MPW-P4-01
External wall	E17: Corner (inverted - internal area greater than external area)	SAP table default	0 (!)	
Party wall	P7: Exposed floor (normal)	SAP table default	0.48	

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

+ Radiator heating	
Main heating system 1: Boiler with radiators or underfloor heating - Mains gas	
Efficiency	88.6%
Emitter type	Both radiators and underfloor
Flow temperature	
System type	Combi boiler
Manufacturer	Vaillant
Model	ecoTEC sustain 34
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	2.43 kWp	
Orientation	East	
Pitch	30°	
Overshading	None or very little	
Manufacturer	PV	
MCS certificate		
Technology type: Photovoltaic system (2)		
Peak power	0.6 kWp	
Orientation	West	
Pitch	30°	
Overshading	None or very little	
Manufacturer	PV	
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 66	Prop Type Ref	SAP VG 21-0282	
Property				

SAP Rating	93 A	DER	12.36	TER	12.40
Environmental	89 B	% DER < TER			0.32
CO ₂ Emissions (t/year)	1.34	DFEE	39.75	TFEE	43.34
Compliance Check	See BREL	% DFEE < TFEE			8.27
% DPER < TPER	0.03	DPER	65.09	TPER	65.11

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	2024
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	256.49 kJ/m ² K
7.0 Electricity Tariff	Standard
Smart electricity meter fitted	Yes
Smart gas meter fitted	Yes

7.0 Measurements	Heat Loss Perimeter	Internal Floor Area	Unheated Space Floor Area	Average Storey Height
Ground floor:	22.99 m	25.12 m ²	18.51 m ²	2.85 m
1st Storey:	19.15 m	43.63 m ²		2.40 m
2nd Storey:	19.15 m	43.63 m ²		2.63 m

8.0 Living Area	20.57 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	125.79	110.16	0.00	None	15.63	Enter Gross Area
	Retaining wall	Cavity Wall	Cavity wall; plasterboard on dabs or battens, lightweight aggregate block, filled cavity, any outside structure	0.18	110.00	13.02	13.02	0.00	None	0.00	Enter Gross Area
	Garage wall	Cavity Wall	Cavity wall; plasterboard on dabs or battens, lightweight aggregate block, filled cavity, any outside structure	0.15	110.00	23.03	23.03	0.55	Garage Single 2 Inside	0.00	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	Dense plaster both sides. lightweight aggregate blocks, cavity or cavity fill	0.00	140.00	61.49	0.00	None

9.2 Internal Walls	Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
	Internal Wall	Plasterboard on timber frame	9.00	168.13

10.0 External Roofs	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area	Shelter Code	Shelter Factor	Calculation Type	Openings
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Summary for Input Data



Plane roof	External Plane Roof	Plasterboard, insulated at ceiling level	0.09	9.00	43.63	43.63 (m ²)	None	0.00	Enter Gross Area	0.00
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10.2 Internal Ceilings

Description	Storey	Construction	Area (m ²)
Internal Ceiling 1	Lowest occupied	Plasterboard ceiling, carpeted chipboard floor	68.76

11.0 Heat Loss Floors

Description	Type	Storey Index	Construction	U-Value (W/m ² K)	Shelter Code	Shelter Factor	Kappa (kJ/m ² K)	Area (m ²)
Ground floor	Ground Floor - Solid	Lowest occupied	Other	0.13	None	0.00	0.00	25.12
Exposed floor	Exposed Floor - Timber	Lowest occupied	Timber exposed floor, insulation between joists	0.20	None	0.00	20.00	18.51

11.2 Internal Floors

Description	Storey Index	Construction	Kappa (kJ/m ² K)	Area (m ²)
Internal Floor 1		Plasterboard ceiling, carpeted chipboard floor	9.00	68.76

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m ² K)
Solid front door	Manufacturer	Solid Door				0.00			1.10
Windows	Manufacturer	Window	Double Low-E Soft 0.05			0.73		0.70	1.30

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m ²)	Pitch
Front door	Solid front door	Brick wall	West	2.14	0
Front windows brick	Windows	Brick wall	West	4.86	0
Side windows brick	Windows	Brick wall	South	1.42	0
Rear windows brick	Windows	Brick wall	East	7.21	0

14.0 Conservatory

None

15.0 Draught Proofing

100 %

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E2 Other lintels (including other steel lintels)	Independently assessed	10.75	0.02	0.02 MFF-150-E2-02	No
E3 Sill	Independently assessed	7.92	0.02	0.02 MFF-150-E3-01	No
E4 Jamb	Independently assessed	30.30	0.02	0.02 MFF-150-E4-01	No
E5 Ground floor (normal)	Independently assessed	25.25	0.09	0.09 Manufacturer Declaration	No
E6 Intermediate floor within a dwelling	Independently assessed	34.06	0.00	0.00 MFF-150-E6-01	No
E10 Eaves (insulation at ceiling level)	Independently assessed	7.57	0.06	0.06 MFF-150-E10-01	No
E12 Gable (insulation at ceiling level)	Independently assessed	11.58	0.06	0.06 MFF-150-E12-01	No
E16 Corner (normal)	Independently assessed	23.64	0.05	0.05 MFF-150-E16-01	No
E17 Corner (inverted – internal area greater than external area)	Independently assessed	7.88	-0.09	-0.09 MFF-150-E17-01	No
E20 Exposed floor (normal)	Independently assessed	10.34	0.07	0.07 MFF-150-E20-01	No
E21 Exposed floor (inverted)	Table K1 - Default	8.08	0.32	0.32	No
E18 Party wall between dwellings	Independently assessed	15.76	0.04	0.04 MFF-150-E18-04	No
P1 Party wall - Ground floor	Independently assessed	3.19	0.09	0.09 Manufacturer Declaration	No
P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	13.92	0.00	0.00	No
P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	10.01	0.10	0.10 MFF-150-MPW-P4-01	No
E17 Corner (inverted – internal area greater than external area)	Table K1 - Default	2.85	0.00	0.00	No
P7 Party Wall - Exposed floor (normal)	Table K1 - Default	6.10	0.48	0.48	No

Y-value 0.05 W/m²K

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present No

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 6
 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	m³/(h.m²) @ 50 Pa								
Property Tested?	Yes									
Test Method	Blower Door									
22.0 Lighting	No									
No Fixed Lighting	No									
	Name Lighting 1	Efficacy 85.00	Power 10.00	Capacity 850.00	Count 26					
24.0 Main Heating 1	Database									
Percentage of Heat	100.00				%					
Database Ref. No.	18120									
Fuel Type	Mains gas									
SAP Code	0									
In Winter	88.60									
In Summer	79.60									
Model Name	ecoTEC sustain 34									
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 and Underfloor									
Underfloor Heating	Yes - Pipes in Concrete									
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									
Waste Water Heat Recovery Storage System	No									

Summary for Input Data

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
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32.0 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
2.43	East	30°	None Or Little	No	No	1.00		PV
0.60	West	30°	None Or Little	No	No	1.00		PV

34.0 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
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Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

Property Reference	SAP VG 21-0282				Issued on Date	15/11/2024
Assessment Reference	Plot 66	Prop Type Ref	SAP VG 21-0282			
Property						
SAP Rating	93 A	DER	12.36	TER	12.40	
Environmental	89 B	% DER < TER				0.32
CO ₂ Emissions (t/year)	1.34	DFEE	39.75	TFEE	43.34	
Compliance Check	See BREL	% DFEE < TFEE				8.27
% DPER < TPER	0.03	DPER	65.09	TPER	65.11	
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	25.1200 (1b)	x 2.8500 (2b)	= 71.5920 (1b) - (3b)
First floor	43.6300 (1c)	x 2.4000 (2c)	= 104.7120 (1c) - (3c)
Second floor	43.6300 (1d)	x 2.6300 (2d)	= 114.7469 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n)	112.3800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)... (3n)	= 291.0509 (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	6 * 10 =	60.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		Air changes per hour 60.0000 / (5) = 0.2061 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.4061 (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) =	0.3757 (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												
	0.4790	0.4696	0.4602	0.4133	0.4039	0.3569	0.3569	0.3475	0.3757	0.4039	0.4226	0.4414 (22b)
Effective ac	0.6147	0.6103	0.6059	0.5854	0.5816	0.5637	0.5637	0.5604	0.5706	0.5816	0.5893	0.5974 (25)

3. Heat losses and heat loss parameter

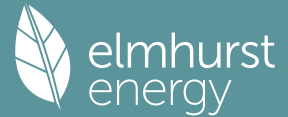
Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Solid front door			2.1400	1.1000	2.3540		(26)
Windows (Uw = 1.30)			13.4900	1.2357	16.6702		(27)
Ground floor			25.1200	0.1300	3.2656	0.0000	0.0000 (28a)
Exposed floor			18.5100	0.2000	3.7020	20.0000	370.2000 (28b)
Brick wall	125.7900	15.6300	110.1600	0.1900	20.9304	110.0000	12117.6000 (29a)
Retaining wall	13.0200		13.0200	0.1800	2.3436	110.0000	1432.2000 (29a)
Garage wall	23.0300		23.0300	0.1400	3.2242	110.0000	2533.3000 (29a)
Plane roof	43.6300		43.6300	0.0900	3.9267	9.0000	392.6700 (30)
Total net area of external elements Aum(A, m2)			249.1000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.4167		(33)
Party Wall 1			61.4900	0.0000	0.0000	140.0000	8608.6000 (32c)
Internal Wall			168.1300			9.0000	1513.1700 (32c)
Internal Floor 1			68.7600			18.0000	1237.6800 (32d)
Internal Ceiling 1			68.7600			9.0000	618.8400 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		28824.2600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							256.4892 (35)
List of Thermal Bridges							

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	141.4191	141.4191	141.4191	141.4191	141.4191	141.4191	141.4191	141.4191	141.4191	141.4191	141.4191	141.4191	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	153.9094	170.3997	153.9094	159.0397	153.9094	159.0397	153.9094	153.9094	159.0397	153.9094	159.0397	153.9094	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	274.9320	277.7850	270.5957	255.2905	235.9705	217.8123	205.6816	202.8287	210.0180	225.3232	244.6432	262.8013	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1419	37.1419	37.1419	37.1419	37.1419	37.1419	37.1419	37.1419	37.1419	37.1419	37.1419	37.1419	(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)	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	(71)
Water heating gains (Table 5)	104.3033	101.6570	96.5225	85.2191	78.2990	71.0573	66.5935	70.2602	74.5588	82.5877	93.4192	102.8562	(72)
Total internal gains	601.5705	618.2674	589.4533	567.9751	536.6046	513.3351	491.6103	492.4241	509.0423	530.2460	565.5279	587.9926	(73)

[Jan	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East	7.2100	19.6403	0.7300	0.7000	0.7700	50.1460 (76)

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South			1.4200		46.7521		0.7300		0.7000		0.7700		23.5095 (78)
West			4.8600		19.6403		0.7300		0.7000		0.7700		33.8016 (80)
Solar gains	107.4572	202.7220	319.4914	449.8614	541.1516	550.4233	525.4162	457.4163	365.7736	236.3888	132.5397	89.3489	(83)
Total gains	709.0277	820.9894	908.9447	1017.8365	1077.7563	1063.7584	1017.0265	949.8404	874.8159	766.6348	698.0675	677.3415	(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	62.3718	62.5804	62.7862	63.7713	63.9591	64.8478	64.8478	65.0151	64.5026	63.9591	63.5804	63.1893	
alpha	5.1581	5.1720	5.1857	5.2514	5.2639	5.3232	5.3232	5.3343	5.3002	5.2639	5.2387	5.2126	
util living area	0.9978	0.9948	0.9871	0.9561	0.8709	0.6965	0.5252	0.5805	0.8322	0.9737	0.9951	0.9983	(86)
MIT	20.4837	20.5292	20.5977	20.6946	20.7703	20.8137	20.8231	20.8221	20.7943	20.6927	20.5745	20.4808	(87)
Th 2	19.9664	19.9695	19.9726	19.9868	19.9895	20.0019	20.0019	20.0042	19.9971	19.9895	19.9841	19.9784	(88)
util rest of house	0.9970	0.9930	0.9823	0.9395	0.8240	0.6064	0.4108	0.4630	0.7580	0.9606	0.9931	0.9977	(89)
MIT 2	19.3436	19.4045	19.4944	19.6282	19.7176	19.7711	19.7770	19.7793	19.7511	19.6303	19.4762	19.3511	(90)
Living area fraction									fLA = Living area / (4) =			0.1830	(91)
MIT	19.5523	19.6104	19.6963	19.8234	19.9103	19.9619	19.9685	19.9701	19.9421	19.8248	19.6772	19.5579	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.4023	19.4604	19.5463	19.6734	19.7603	19.8119	19.8185	19.8201	19.7921	19.6748	19.5272	19.4079	(93)
8. Space heating requirement													
Utilisation	0.9965	0.9919	0.9798	0.9331	0.8114	0.5878	0.3891	0.4402	0.7400	0.9552	0.9919	0.9972	(94)
Useful gains	706.5127	814.3171	890.5691	949.7404	874.5261	625.2462	395.7580	418.1154	647.3376	732.2593	692.3992	675.4515	(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	1938.6922	1862.9005	1663.7179	1352.6378	1009.0327	643.5159	397.3899	421.1959	706.5606	1136.0280	1564.9729	1926.9960	(97)
Space heating kWh	916.7415	704.6481	575.2227	290.0861	100.0729	0.0000	0.0000	0.0000	0.0000	300.4039	628.2531	931.1491	(98a)
Space heating requirement - total per year (kWh/year)												4446.5775	
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	916.7415	704.6481	575.2227	290.0861	100.0729	0.0000	0.0000	0.0000	0.0000	300.4039	628.2531	931.1491	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4446.5775	
Space heating per m2										(98c) / (4) =		39.5673	(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 %)													88.6000 (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	916.7415	704.6481	575.2227	290.0861	100.0729	0.0000	0.0000	0.0000	0.0000	300.4039	628.2531	931.1491	(98)
Space heating efficiency (main heating system 1)	88.6000	88.6000	88.6000	88.6000	88.6000	0.0000	0.0000	0.0000	0.0000	88.6000	88.6000	88.6000	(210)
Space heating fuel (main heating system)	1034.6970	795.3139	649.2356	327.4110	112.9491	0.0000	0.0000	0.0000	0.0000	339.0563	709.0892	1050.9584	(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	234.0126	206.0332	216.6250	185.1366	175.8110	154.4396	149.5756	157.7840	162.0065	185.3886	202.8832	230.7698	(64)
Efficiency of water heater (217)m	86.6087	86.3901	85.9417	84.8620	82.6452	79.6000	79.6000	79.6000	79.6000	84.9352	86.2204	86.6541	(216)
Fuel for water heating, kWh/month	270.1954	238.4916	252.0603	218.1620	212.7298	194.0196	187.9091	198.2211	203.5257	218.2706	235.3078	266.3115	(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	31.3257	25.1306	22.6274	16.5778	12.8051	10.4619	11.6813	15.1838	19.7222	25.8766	29.2276	32.1963	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-33.2922	-51.8822	-82.7170	-100.1762	-111.7310	-105.2964	-103.4832	-95.5492	-81.1852	-62.1962	-37.9098	-27.9634	(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	-14.6928	-35.7412	-84.9074	-148.4227	-214.1785	-222.3327	-216.8062	-172.1400	-111.3822	-54.9785	-20.5365	-11.1379	(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												5018.7105	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.6000	
Water heating fuel used												2695.2045	(219)
Space cooling fuel												0.0000	(221)

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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)	252.8163 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2200.6387 (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	5852.0926 (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	5018.7105	0.2100	1053.9292 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2695.2045	0.2100	565.9929 (264)
Space and water heating			1619.9221 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	252.8163	0.1443	36.4892 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-893.3820	0.1331	-118.9266
PV Unit electricity exported	-1307.2566	0.1223	-159.8935
Total			-278.8201 (269)
Total CO2, kg/year			1389.5205 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			12.3600 (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	5018.7105	1.1300	5671.1428 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2695.2045	1.1300	3045.5811 (278)
Space and water heating			8716.7239 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	252.8163	1.5338	387.7781 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-893.3820	1.4919	-1332.8480
PV Unit electricity exported	-1307.2566	0.4488	-586.6928
Total			-1919.5408 (283)
Total Primary energy kWh/year			7315.0620 (286)
Dwelling Primary energy Rate (DPER)			65.0900 (287)

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

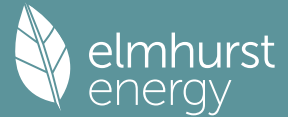
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	25.1200 (1b)	x 2.8500 (2b)	= 71.5920 (1b) - (3b)
First floor	43.6300 (1c)	x 2.4000 (2c)	= 104.7120 (1c) - (3c)
Second floor	43.6300 (1d)	x 2.6300 (2d)	= 114.7469 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.3800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	291.0509 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1374 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3874 (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) = 0.3584 (21)

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Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4569	0.4480	0.4390	0.3942	0.3853	0.3405	0.3405	0.3315	0.3584	0.3853	0.4032	0.4211 (22b)
	0.6044	0.6003	0.5964	0.5777	0.5742	0.5580	0.5580	0.5549	0.5642	0.5742	0.5813	0.5887 (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)			13.4900	1.1450	15.4466		(27)
Ground floor			25.1200	0.1300	3.2656		(28a)
Exposed floor			18.5100	0.1300	2.4063		(28b)
Brick wall	125.7900	15.6300	110.1600	0.1800	19.8288		(29a)
Retaining wall	13.0200		13.0200	0.1800	2.3436		(29a)
Garage wall	23.0300		23.0300	0.1800	4.1454		(29a)
Plane roof	43.6300		43.6300	0.1100	4.7993		(30)
Total net area of external elements Aum(A, m2)			249.1000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	54.3756	(33)
Party Wall 1			61.4900	0.0000	0.0000		(32)

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

256.4892 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	10.7500	0.0500	0.5375
E3 Sill	7.9200	0.0500	0.3960
E4 Jamb	30.3000	0.0500	1.5150
E5 Ground floor (normal)	25.2500	0.1600	4.0400
E6 Intermediate floor within a dwelling	34.0600	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	7.5700	0.0600	0.4542
E12 Gable (insulation at ceiling level)	11.5800	0.0600	0.6948
E16 Corner (normal)	23.6400	0.0900	2.1276
E17 Corner (inverted - internal area greater than external area)	7.8800	-0.0900	-0.7092
E20 Exposed floor (normal)	10.3400	0.3200	3.3088
E21 Exposed floor (inverted)	8.0800	0.3200	2.5856
E18 Party wall between dwellings	15.7600	0.0600	0.9456
P1 Party wall - Ground floor	3.1900	0.0800	0.2552
P2 Party wall - Intermediate floor within a dwelling	13.9200	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	10.0100	0.1200	1.2012
E17 Corner (inverted - internal area greater than external area)	2.8500	-0.0900	-0.2565
P7 Party Wall - Exposed floor (normal)	6.1000	0.1600	0.9760

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

Point Thermal bridges	(36a) =	18.0718 (36)
Total fabric heat loss	(33) + (36) + (36a) =	72.4474 (37)

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

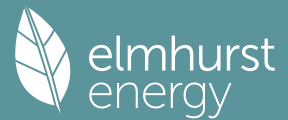
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	58.0499	57.6606	57.2789	55.4864	55.1511	53.5898	53.5898	53.3007	54.1912	55.1511	55.8295	56.5388 (38)
Heat transfer coeff	130.4973	130.1079	129.7263	127.9338	127.5984	126.0372	126.0372	125.7481	126.6386	127.5984	128.2769	128.9862 (39)
Average = Sum(39)m / 12 =												127.9322

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1612	1.1577	1.1544	1.1384	1.1354	1.1215	1.1215	1.1190	1.1269	1.1354	1.1415	1.1478 (40)
HLP (average)												1.1384
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8284 (42)
Hot water usage for mixer showers													
71.6425	70.5658	68.9969	65.9952	63.7799	61.3095	59.9053	61.4623	63.1691	65.8216	68.8879	71.3680	(42a)	
Hot water usage for baths													
30.9318	30.4725	29.8255	28.6328	27.7396	26.7493	26.2144	26.8567	27.5562	28.6159	29.8332	30.8273	(42b)	
Hot water usage for other uses													
43.5955	42.0102	40.4249	38.8396	37.2543	35.6690	35.6690	37.2543	38.8396	40.4249	42.0102	43.5955	(42c)	
Average daily hot water use (litres/day)												134.3629 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	146.1698	143.0485	139.2474	133.4675	128.7739	123.7278	121.7887	125.5734	129.5649	134.8623	140.7312	145.7907 (44)	
Energy content (annual)	231.4972	203.6991	214.0180	182.7104	173.3544	152.1378	147.2929	155.4861	159.7664	183.0069	200.4974	228.2730 (45)	
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		2231.7397	
34.7246	30.5549	32.1027	27.4066	26.0032	22.8207	22.0939	23.3229	23.9650	27.4510	30.0746	34.2410	(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													
282.4561	249.7265	264.9769	232.0254	224.3133	201.4529	198.2518	206.4450	209.0815	233.9658	249.8125	279.2319	(62)	
WWHRS	-32.7520	-28.9661	-30.3316	-25.1158	-23.4070	-20.0295	-18.7745	-19.9648	-20.7233	-24.4305	-27.6768	-32.1454 (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	249.7041	220.7604	234.6453	206.9097	200.9063	181.4233	179.4773	186.4802	188.3582	209.5353	222.1357	247.0865 (64)	
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2527.4222 (64)	
Electric shower(s)												2527 (64)	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)	
Heat gains from water heating, kWh/month													
89.7125	79.2368	83.9007	73.0800	70.3801	62.9146	61.7146	64.4388	65.4511	73.5895	78.9942	88.6405	(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	141.4191	141.4191	141.4191	141.4191	141.4191	141.4191	141.4191	141.4191	141.4191	141.4191	141.4191	141.4191 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	153.9094	170.3997	153.9094	159.0397	153.9094	159.0397	153.9094	153.9094	159.0397	153.9094	159.0397	153.9094 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	274.9320	277.7850	270.5957	255.2905	235.9705	217.8123	205.6816	202.8287	210.0180	225.3232	244.6432	262.8013 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1419	37.1419	37.1419	37.1419	37.1419	37.1419	37.1419	37.1419	37.1419	37.1419	37.1419	37.1419 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353 (71)
Water heating gains (Table 5)	120.5814	117.9119	112.7698	101.5000	94.5968	87.3814	82.9497	86.6114	90.9043	98.9107	109.7141	119.1405 (72)
Total internal gains	617.8486	634.5223	605.7006	584.2559	552.9025	529.6592	507.9665	508.7752	525.3878	546.5690	581.8228	604.2769 (73)

6. Solar gains

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

East				7.2100	19.6403		0.6300	0.7000		0.7700	43.2767 (76)	
South				1.4200	46.7521		0.6300	0.7000		0.7700	20.2890 (78)	
West				4.8600	19.6403		0.6300	0.7000		0.7700	29.1713 (80)	

Solar gains	92.7370	174.9518	275.7255	388.2365	467.0213	475.0228	453.4414	394.7565	315.6677	204.0068	114.3835	77.1093 (83)
Total gains	710.5856	809.4742	881.4261	972.4925	1019.9237	1004.6820	961.4079	903.5317	841.0555	750.5757	696.2063	681.3862 (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	61.3556	61.5392	61.7202	62.5850	62.7495	63.5268	63.5268	63.6729	63.2251	62.7495	62.4176	62.0744
alpha	5.0904	5.1026	5.1147	5.1723	5.1833	5.2351	5.2351	5.2449	5.2150	5.1833	5.1612	5.1383
util living area	0.9978	0.9952	0.9889	0.9644	0.8946	0.7356	0.5627	0.6165	0.8547	0.9767	0.9952	0.9982 (86)
MIT	19.6284	19.7967	20.0572	20.4285	20.7430	20.9365	20.9872	20.9799	20.8546	20.4434	19.9795	19.6097 (87)
Th 2	19.9512	19.9539	19.9567	19.9696	19.9720	19.9833	19.9833	19.9854	19.9789	19.9720	19.9671	19.9620 (88)
util rest of house	0.9970	0.9935	0.9847	0.9503	0.8523	0.6446	0.4400	0.4924	0.7839	0.9647	0.9932	0.9976 (89)
MIT 2	18.3544	18.5713	18.9048	19.3782	19.7481	19.9461	19.9792	19.9782	19.8764	19.4047	18.8151	18.3382 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.5876	18.7956	19.1157	19.5705	19.9302	20.1274	20.1637	20.1615	20.0554	19.5948	19.0282	18.5709 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.5876	18.7956	19.1157	19.5705	19.9302	20.1274	20.1637	20.1615	20.0554	19.5948	19.0282	18.5709 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9954	0.9908	0.9801	0.9432	0.8503	0.6586	0.4625	0.5150	0.7901	0.9587	0.9906	0.9963 (94)
Useful gains	707.3357	802.0116	863.8598	917.2796	867.2049	661.6697	444.6677	465.3072	664.5420	719.5939	689.6375	678.8625 (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	1864.4887	1807.9228	1636.5927	1365.1131	1050.1577	696.6518	449.1606	473.0058	754.1858	1147.7256	1530.1143	1853.6496 (97)
Space heating kWh	860.9219	675.9723	574.9133	322.4401	136.1169	0.0000	0.0000	0.0000	0.0000	318.5300	605.1433	874.0417 (98a)
Space heating requirement - total per year (kWh/year)												4368.0795
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	860.9219	675.9723	574.9133	322.4401	136.1169	0.0000	0.0000	0.0000	0.0000	318.5300	605.1433	874.0417 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4368.0795
Space heating per m ²												38.8688 (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	860.9219	675.9723	574.9133	322.4401	136.1169	0.0000	0.0000	0.0000	0.0000	318.5300	605.1433	874.0417 (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)	931.7336	731.5718	622.2005	348.9612	147.3127	0.0000	0.0000	0.0000	0.0000	344.7294	654.9170	945.9325 (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	249.7041	220.7604	234.6453	206.9097	200.9063	181.4233	179.4773	186.4802	188.3582	209.5353	222.1357	247.0865 (64)

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Efficiency of water heater (217)m	86.8097	86.6163	86.2235	85.3280	83.5649	80.3000	80.3000	80.3000	80.3000	85.2761	86.4149	80.3000 (216)
Fuel for water heating, kWh/month	287.6455	254.8717	272.1362	242.4874	240.4194	225.9319	223.5084	232.2294	234.5681	245.7141	257.0571	86.8500 (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 (233a)m	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 (233a)m	31.9793	25.6550	23.0995	16.9237	13.0723	10.6802	11.9250	15.5006	20.1337	26.4166	29.8374	32.8681 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-41.8593	-59.5450	-86.3195	-97.8638	-106.1544	-99.2487	-97.9883	-92.1990	-82.0863	-68.4385	-46.1960	-36.1249 (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	-22.0236	-46.5215	-92.8423	-140.0083	-185.7017	-186.8477	-184.6856	-156.1334	-114.0997	-66.7567	-29.4740	-17.4039 (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												4727.3587 (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												3001.0670 (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)												258.0916 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-2156.5221 (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												5915.9952 (238)

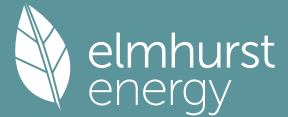
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4727.3587	0.2100	992.7453	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3001.0670	0.2100	630.2241	(264)
Space and water heating			1622.9694	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	258.0916	0.1443	37.2506	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-914.0238	0.1344	-122.8630	
PV Unit electricity exported	-1242.4983	0.1258	-156.2703	
Total			-279.1333	(269)
Total CO2, kg/year			1393.0159	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.4000	(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	4727.3587	1.1300	5341.9154	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3001.0670	1.1300	3391.2057	(278)
Space and water heating			8733.1211	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	258.0916	1.5338	395.8695	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-914.0238	1.4968	-1368.0964	
PV Unit electricity exported	-1242.4983	0.4617	-573.6114	
Total			-1941.7078	(283)
Total Primary energy kWh/year			7317.3836	(286)
Target Primary Energy Rate (TPER)			65.1100	(287)

Full SAP Calculation Printout



Property Reference	SAP VG 21-0282				Issued on Date	15/11/2024	
Assessment Reference	Plot 66			Prop Type Ref	SAP VG 21-0282		
Property							
SAP Rating	93 A	DER	12.36	TER	12.40		
Environmental	89 B	% DER < TER				0.32	
CO ₂ Emissions (t/year)	1.34	DFEE	39.75	TFEE	43.34		
Compliance Check	See BREL	% DFEE < TFEE				8.27	
% DPER < TPER	0.03	DPER	65.09	TPER	65.11		
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	25.1200 (1b)	x 2.8500 (2b)	= 71.5920 (1b) - (3b)
First floor	43.6300 (1c)	x 2.4000 (2c)	= 104.7120 (1c) - (3c)
Second floor	43.6300 (1d)	x 2.6300 (2d)	= 114.7469 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.3800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	291.0509 (5)

2. Ventilation rate

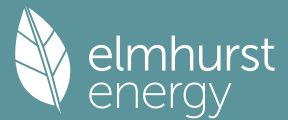
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
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) = 0.1374 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.3374 (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) = 0.3121 (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	0.3980	0.3902	0.3824	0.3433	0.3355	0.2965	0.2965	0.2887	0.3121	0.3355	0.3511	0.3667 (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	0.5792	0.5761	0.5731	0.5589	0.5563	0.5440	0.5440	0.5417	0.5487	0.5563	0.5617	0.5673 (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
Solid front door			2.1400	1.1000	2.3540		(26)
Windows (Uw = 1.30)			13.4900	1.2357	16.6702		(27)
Ground floor			25.1200	0.1300	3.2656	0.0000	0.0000 (28a)
Exposed floor			18.5100	0.2000	3.7020	20.0000	370.2000 (28b)
Brick wall	125.7900	15.6300	110.1600	0.1900	20.9304	110.0000	12117.6000 (29a)
Retaining wall	13.0200		13.0200	0.1800	2.3436	110.0000	1432.2000 (29a)
Garage wall	23.0300		23.0300	0.1400	3.2242	110.0000	2533.3000 (29a)
Plane roof	43.6300		43.6300	0.0900	3.9267	9.0000	392.6700 (30)
Total net area of external elements A _{um} (A, m ²)			249.1000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.4167		(33)
Party Wall 1			61.4900	0.0000	0.0000	140.0000	8608.6000 (32)
Internal Wall			168.1300			9.0000	1513.1700 (32c)
Internal Floor 1			68.7600			18.0000	1237.6800 (32d)
Internal Ceiling 1			68.7600			9.0000	618.8400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	28824.2600 (34)

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

256.4892 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	10.7500	0.0240	0.2580
E2 Other lintels (including other steel lintels)	7.9200	0.0220	0.1742
E3 Sill	30.3000	0.0170	0.5151
E4 Jamb	25.2500	0.0920	2.3230
E5 Ground floor (normal)	34.0600	0.0010	0.0341
E6 Intermediate floor within a dwelling	7.5700	0.0600	0.4542
E10 Eaves (insulation at ceiling level)	11.5800	0.0560	0.6485
E12 Gable (insulation at ceiling level)	23.6400	0.0460	1.0874
E16 Corner (normal)	7.8800	-0.0880	-0.6934
E17 Corner (inverted - internal area greater than external area)	10.3400	0.0690	0.7135
E20 Exposed floor (normal)	8.0800	0.3200	2.5856
E21 Exposed floor (inverted)	15.7600	0.0380	0.5989
E18 Party wall between dwellings	3.1900	0.0860	0.2743
P1 Party wall - Ground floor	13.9200	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	10.0100	0.1010	1.0110
P4 Party wall - Roof (insulation at ceiling level)	2.8500	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	6.1000	0.4800	2.9280
P7 Party wall - Exposed floor (normal)			

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

12.9124 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 69.3290 (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	55.6290	55.3336	55.0442	53.6844	53.4301	52.2458	52.2458	52.0265	52.7020	53.4301	53.9447	54.4827
Heat transfer coeff	124.9580	124.6627	124.3732	123.0135	122.7591	121.5748	121.5748	121.3555	122.0310	122.7591	123.2737	123.8117
Average = Sum(39)m / 12 =												

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1119	1.1093	1.1067	1.0946	1.0924	1.0818	1.0818	1.0799	1.0859	1.0924	1.0969	1.1017
HLP (average)												1.0946
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy

2.8284 (42)

Hot water usage for mixer showers

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42a)

Hot water usage for baths

30.9318 30.4725 29.8255 28.6328 27.7396 26.7493 26.2144 26.8567 27.5562 28.6159 29.8332 30.8273 (42b)

Hot water usage for other uses

43.5955 42.0102 40.4249 38.8396 37.2543 35.6690 35.6690 37.2543 38.8396 40.4249 42.0102 43.5955 (42c)

Average daily hot water use (litres/day)

68.3109 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	74.5273	72.4826	70.2504	67.4724	64.9939	62.4183	61.8834	64.1110	66.3958	69.0408	71.8434	74.4227
Energy conte	118.0330	103.2143	107.9723	92.3663	87.4943	76.7506	74.8426	79.3829	81.8726	93.6876	102.3541	116.5280
Energy content (annual)												

Total = Sum(45)m = 1134.4985

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

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

Water storage loss:

Total storage loss

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

If cylinder contains dedicated solar storage

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)

Primary loss

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (59)

Combi loss

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)

Total heat required for water heating calculated for each month

100.3281 87.7321 91.7764 78.5113 74.3702 65.2380 63.6162 67.4754 69.5917 79.6345 87.0010 99.0488 (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

100.3281 87.7321 91.7764 78.5113 74.3702 65.2380 63.6162 67.4754 69.5917 79.6345 87.0010 99.0488 (64)

Total per year (kWh/year) = Sum(64)m = 964.3238 (64)

12Total per year (kWh/year)

57.3737 51.1204 55.8215 53.2698 54.2694 51.7678 53.4933 54.2694 53.2698 55.8215 54.7719 57.3737 (64a)

Electric shower(s)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 652.6223 (64a)

Heat gains from water heating, kWh/month

39.4254 34.7131 36.8995 32.9453 32.1599 29.2514 29.2774 30.4362 30.7154 33.8640 35.4432 39.1056 (65)

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

Metabolic gains (Table 5), Watts

(66)m 141.4191 141.4191 141.4191 141.4191 141.4191 141.4191 141.4191 141.4191 141.4191 141.4191 141.4191 141.4191 (66)

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

153.9094 170.3997 153.9094 159.0397 153.9094 159.0397 153.9094 153.9094 159.0397 153.9094 159.0397 153.9094 (67)

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

274.9320 277.7850 270.5957 255.2905 235.9705 217.8123 205.6816 202.8287 210.0180 225.3232 244.6432 262.8013 (68)

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

37.1419 37.1419 37.1419 37.1419 37.1419 37.1419 37.1419 37.1419 37.1419 37.1419 37.1419 37.1419 (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)

-113.1353 -113.1353 -113.1353 -113.1353 -113.1353 -113.1353 -113.1353 -113.1353 -113.1353 -113.1353 -113.1353 -113.1353 (71)

Water heating gains (Table 5)

52.9912 51.6565 49.5961 45.7573 43.2257 40.6270 39.3513 40.9089 42.6603 45.5161 49.2267 52.5613 (72)

Total internal gains

547.2584 565.2669 539.5269 525.5133 498.5313 482.9048 464.3681 463.0727 477.1437 490.1745 518.3353 534.6978 (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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East	7.2100	19.6403	0.7300	0.7000	0.7700	50.1460 (76)
South	1.4200	46.7521	0.7300	0.7000	0.7700	23.5095 (78)
West	4.8600	19.6403	0.7300	0.7000	0.7700	33.8016 (80)

Solar gains	107.4572	202.7220	319.4914	449.8614	541.1516	550.4233	525.4162	457.4163	365.7736	236.3888	132.5397	89.3489 (83)
Total gains	654.7155	767.9888	859.0184	975.3747	1039.6829	1033.3281	989.7843	920.4890	842.9174	726.5633	650.8750	624.0466 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	64.0754	64.2272	64.3767	65.0883	65.2232	65.8585	65.8585	65.9775	65.6123	65.2232	64.9509	64.6687
alpha	5.2717	5.2818	5.2918	5.3392	5.3482	5.3906	5.3906	5.3985	5.3742	5.3482	5.3301	5.3112
util living area	0.9985	0.9961	0.9896	0.9613	0.8791	0.7048	0.5313	0.5897	0.8427	0.9783	0.9964	0.9988 (86)
MIT	19.6513	19.8306	20.1020	20.4800	20.7850	20.9529	20.9914	20.9854	20.8755	20.4655	19.9951	19.6266 (87)
Th 2	19.9911	19.9932	19.9953	20.0052	20.0071	20.0157	20.0157	20.0173	20.0124	20.0071	20.0033	19.9994 (88)
util rest of house	0.9979	0.9948	0.9857	0.9463	0.8342	0.6156	0.4173	0.4723	0.7710	0.9672	0.9949	0.9984 (89)
MIT 2	18.7608	18.9410	19.2119	19.5869	19.8631	19.9946	20.0136	20.0133	19.9447	19.5801	19.1134	18.7426 (90)
Living area fraction	fLA = Living area / (4) =											0.1830 (91)
MIT	18.9238	19.1038	19.3748	19.7504	20.0318	20.1700	20.1926	20.1912	20.1150	19.7422	19.2748	18.9044 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9238	19.1038	19.3748	19.7504	20.0318	20.1700	20.1926	20.1912	20.1150	19.7422	19.2748	18.9044 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9971	0.9931	0.9825	0.9416	0.8355	0.6305	0.4383	0.4938	0.7795	0.9632	0.9934	0.9978 (94)
Useful gains	652.8357	762.6861	843.9672	918.3698	868.6570	651.5345	433.7833	454.5751	657.0679	699.8301	646.5615	622.6543 (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	1827.3567	1770.6857	1601.2792	1334.7459	1022.8092	677.1745	436.7656	460.0858	734.0200	1122.2845	1500.8331	1820.5730 (97)
Space heating kWh	873.8437	677.3758	563.4401	299.7908	114.6893	0.0000	0.0000	0.0000	0.0000	314.3060	615.0755	891.2515 (98a)
Space heating requirement - total per year (kWh/year)												4349.7727
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	873.8437	677.3758	563.4401	299.7908	114.6893	0.0000	0.0000	0.0000	0.0000	314.3060	615.0755	891.2515 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4349.7727
Space heating per m2												(98c) / (4) = 38.7059 (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	1142.8033	899.6536	922.3019	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8402	0.9112	0.8788	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	960.1875	819.7724	810.5579	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1133.9047	1086.3790	1008.5610	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000										
			0.0000	0.0000	0.0000	125.0764	198.3553	147.3142	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	31.2691	49.5888	36.8286	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												117.6865 (107)
Energy for space heating												38.7059 (99)
Energy for space cooling												1.0472 (108)
Total												39.7532 (109)
Fabric Energy Efficiency (DFEE)												39.8 (109)

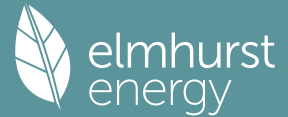
SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	25.1200 (1b)	x 2.8500 (2b)	= 71.5920 (1b) - (3b)
First floor	43.6300 (1c)	x 2.4000 (2c)	= 104.7120 (1c) - (3c)
Second floor	43.6300 (1d)	x 2.6300 (2d)	= 114.7469 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.3800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	291.0509 (5)

2. Ventilation rate

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

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1374 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3874	(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) =	0.3584	(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	0.4569	0.4480	0.4390	0.3942	0.3853	0.3405	0.3405	0.3315	0.3584	0.3853	0.4032	0.4211	(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	0.6044	0.6003	0.5964	0.5777	0.5742	0.5580	0.5580	0.5549	0.5642	0.5742	0.5813	0.5887	(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)			13.4900	1.1450	15.4466			(27)
Ground floor			25.1200	0.1300	3.2656			(28a)
Exposed floor			18.5100	0.1300	2.4063			(28b)
Brick wall	125.7900	15.6300	110.1600	0.1800	19.8288			(29a)
Retaining wall	13.0200		13.0200	0.1800	2.3436			(29a)
Garage wall	23.0300		23.0300	0.1800	4.1454			(29a)
Plane roof	43.6300		43.6300	0.1100	4.7993			(30)
Total net area of external elements Aum(A, m2)			249.1000					(31)
Fabric heat loss, W/K = Sum (A x U)						(26)...(30) + (32) =	54.3756	(33)
Party Wall 1			61.4900	0.0000	0.0000			(32)

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

256.4892 (35)

List of Thermal Bridges	Length	Psi-value	Total	
K1 Element	10.7500	0.0500	0.5375	
E2 Other lintels (including other steel lintels)	7.9200	0.0500	0.3960	
E3 Sill	30.3000	0.0500	1.5150	
E4 Jamb	25.2500	0.1600	4.0400	
E5 Ground floor (normal)	34.0600	0.0000	0.0000	
E6 Intermediate floor within a dwelling	7.5700	0.0600	0.4542	
E10 Eaves (insulation at ceiling level)	11.5800	0.0600	0.6948	
E12 Gable (insulation at ceiling level)	23.6400	0.0900	2.1276	
E16 Corner (normal)	7.8800	-0.0900	-0.7092	
E17 Corner (inverted - internal area greater than external area)	10.3400	0.3200	3.3088	
E20 Exposed floor (normal)	8.0800	0.3200	2.5856	
E21 Exposed floor (inverted)	15.7600	0.0600	0.9456	
E18 Party wall between dwellings	3.1900	0.0800	0.2552	
P1 Party wall - Ground floor	13.9200	0.0000	0.0000	
P2 Party wall - Intermediate floor within a dwelling	10.0100	0.1200	1.2012	
P4 Party wall - Roof (insulation at ceiling level)	2.8500	-0.0900	-0.2565	
E17 Corner (inverted - internal area greater than external area)	6.1000	0.1600	0.9760	
P7 Party Wall - Exposed floor (normal)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				18.0718 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	72.4474 (37)

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

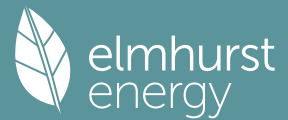
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	58.0499	57.6606	57.2789	55.4864	55.1511	53.5898	53.5898	53.3007	54.1912	55.1511	55.8295	56.5388	(38)
Heat transfer coeff	130.4973	130.1079	129.7263	127.9338	127.5984	126.0372	126.0372	125.7481	126.6386	127.5984	128.2769	128.9862	(39)
Average = Sum(39)m / 12 =												127.9322	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	1.1612	1.1577	1.1544	1.1384	1.1354	1.1215	1.1215	1.1190	1.1269	1.1354	1.1415	1.1478	(40)
HLP (average)												1.1384	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8284 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	30.9318	30.4725	29.8255	28.6328	27.7396	26.7493	26.2144	26.8567	27.5562	28.6159	29.8332	30.8273	(42b)
Hot water usage for other uses	43.5955	42.0102	40.4249	38.8396	37.2543	35.6690	35.6690	37.2543	38.8396	40.4249	42.0102	43.5955	(42c)
Average daily hot water use (litres/day)												68.3109	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	74.5273	72.4826	70.2504	67.4724	64.9939	62.4183	61.8834	64.1110	66.3958	69.0408	71.8434	74.4227	(44)
Energy conte	118.0330	103.2143	107.9723	92.3663	87.4943	76.7506	74.8426	79.3829	81.8726	93.6876	102.3541	116.5280	(45)
Energy content (annual)										Total = Sum(45)m =		1134.4985	
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:													

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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	(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	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	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												
	100.3281	87.7321	91.7764	78.5113	74.3702	65.2380	63.6162	67.4754	69.5917	79.6345	87.0010	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	100.3281	87.7321	91.7764	78.5113	74.3702	65.2380	63.6162	67.4754	69.5917	79.6345	87.0010	(64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum (64)m =											964.3238 (64)
Electric shower(s)	57.3737	51.1204	55.8215	53.2698	54.2694	51.7678	53.4933	54.2694	53.2698	55.8215	54.7719	57.3737 (64a)
Heat gains from water heating, kWh/month	39.4254	34.7131	36.8995	32.9453	32.1599	29.2514	29.2774	30.4362	30.7154	33.8640	35.4432	39.1056 (65)
Total Energy used by instantaneous electric shower (s) (kWh/year) = Sum (64a)m =												
												964 (64)

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	141.4191	141.4191	141.4191	141.4191	141.4191	141.4191	141.4191	141.4191	141.4191	141.4191	141.4191	141.4191 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	153.9094	170.3997	153.9094	159.0397	153.9094	159.0397	153.9094	153.9094	159.0397	153.9094	159.0397	153.9094 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	274.9320	277.7850	270.5957	255.2905	235.9705	217.8123	205.6816	202.8287	210.0180	225.3232	244.6432	262.8013 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1419	37.1419	37.1419	37.1419	37.1419	37.1419	37.1419	37.1419	37.1419	37.1419	37.1419	37.1419 (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)	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353 (71)
Water heating gains (Table 5)	52.9912	51.6565	49.5961	45.7573	43.2257	40.6270	39.3513	40.9089	42.6603	45.5161	49.2267	52.5613 (72)
Total internal gains	547.2584	565.2669	539.5269	525.5133	498.5313	482.9048	464.3681	463.0727	477.1437	490.1745	518.3353	534.6978 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
East					7.2100	19.6403	0.6300	0.7000	0.7700		43.2767 (76)	
South					1.4200	46.7521	0.6300	0.7000	0.7700		20.2890 (78)	
West					4.8600	19.6403	0.6300	0.7000	0.7700		29.1713 (80)	
Solar gains	92.7370	174.9518	275.7255	388.2365	467.0213	475.0228	453.4414	394.7565	315.6677	204.0068	114.3835	77.1093 (83)
Total gains	639.9954	740.2187	815.2524	913.7498	965.5525	957.9276	917.8095	857.8293	792.8114	694.1812	632.7189	611.8071 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	61.3556	61.5392	61.7202	62.5850	62.7495	63.5268	63.5268	63.6729	63.2251	62.7495	62.4176	62.0744
alpha	5.0904	5.1026	5.1147	5.1723	5.1833	5.2351	5.2351	5.2449	5.2150	5.1833	5.1612	5.1383
util living area	0.9986	0.9968	0.9921	0.9721	0.9112	0.7598	0.5863	0.6439	0.8770	0.9831	0.9969	0.9989 (86)
MIT	19.5633	19.7335	19.9986	20.3821	20.7124	20.9260	20.9846	20.9755	20.8324	20.3959	19.9213	19.5452 (87)
Th 2	19.9512	19.9539	19.9567	19.9696	19.9720	19.9833	19.9833	19.9854	19.9789	19.9720	19.9671	19.9620 (88)
util rest of house	0.9981	0.9956	0.9890	0.9606	0.8732	0.6699	0.4601	0.5169	0.8116	0.9741	0.9956	0.9985 (89)
MIT 2	18.6418	18.8137	19.0793	19.4653	19.7730	19.9487	19.9794	19.9784	19.8841	19.4850	19.0117	18.6322 (90)
Living area fraction	18.8105	18.9820	19.2476	19.6331	19.9449	20.1276	20.1634	20.1609	20.0577	19.6517	19.1782	18.7993 (91)
MIT	18.8105	18.9820	19.2476	19.6331	19.9449	20.1276	20.1634	20.1609	20.0577	19.6517	19.1782	18.7993 (92)
Temperature adjustment	18.8105	18.9820	19.2476	19.6331	19.9449	20.1276	20.1634	20.1609	20.0577	19.6517	19.1782	18.7993 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	638.2990	735.8747	804.0051	873.2874	841.9423	655.1010	443.6142	463.3510	648.2051	673.5074	629.0239	610.5259 (94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1893.5757	1832.1824	1653.6990	1373.1225	1052.0393	696.6811	449.1175	472.9238	754.4724	1154.9886	1549.3533	1883.1076 (97)
Space heating kWh	933.9258	736.7188	632.1723	359.8813	156.3122	0.0000	0.0000	0.0000	0.0000	358.2220	662.6372	946.8008 (98a)
Space heating requirement - total per year (kWh/year)												4786.6704
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	933.9258	736.7188	632.1723	359.8813	156.3122	0.0000	0.0000	0.0000	0.0000	358.2220	662.6372	946.8008 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4786.6704
Space heating per m2												(98c) / (4) = 42.5936 (99)

8c. Space cooling requirement

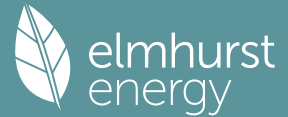
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 Calculated for June, July and August. See Table 10b

	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	1184.7496	932.6752	955.6854	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7830	0.8682	0.8307	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	927.7055	809.7748	793.8763	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1045.7743	1002.2526	935.3223	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	85.0096	143.2035	105.2358	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	21.2524	35.8009	26.3089	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												83.3622 (107)
Energy for space heating												42.5936 (99)
Energy for space cooling												0.7418 (108)
Total												43.3354 (109)
Fabric Energy Efficiency (TFEE)												43.3 (109)

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Property Reference	SAP VG 21-0282				Issued on Date	15/11/2024		
Assessment Reference	Plot 66			Prop Type Ref	SAP VG 21-0282			
Property								
SAP Rating	93 A		DER	12.36		TER	12.40	
Environmental	89 B		% DER < TER				0.32	
CO ₂ Emissions (t/year)	1.34		DFEE	39.75		TFEE	43.34	
Compliance Check	See BREL		% DFEE < TFEE				8.27	
% DPER < TPER	0.03		DPER	65.09		TPER	65.11	
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	25.1200 (1b)	x	2.8500 (2b)	=	71.5920 (1b)	- (3b)
First floor	43.6300 (1c)	x	2.4000 (2c)	=	104.7120 (1c)	- (3c)
Second floor	43.6300 (1d)	x	2.6300 (2d)	=	114.7469 (1d)	- (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.3800					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	291.0509	(5)

2. Ventilation rate

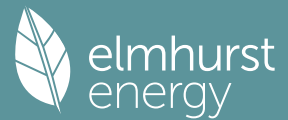
		m ³ per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)	
Number of open flues	0 * 20 =	0.0000 (6b)	
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)	
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)	
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)	
Number of blocked chimneys	0 * 20 =	0.0000 (6f)	
Number of intermittent extract fans	6 * 10 =	60.0000 (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) =	60.0000 / (5) =	0.2061 (8)	
Pressure test	Yes		
Pressure Test Method	Blower Door		
Measured/design AP50	4.0000	(17)	
Infiltration rate	0.4061	(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) =	0.3757 (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	0.4790	0.4696	0.4602	0.4133	0.4039	0.3569	0.3569	0.3475	0.3757	0.4039	0.4226	0.4414	(22b)
Effective ac	0.6147	0.6103	0.6059	0.5854	0.5816	0.5637	0.5637	0.5604	0.5706	0.5816	0.5893	0.5974	(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	
Solid front door			2.1400	1.1000	2.3540			(26)
Windows (U _w = 1.30)			13.4900	1.2357	16.6702			(27)
Ground floor			25.1200	0.1300	3.2656	0.0000	0.0000	(28a)
Exposed floor			18.5100	0.2000	3.7020	20.0000	370.2000	(28b)
Brick wall	125.7900	15.6300	110.1600	0.1900	20.9304	110.0000	12117.6000	(29a)
Retaining wall	13.0200		13.0200	0.1800	2.3436	110.0000	1432.2000	(29a)
Garage wall	23.0300		23.0300	0.1400	3.2242	110.0000	2533.3000	(29a)
Plane roof	43.6300		43.6300	0.0900	3.9267	9.0000	392.6700	(29a)
Total net area of external elements A _{um} (A, m ²)			249.1000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.4167			(33)
Party Wall 1			61.4900	0.0000	0.0000	140.0000	8608.6000	(32)
Internal Wall			168.1300			9.0000	1513.1700	(32c)
Internal Floor 1			68.7600			18.0000	1237.6800	(32d)
Internal Ceiling 1			68.7600			9.0000	618.8400	(32e)
Heat capacity C _m = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	28824.2600	(34)
Thermal mass parameter (TMP = C _m / TFA) in kJ/m ² K							256.4892	(35)
List of Thermal Bridges								

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K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	10.7500	0.0240	0.2580
E3 Sill	7.9200	0.0220	0.1742
E4 Jamb	30.3000	0.0170	0.5151
E5 Ground floor (normal)	25.2500	0.0920	2.3230
E6 Intermediate floor within a dwelling	34.0600	0.0010	0.0341
E10 Eaves (insulation at ceiling level)	7.5700	0.0600	0.4542
E12 Gable (insulation at ceiling level)	11.5800	0.0560	0.6485
E16 Corner (normal)	23.6400	0.0460	1.0874
E17 Corner (inverted - internal area greater than external area)	7.8800	-0.0880	-0.6934
E20 Exposed floor (normal)	10.3400	0.0690	0.7135
E21 Exposed floor (inverted)	8.0800	0.3200	2.5856
E18 Party wall between dwellings	15.7600	0.0380	0.5989
P1 Party wall - Ground floor	3.1900	0.0860	0.2743
P2 Party wall - Intermediate floor within a dwelling	13.9200	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	10.0100	0.1010	1.0110
E17 Corner (inverted - internal area greater than external area)	2.8500	0.0000	0.0000
P7 Party Wall - Exposed floor (normal)	6.1000	0.4800	2.9280
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			12.9124 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	69.3290 (37)

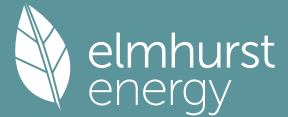
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	59.0421	58.6142	58.1948	56.2249	55.8563	54.1406	54.1406	53.8229	54.8015	55.8563	56.6019	57.3814
Average = Sum(39)m / 12 =	128.3711	127.9432	127.5238	125.5539	125.1854	123.4697	123.4697	123.1519	124.1305	125.1854	125.9310	126.7104
												125.5522
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1423	1.1385	1.1348	1.1172	1.1139	1.0987	1.0987	1.0959	1.1046	1.1139	1.1206	1.1275
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.8284 (42)
Hot water usage for mixer showers												
Hot water usage for baths	71.6425	70.5658	68.9969	65.9952	63.7799	61.3095	59.9053	61.4623	63.1691	65.8216	68.8879	71.3680
Hot water usage for other uses	30.9318	30.4725	29.8255	28.6328	27.7396	26.7493	26.2144	26.8567	27.5562	28.6159	29.8332	30.8273
Average daily hot water use (litres/day)	43.5955	42.0102	40.4249	38.8396	37.2543	35.6690	35.6690	37.2543	38.8396	40.4249	42.0102	43.5955
												134.3629 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	146.1698	143.0485	139.2474	133.4675	128.7739	123.7278	121.7887	125.5734	129.5649	134.8623	140.7312	145.7907
Energy content (annual)	231.4972	203.6991	214.0180	182.7104	173.3544	152.1378	147.2929	155.4861	159.7664	183.0069	200.4974	228.2730
Distribution loss (46)m = 0.15 x (45)m	34.7246	30.5549	32.1027	27.4066	26.0032	22.8207	22.0939	23.3229	23.9650	27.4510	30.0746	34.2410
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
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
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
Combi loss	2.5154	2.3341	2.6070	2.4262	2.4566	2.3018	2.2828	2.2979	2.2400	2.3817	2.3857	2.4968
Total heat required for water heating calculated for each month	234.0126	206.0332	216.6250	185.1366	175.8110	154.4396	149.5756	157.7840	162.0065	185.3886	202.8832	230.7698
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Output from w/h	234.0126	206.0332	216.6250	185.1366	175.8110	154.4396	149.5756	157.7840	162.0065	185.3886	202.8832	230.7698
12Total per year (kWh/year)												2260.4657
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
Heat gains from water heating, kWh/month	77.6017	68.3135	71.8127	61.3578	58.2545	51.1613	49.5456	52.2736	53.6824	61.4452	67.2618	76.5250

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	141.4191	141.4191	141.4191	141.4191	141.4191	141.4191	141.4191	141.4191	141.4191	141.4191	141.4191	141.4191
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	153.9094	170.3997	153.9094	159.0397	153.9094	159.0397	153.9094	153.9094	159.0397	153.9094	159.0397	153.9094
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	274.9320	277.7850	270.5957	255.2905	235.9705	217.8123	205.6816	202.8287	210.0180	225.3232	244.6432	262.8013
Pumps, fans	37.1419	37.1419	37.1419	37.1419	37.1419	37.1419	37.1419	37.1419	37.1419	37.1419	37.1419	37.1419
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000
Water heating gains (Table 5)	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353
Total internal gains	104.3033	101.6570	96.5225	85.2191	78.2990	71.0573	66.5935	70.2602	74.5588	82.5877	93.4192	102.8562
	601.5705	618.2674	589.4533	567.9751	536.6046	513.3351	491.6103	492.4241	509.0423	530.2460	565.5279	587.9926

6. Solar gains												
[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m2	Table 6a	W/m2	Specific data	factor	W						
				or Table 6b	or Table 6c							
East	7.2100	19.6403	0.7300	0.7000	0.7700	50.1460						

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South			1.4200		46.7521		0.7300		0.7000		0.7700		23.5095 (78)
West			4.8600		19.6403		0.7300		0.7000		0.7700		33.8016 (80)
Solar gains	107.4572	202.7220	319.4914	449.8614	541.1516	550.4233	525.4162	457.4163	365.7736	236.3888	132.5397	89.3489	(83)
Total gains	709.0277	820.9894	908.9447	1017.8365	1077.7563	1063.7584	1017.0265	949.8404	874.8159	766.6348	698.0675	677.3415	(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	62.3718	62.5804	62.7862	63.7713	63.9591	64.8478	64.8478	65.0151	64.5026	63.9591	63.5804	63.1893	
alpha	5.1581	5.1720	5.1857	5.2514	5.2639	5.3232	5.3232	5.3343	5.3002	5.2639	5.2387	5.2126	
util living area	0.9978	0.9948	0.9871	0.9561	0.8709	0.6965	0.5252	0.5805	0.8322	0.9737	0.9951	0.9983	(86)
MIT	20.4837	20.5292	20.5977	20.6946	20.7703	20.8137	20.8231	20.8221	20.7943	20.6927	20.5745	20.4808	(87)
Th 2	19.9664	19.9695	19.9726	19.9868	19.9895	20.0019	20.0019	20.0042	19.9971	19.9895	19.9841	19.9784	(88)
util rest of house	0.9970	0.9930	0.9823	0.9395	0.8240	0.6064	0.4108	0.4630	0.7580	0.9606	0.9931	0.9977	(89)
MIT 2	19.3436	19.4045	19.4944	19.6282	19.7176	19.7711	19.7770	19.7793	19.7511	19.6303	19.4762	19.3511	(90)
Living area fraction									fLA = Living area / (4) =			0.1830	(91)
MIT	19.5523	19.6104	19.6963	19.8234	19.9103	19.9619	19.9685	19.9701	19.9421	19.8248	19.6772	19.5579	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.4023	19.4604	19.5463	19.6734	19.7603	19.8119	19.8185	19.8201	19.7921	19.6748	19.5272	19.4079	(93)
8. Space heating requirement													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9965	0.9919	0.9798	0.9331	0.8114	0.5878	0.3891	0.4402	0.7400	0.9552	0.9919	0.9972	(94)
Useful gains	706.5127	814.3171	890.5691	949.7404	874.5261	625.2462	395.7580	418.1154	647.3376	732.2593	692.3992	675.4515	(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	1938.6922	1862.9005	1663.7179	1352.6378	1009.0327	643.5159	397.3899	421.1959	706.5606	1136.0280	1564.9729	1926.9960	(97)
Space heating kWh	916.7415	704.6481	575.2227	290.0861	100.0729	0.0000	0.0000	0.0000	0.0000	300.4039	628.2531	931.1491	(98a)
Space heating requirement - total per year (kWh/year)												4446.5775	
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	916.7415	704.6481	575.2227	290.0861	100.0729	0.0000	0.0000	0.0000	0.0000	300.4039	628.2531	931.1491	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4446.5775	
Space heating per m2										(98c) / (4) =		39.5673	(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 %)													88.6000 (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	916.7415	704.6481	575.2227	290.0861	100.0729	0.0000	0.0000	0.0000	0.0000	300.4039	628.2531	931.1491	(98)
Space heating efficiency (main heating system 1)	88.6000	88.6000	88.6000	88.6000	88.6000	0.0000	0.0000	0.0000	0.0000	88.6000	88.6000	88.6000	(210)
Space heating fuel (main heating system)	1034.6970	795.3139	649.2356	327.4110	112.9491	0.0000	0.0000	0.0000	0.0000	339.0563	709.0892	1050.9584	(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	234.0126	206.0332	216.6250	185.1366	175.8110	154.4396	149.5756	157.7840	162.0065	185.3886	202.8832	230.7698	(64)
Efficiency of water heater (217)m	86.6087	86.3901	85.9417	84.8620	82.6452	79.6000	79.6000	79.6000	79.6000	84.9352	86.2204	86.6541	(216)
Fuel for water heating, kWh/month	270.1954	238.4916	252.0603	218.1620	212.7298	194.0196	187.9091	198.2211	203.5257	218.2706	235.3078	266.3115	(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	31.3257	25.1306	22.6274	16.5778	12.8051	10.4619	11.6813	15.1838	19.7222	25.8766	29.2276	32.1963	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-33.2922	-51.8822	-82.7170	-100.1762	-111.7310	-105.2964	-103.4832	-95.5492	-81.1852	-62.1962	-37.9098	-27.9634	(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	-14.6928	-35.7412	-84.9074	-148.4227	-214.1785	-222.3327	-216.8062	-172.1400	-111.3822	-54.9785	-20.5365	-11.1379	(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												5018.7105	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.6000	
Water heating fuel used												2695.2045	(219)
Space cooling fuel												0.0000	(221)

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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)	252.8163 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2200.6387 (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	5852.0926 (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	5018.7105	0.2100	1053.9292 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2695.2045	0.2100	565.9929 (264)
Space and water heating			1619.9221 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	252.8163	0.1443	36.4892 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-893.3820	0.1331	-118.9266
PV Unit electricity exported	-1307.2566	0.1223	-159.8935
Total			-278.8201 (269)
Total CO2, kg/year			1389.5205 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			12.3600 (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	5018.7105	1.1300	5671.1428 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2695.2045	1.1300	3045.5811 (278)
Space and water heating			8716.7239 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	252.8163	1.5338	387.7781 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-893.3820	1.4919	-1332.8480
PV Unit electricity exported	-1307.2566	0.4488	-586.6928
Total			-1919.5408 (283)
Total Primary energy kWh/year			7315.0620 (286)
Dwelling Primary energy Rate (DPER)			65.0900 (287)

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

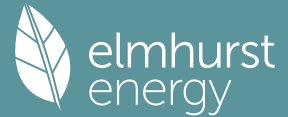
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	25.1200 (1b)	x 2.8500 (2b)	= 71.5920 (1b) - (3b)
First floor	43.6300 (1c)	x 2.4000 (2c)	= 104.7120 (1c) - (3c)
Second floor	43.6300 (1d)	x 2.6300 (2d)	= 114.7469 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.3800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	291.0509 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1374 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3874 (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) = 0.3584 (21)

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Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4569	0.4480	0.4390	0.3942	0.3853	0.3405	0.3405	0.3315	0.3584	0.3853	0.4032	0.4211 (22b)
	0.6044	0.6003	0.5964	0.5777	0.5742	0.5580	0.5580	0.5549	0.5642	0.5742	0.5813	0.5887 (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)			13.4900	1.1450	15.4466		(27)
Ground floor			25.1200	0.1300	3.2656		(28a)
Exposed floor			18.5100	0.1300	2.4063		(28b)
Brick wall	125.7900	15.6300	110.1600	0.1800	19.8288		(29a)
Retaining wall	13.0200		13.0200	0.1800	2.3436		(29a)
Garage wall	23.0300		23.0300	0.1800	4.1454		(29a)
Plane roof	43.6300		43.6300	0.1100	4.7993		(30)
Total net area of external elements Aum(A, m2)			249.1000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)... (30) + (32) =	54.3756	(33)
Party Wall 1			61.4900	0.0000	0.0000		(32)

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

256.4892 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	10.7500	0.0500	0.5375
E3 Sill	7.9200	0.0500	0.3960
E4 Jamb	30.3000	0.0500	1.5150
E5 Ground floor (normal)	25.2500	0.1600	4.0400
E6 Intermediate floor within a dwelling	34.0600	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	7.5700	0.0600	0.4542
E12 Gable (insulation at ceiling level)	11.5800	0.0600	0.6948
E16 Corner (normal)	23.6400	0.0900	2.1276
E17 Corner (inverted - internal area greater than external area)	7.8800	-0.0900	-0.7092
E20 Exposed floor (normal)	10.3400	0.3200	3.3088
E21 Exposed floor (inverted)	8.0800	0.3200	2.5856
E18 Party wall between dwellings	15.7600	0.0600	0.9456
P1 Party wall - Ground floor	3.1900	0.0800	0.2552
P2 Party wall - Intermediate floor within a dwelling	13.9200	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	10.0100	0.1200	1.2012
E17 Corner (inverted - internal area greater than external area)	2.8500	-0.0900	-0.2565
P7 Party Wall - Exposed floor (normal)	6.1000	0.1600	0.9760

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

Point Thermal bridges	(36a) =	18.0718 (36)
Total fabric heat loss	(33) + (36) + (36a) =	72.4474 (37)

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

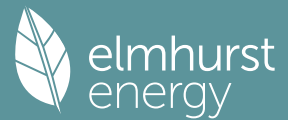
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	58.0499	57.6606	57.2789	55.4864	55.1511	53.5898	53.5898	53.3007	54.1912	55.1511	55.8295	56.5388 (38)
Heat transfer coeff												
	130.4973	130.1079	129.7263	127.9338	127.5984	126.0372	126.0372	125.7481	126.6386	127.5984	128.2769	128.9862 (39)
Average = Sum(39)m / 12 =												127.9322

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1612	1.1577	1.1544	1.1384	1.1354	1.1215	1.1215	1.1190	1.1269	1.1354	1.1415	1.1478 (40)
HLP (average)												1.1384
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8284 (42)
Hot water usage for mixer showers												
	71.6425	70.5658	68.9969	65.9952	63.7799	61.3095	59.9053	61.4623	63.1691	65.8216	68.8879	71.3680 (42a)
Hot water usage for baths												
	30.9318	30.4725	29.8255	28.6328	27.7396	26.7493	26.2144	26.8567	27.5562	28.6159	29.8332	30.8273 (42b)
Hot water usage for other uses												
	43.5955	42.0102	40.4249	38.8396	37.2543	35.6690	35.6690	37.2543	38.8396	40.4249	42.0102	43.5955 (42c)
Average daily hot water use (litres/day)												134.3629 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	146.1698	143.0485	139.2474	133.4675	128.7739	123.7278	121.7887	125.5734	129.5649	134.8623	140.7312	145.7907 (44)
Energy conte	231.4972	203.6991	214.0180	182.7104	173.3544	152.1378	147.2929	155.4861	159.7664	183.0069	200.4974	228.2730 (45)
Energy content (annual)										Total = Sum(45)m =		2231.7397
Distribution loss (46)m = 0.15 x (45)m												
	34.7246	30.5549	32.1027	27.4066	26.0032	22.8207	22.0939	23.3229	23.9650	27.4510	30.0746	34.2410 (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												
	282.4561	249.7265	264.9769	232.0254	224.3133	201.4529	198.2518	206.4450	209.0815	233.9658	249.8125	279.2319 (62)
WWHRS	-32.7520	-28.9661	-30.3316	-25.1158	-23.4070	-20.0295	-18.7745	-19.9648	-20.7233	-24.4305	-27.6768	-32.1454 (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	249.7041	220.7604	234.6453	206.9097	200.9063	181.4233	179.4773	186.4802	188.3582	209.5353	222.1357	247.0865 (64)
										Total per year (kWh/year) = Sum(64)m =		2527.4222 (64)
12Total per year (kWh/year)												2527 (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												
	89.7125	79.2368	83.9007	73.0800	70.3801	62.9146	61.7146	64.4388	65.4511	73.5895	78.9942	88.6405 (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	141.4191	141.4191	141.4191	141.4191	141.4191	141.4191	141.4191	141.4191	141.4191	141.4191	141.4191	141.4191 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	153.9094	170.3997	153.9094	159.0397	153.9094	159.0397	153.9094	153.9094	159.0397	153.9094	159.0397	153.9094 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	274.9320	277.7850	270.5957	255.2905	235.9705	217.8123	205.6816	202.8287	210.0180	225.3232	244.6432	262.8013 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1419	37.1419	37.1419	37.1419	37.1419	37.1419	37.1419	37.1419	37.1419	37.1419	37.1419	37.1419 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353 (71)
Water heating gains (Table 5)	120.5814	117.9119	112.7698	101.5000	94.5968	87.3814	82.9497	86.6114	90.9043	98.9107	109.7141	119.1405 (72)
Total internal gains	617.8486	634.5223	605.7006	584.2559	552.9025	529.6592	507.9665	508.7752	525.3878	546.5690	581.8228	604.2769 (73)

6. Solar gains

[Jan]						Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East						7.2100	19.6403	0.6300	0.7000	0.7700	43.2767 (76)	
South						1.4200	46.7521	0.6300	0.7000	0.7700	20.2890 (78)	
West						4.8600	19.6403	0.6300	0.7000	0.7700	29.1713 (80)	
Solar gains	92.7370	174.9518	275.7255	388.2365	467.0213	475.0228	453.4414	394.7565	315.6677	204.0068	114.3835	77.1093 (83)
Total gains	710.5856	809.4742	881.4261	972.4925	1019.9237	1004.6820	961.4079	903.5317	841.0555	750.5757	696.2063	681.3862 (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	61.3556	61.5392	61.7202	62.5850	62.7495	63.5268	63.5268	63.6729	63.2251	62.7495	62.4176	62.0744
alpha	5.0904	5.1026	5.1147	5.1723	5.1833	5.2351	5.2351	5.2449	5.2150	5.1833	5.1612	5.1383
util living area	0.9978	0.9952	0.9889	0.9644	0.8946	0.7356	0.5627	0.6165	0.8547	0.9767	0.9952	0.9982 (86)
MIT	19.6284	19.7967	20.0572	20.4285	20.7430	20.9365	20.9872	20.9799	20.8546	20.4434	19.9795	19.6097 (87)
Th 2	19.9512	19.9539	19.9567	19.9696	19.9720	19.9833	19.9833	19.9854	19.9789	19.9720	19.9671	19.9620 (88)
util rest of house	0.9970	0.9935	0.9847	0.9503	0.8523	0.6446	0.4400	0.4924	0.7839	0.9647	0.9932	0.9976 (89)
MIT 2	18.3544	18.5713	18.9048	19.3782	19.7481	19.9461	19.9792	19.9782	19.8764	19.4047	18.8151	18.3382 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.5876	18.7956	19.1157	19.5705	19.9302	20.1274	20.1637	20.1615	20.0554	19.5948	19.0282	18.5709 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.5876	18.7956	19.1157	19.5705	19.9302	20.1274	20.1637	20.1615	20.0554	19.5948	19.0282	18.5709 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9954	0.9908	0.9801	0.9432	0.8503	0.6586	0.4625	0.5150	0.7901	0.9587	0.9906	0.9963 (94)
Useful gains	707.3357	802.0116	863.8598	917.2796	867.2049	661.6697	444.6677	465.3072	664.5420	719.5939	689.6375	678.8625 (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	1864.4887	1807.9228	1636.5927	1365.1131	1050.1577	696.6518	449.1606	473.0058	754.1858	1147.7256	1530.1143	1853.6496 (97)
Space heating kWh	860.9219	675.9723	574.9133	322.4401	136.1169	0.0000	0.0000	0.0000	0.0000	318.5300	605.1433	874.0417 (98a)
Space heating requirement - total per year (kWh/year)												4368.0795
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	860.9219	675.9723	574.9133	322.4401	136.1169	0.0000	0.0000	0.0000	0.0000	318.5300	605.1433	874.0417 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4368.0795
Space heating per m ²												(98c) / (4) = 38.8688 (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	860.9219	675.9723	574.9133	322.4401	136.1169	0.0000	0.0000	0.0000	0.0000	318.5300	605.1433	874.0417 (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)	931.7336	731.5718	622.2005	348.9612	147.3127	0.0000	0.0000	0.0000	0.0000	344.7294	654.9170	945.9325 (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	249.7041	220.7604	234.6453	206.9097	200.9063	181.4233	179.4773	186.4802	188.3582	209.5353	222.1357	247.0865 (64)

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Efficiency of water heater (217)m	86.8097	86.6163	86.2235	85.3280	83.5649	80.3000	80.3000	80.3000	80.3000	85.2761	86.4149	80.3000 (216)
Fuel for water heating, kWh/month	287.6455	254.8717	272.1362	242.4874	240.4194	225.9319	223.5084	232.2294	234.5681	245.7141	257.0571	86.8500 (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 (233a)m	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 (233a)m	31.9793	25.6550	23.0995	16.9237	13.0723	10.6802	11.9250	15.5006	20.1337	26.4166	29.8374	32.8681 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-41.8593	-59.5450	-86.3195	-97.8638	-106.1544	-99.2487	-97.9883	-92.1990	-82.0863	-68.4385	-46.1960	-36.1249 (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)	-22.0236	-46.5215	-92.8423	-140.0083	-185.7017	-186.8477	-184.6856	-156.1334	-114.0997	-66.7567	-29.4740	-17.4039 (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												4727.3587 (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												3001.0670 (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)												258.0916 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-2156.5221 (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												5915.9952 (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	4727.3587	0.2100	992.7453 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3001.0670	0.2100	630.2241 (264)
Space and water heating			1622.9694 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	258.0916	0.1443	37.2506 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-914.0238	0.1344	-122.8630
PV Unit electricity exported	-1242.4983	0.1258	-156.2703
Total			-279.1333 (269)
Total CO2, kg/year			1393.0159 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.4000 (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	4727.3587	1.1300	5341.9154 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3001.0670	1.1300	3391.2057 (278)
Space and water heating			8733.1211 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	258.0916	1.5338	395.8695 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-914.0238	1.4968	-1368.0964
PV Unit electricity exported	-1242.4983	0.4617	-573.6114
Total			-1941.7078 (283)
Total Primary energy kWh/year			7317.3836 (286)
Target Primary Energy Rate (TPER)			65.1100 (287)

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Property Reference	SAP VG 21-0282				Issued on Date	15/11/2024
Assessment Reference	Plot 66		Prop Type Ref	SAP VG 21-0282		
Property						
SAP Rating	93 A	DER	12.36	TER	12.40	
Environmental	89 B	% DER < TER				0.32
CO ₂ Emissions (t/year)	1.34	DFEE	39.75	TFEE	43.34	
Compliance Check	See BREL	% DFEE < TFEE				8.27
% DPER < TPER	0.03	DPER	65.09	TPER	65.11	
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	25.1200 (1b)	x 2.8500 (2b)	= 71.5920 (1b) - (3b)
First floor	43.6300 (1c)	x 2.4000 (2c)	= 104.7120 (1c) - (3c)
Second floor	43.6300 (1d)	x 2.6300 (2d)	= 114.7469 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.3800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	291.0509 (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	6 * 10 = 60.0000 (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) =	60.0000 / (5) = 0.2061 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.4061 (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) = 0.3757 (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	0.4790	0.4696	0.4602	0.4133	0.4039	0.3569	0.3569	0.3475	0.3757	0.4039	0.4226	0.4414 (22b)
Effective ac	0.6147	0.6103	0.6059	0.5854	0.5816	0.5637	0.5637	0.5604	0.5706	0.5816	0.5893	0.5974 (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
Solid front door			2.1400	1.1000	2.3540		(26)
Windows (Uw = 1.30)			13.4900	1.2357	16.6702		(27)
Ground floor			25.1200	0.1300	3.2656	0.0000	0.0000 (28a)
Exposed floor			18.5100	0.2000	3.7020	20.0000	370.2000 (28b)
Brick wall	125.7900	15.6300	110.1600	0.1900	20.9304	110.0000	12117.6000 (29a)
Retaining wall	13.0200		13.0200	0.1800	2.3436	110.0000	1432.2000 (29a)
Garage wall	23.0300		23.0300	0.1400	3.2242	110.0000	2533.3000 (29a)
Plane roof	43.6300		43.6300	0.0900	3.9267	9.0000	392.6700 (30)
Total net area of external elements Aum(A, m ²)			249.1000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.4167		(33)
Party Wall 1			61.4900	0.0000	0.0000	140.0000	8608.6000 (32)
Internal Wall			168.1300			9.0000	1513.1700 (32c)
Internal Floor 1			68.7600			18.0000	1237.6800 (32d)
Internal Ceiling 1			68.7600			9.0000	618.8400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	28824.2600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							256.4892 (35)
List of Thermal Bridges							

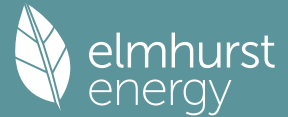
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 59.0421	Feb 58.6142	Mar 58.1948	Apr 56.2249	May 55.8563	Jun 54.1406	Jul 54.1406	Aug 53.8229	Sep 54.8015	Oct 55.8563	Nov 56.6019	Dec 57.3814 (38)
Heat transfer coeff	128.3711	127.9432	127.5238	125.5539	125.1854	123.4697	123.4697	123.1519	124.1305	125.1854	125.9310	126.7104 (39)
Average = Sum(39)m / 12 =												125.5522
HLP	Jan 1.1423	Feb 1.1385	Mar 1.1348	Apr 1.1172	May 1.1139	Jun 1.0987	Jul 1.0987	Aug 1.0959	Sep 1.1046	Oct 1.1139	Nov 1.1206	Dec 1.1275 (40)
HLP (average)												1.1172
Days in mopt	31	28	31	30	31	30	31	31	30	31	30	31

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	169.7029	169.7029	169.7029	169.7029	169.7029	169.7029	169.7029	169.7029	169.7029	169.7029	169.7029	169.7029 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	35.7888	31.7873	25.8511	19.5710	14.6295	12.3509	13.3456	17.3471	23.2832	29.5633	34.5048	36.7834 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	410.3463	414.6044	403.8741	381.0306	352.1947	325.0931	306.9875	302.7294	313.4597	336.3032	365.1391	392.2407 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7987	54.7987	54.7987	54.7987	54.7987	54.7987	54.7987	54.7987	54.7987	54.7987	54.7987	54.7987 (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)	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353 (71)
Water heating gains (Table 5)	104.3033	101.6570	96.5225	85.2191	78.2990	71.0573	66.5935	70.2602	74.5588	82.5877	93.4192	102.8562 (72)
Total internal gains	664.8047	662.4150	640.6141	600.1870	559.4896	519.8676	498.2929	501.7030	522.6680	562.8205	607.4294	646.2467 (73)

6. Solar gains						
[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East	7.2100	19.6403	0.7300	0.7000	0.7700	50.1460 (76)
South	1.4200	46.7521	0.7300	0.7000	0.7700	23.5095 (78)

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West	4.8600		19.6403		0.7300		0.7000		0.7700		33.8016 (80)	
Solar gains	107.4572	202.7220	319.4914	449.8614	541.1516	550.4233	525.4162	457.4163	365.7736	236.3888	132.5397	89.3489 (83)
Total gains	772.2619	865.1369	960.1055	1050.0484	1100.6412	1070.2908	1023.7091	959.1193	888.4416	799.2093	739.9691	735.5955 (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	62.3718	62.5804	62.7862	63.7713	63.9591	64.8478	64.8478	65.0151	64.5026	63.9591	63.5804	63.1893
alpha	5.1581	5.1720	5.1857	5.2514	5.2639	5.3232	5.3232	5.3343	5.3002	5.2639	5.2387	5.2126
util living area	0.9967	0.9934	0.9837	0.9507	0.8630	0.6933	0.5220	0.5755	0.8255	0.9689	0.9936	0.9974 (86)
MIT	20.4982	20.5392	20.6087	20.7005	20.7729	20.8139	20.8232	20.8222	20.7955	20.6993	20.5840	20.4943 (87)
Th 2	19.9664	19.9695	19.9726	19.9868	19.9895	20.0019	20.0019	20.0042	19.9971	19.9895	19.9841	19.9784 (88)
util rest of house	0.9956	0.9912	0.9778	0.9325	0.8146	0.6032	0.4082	0.4587	0.7502	0.9539	0.9910	0.9965 (89)
MIT 2	19.3622	19.4172	19.5082	19.6351	19.7202	19.7713	19.7771	19.7793	19.7522	19.6381	19.4883	19.3683 (90)
Living area fraction	19.5701	19.6226	19.7096	19.8301	19.9129	19.9621	19.9686	19.9702	19.9431	19.8324	19.6888	19.5744 (91)
MIT	19.5701	19.6226	19.7096	19.8301	19.9129	19.9621	19.9686	19.9702	19.9431	19.8324	19.6888	19.5744 (92)
Temperature adjustment	19.4201	19.4726	19.5596	19.6801	19.7629	19.8121	19.8186	19.8202	19.7931	19.6824	19.5388	-0.1500
adjusted MIT	19.4201	19.4726	19.5596	19.6801	19.7629	19.8121	19.8186	19.8202	19.7931	19.6824	19.5388	19.4244 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9948	0.9898	0.9748	0.9257	0.8019	0.5846	0.3866	0.4361	0.7321	0.9478	0.9895	0.9959 (94)
Useful gains	768.2406	856.3195	935.9307	972.0150	882.5738	625.7149	395.8108	418.2578	650.4040	757.5002	732.2183	732.5991 (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	1940.9848	1864.4621	1665.4151	1353.4821	1009.3555	643.5378	397.3933	421.2044	706.6922	1136.9776	1566.4358	1929.0949 (97)
Space heating kWh	872.5217	677.4719	542.7364	274.6563	94.3256	0.0000	0.0000	0.0000	0.0000	282.3312	600.6366	890.1929 (98a)
Space heating requirement - total per year (kWh/year)												4234.8726
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	872.5217	677.4719	542.7364	274.6563	94.3256	0.0000	0.0000	0.0000	0.0000	282.3312	600.6366	890.1929 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4234.8726
Space heating per m2										(98c) / (4) =		37.6835 (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 %)												88.6000 (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	872.5217	677.4719	542.7364	274.6563	94.3256	0.0000	0.0000	0.0000	0.0000	282.3312	600.6366	890.1929 (98)
Space heating efficiency (main heating system 1)	88.6000	88.6000	88.6000	88.6000	88.6000	0.0000	0.0000	0.0000	0.0000	88.6000	88.6000	88.6000 (210)
Space heating fuel (main heating system)	984.7875	764.6409	612.5693	309.9958	106.4623	0.0000	0.0000	0.0000	0.0000	318.6582	677.9194	1004.7324 (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	234.0126	206.0332	216.6250	185.1366	175.8110	154.4396	149.5756	157.7840	162.0065	185.3886	202.8832	230.7698 (64)
Efficiency of water heater (217)m	86.5309	86.3239	85.8316	84.7420	82.5272	79.6000	79.6000	79.6000	79.6000	84.7997	86.1408	79.6000 (216)
Fuel for water heating, kWh/month	270.4381	238.6746	252.3839	218.4708	213.0340	194.0196	187.9091	198.2211	203.5257	218.6195	235.5250	86.5846 (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	7.0000 (231)
Lighting	31.3257	25.1306	22.6274	16.5778	12.8051	10.4619	11.6813	15.1838	19.7222	25.8766	29.2276	32.1963 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-33.2922	-51.8822	-82.7170	-100.1762	-111.7310	-105.2964	-103.4832	-95.5492	-81.1852	-62.1962	-37.9098	-27.9634 (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	-14.6928	-35.7412	-84.9074	-148.4227	-214.1785	-222.3327	-216.8062	-172.1400	-111.3822	-54.9785	-20.5365	-11.1379 (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												4779.7659 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												79.6000
Water heating fuel used												2697.3465 (219)
Space cooling fuel												0.0000 (221)

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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)	252.8163 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2200.6387 (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	5615.2901 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4779.7659	3.6400	173.9835 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2697.3465	3.6400	98.1834 (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	252.8163	16.4900	41.6894 (250)
Additional standing charges			92.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-893.3820	16.4900	-147.3187
PV Unit electricity exported	-1307.2566	5.5900	-73.0756
Total			-220.3943 (252)
Total energy cost			199.6434 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] = 0.4567 (257)
SAP value	92.5973
SAP rating (Section 12)	93 (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	4779.7659	0.2100	1003.7508 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2697.3465	0.2100	566.4428 (264)
Space and water heating			1570.1936 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	252.8163	0.1443	36.4892 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-893.3820	0.1331	-118.9266
PV Unit electricity exported	-1307.2566	0.1223	-159.8935
Total			-278.8201 (269)
Total CO2, kg/year			1339.7920 (272)
CO2 emissions per m2			11.9200 (273)
EI value			88.5924
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

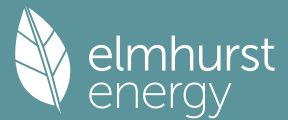
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	25.1200 (1b)	x 2.8500 (2b)	= 71.5920 (1b) - (3b)
First floor	43.6300 (1c)	x 2.4000 (2c)	= 104.7120 (1c) - (3c)
Second floor	43.6300 (1d)	x 2.6300 (2d)	= 114.7469 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.3800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	291.0509 (5)

2. Ventilation rate

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

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

6 * 10 = 60.0000 (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) = 60.0000 / (5) = 0.2061 (8)
Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 4.0000 (17)
Infiltration rate 0.4061 (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) = 0.3757 (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	0.4790	0.4696	0.4602	0.4133	0.4039	0.3569	0.3569	0.3475	0.3757	0.4039	0.4226	0.4414	(22b)
	0.6147	0.6103	0.6059	0.5854	0.5816	0.5637	0.5637	0.5604	0.5706	0.5816	0.5893	0.5974	(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	
Solid front door			2.1400	1.1000	2.3540			(26)
Windows (Uw = 1.30)			13.4900	1.2357	16.6702			(27)
Ground floor			25.1200	0.1300	3.2656	0.0000	0.0000	(28a)
Exposed floor			18.5100	0.2000	3.7020	20.0000	370.2000	(28b)
Brick wall	125.7900	15.6300	110.1600	0.1900	20.9304	110.0000	12117.6000	(29a)
Retaining wall	13.0200		13.0200	0.1800	2.3436	110.0000	1432.2000	(29a)
Garage wall	23.0300		23.0300	0.1400	3.2242	110.0000	2533.3000	(29a)
Plane roof	43.6300		43.6300	0.0900	3.9267	9.0000	392.6700	(30)
Total net area of external elements Aum(A, m2)			249.1000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.4167			(33)
Party Wall 1			61.4900	0.0000	0.0000	140.0000	8608.6000	(32)
Internal Wall			168.1300			9.0000	1513.1700	(32c)
Internal Floor 1			68.7600			18.0000	1237.6800	(32d)
Internal Ceiling 1			68.7600			9.0000	618.8400	(32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element	10.7500	0.0240	0.2580	
E2 Other lintels (including other steel lintels)	7.9200	0.0220	0.1742	
E3 Sill	30.3000	0.0170	0.5151	
E4 Jamb	25.2500	0.0920	2.3230	
E5 Ground floor (normal)	34.0600	0.0010	0.0341	
E6 Intermediate floor within a dwelling	7.5700	0.0600	0.4542	
E10 Eaves (insulation at ceiling level)	11.5800	0.0560	0.6485	
E12 Gable (insulation at ceiling level)	23.6400	0.0460	1.0874	
E16 Corner (normal)	7.8800	-0.0880	-0.6934	
E17 Corner (inverted - internal area greater than external area)	10.3400	0.0690	0.7135	
E20 Exposed floor (normal)	8.0800	0.3200	2.5856	
E21 Exposed floor (inverted)	15.7600	0.0380	0.5989	
E18 Party wall between dwellings	3.1900	0.0860	0.2743	
P1 Party wall - Ground floor	13.9200	0.0000	0.0000	
P2 Party wall - Intermediate floor within a dwelling	10.0100	0.1010	1.0110	
P4 Party wall - Roof (insulation at ceiling level)	2.8500	0.0000	0.0000	
E17 Corner (inverted - internal area greater than external area)	6.1000	0.4800	2.9280	
P7 Party Wall - Exposed floor (normal)				

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

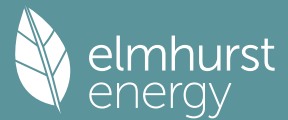
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	59.0421	58.6142	58.1948	56.2249	55.8563	54.1406	54.1406	53.8229	54.8015	55.8563	56.6019	57.3814	(38)
Heat transfer coeff	128.3711	127.9432	127.5238	125.5539	125.1854	123.4697	123.4697	123.1519	124.1305	125.1854	125.9310	126.7104	(39)
Average = Sum(39)m / 12 =												125.5522	

HLP	1.1423	1.1385	1.1348	1.1172	1.1139	1.0987	1.0987	1.0959	1.1046	1.1139	1.1206	1.1275	(40)
HLP (average)												1.1172	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8284	(42)
Hot water usage for mixer showers													
	71.6425	70.5658	68.9969	65.9952	63.7799	61.3095	59.9053	61.4623	63.1691	65.8216	68.8879	71.3680	(42a)
Hot water usage for baths													
	30.9318	30.4725	29.8255	28.6328	27.7396	26.7493	26.2144	26.8567	27.5562	28.6159	29.8332	30.8273	(42b)
Hot water usage for other uses													
	43.5955	42.0102	40.4249	38.8396	37.2543	35.6690	35.6690	37.2543	38.8396	40.4249	42.0102	43.5955	(42c)
Average daily hot water use (litres/day)												134.3629	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	146.1698	143.0485	139.2474	133.4675	128.7739	123.7278	121.7887	125.5734	129.5649	134.8623	140.7312	145.7907	(44)
Energy content (annual)	231.4972	203.6991	214.0180	182.7104	173.3544	152.1378	147.2929	155.4861	159.7664	183.0069	200.4974	228.2730	(45)
Distribution loss (46)m = 0.15 x (45)m												2231.7397	
	34.7246	30.5549	32.1027	27.4066	26.0032	22.8207	22.0939	23.3229	23.9650	27.4510	30.0746	34.2410	(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	2.5154	2.3341	2.6070	2.4262	2.4566	2.3018	2.2828	2.2979	2.2400	2.3817	2.3857	2.4968	(61)

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Total heat required for water heating calculated for each month												
	234.0126	206.0332	216.6250	185.1366	175.8110	154.4396	149.5756	157.7840	162.0065	185.3886	202.8832	230.7698 (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	234.0126	206.0332	216.6250	185.1366	175.8110	154.4396	149.5756	157.7840	162.0065	185.3886	202.8832	230.7698 (64)
Total per year (kWh/year) = Sum(64)m =												2260.4657 (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	77.6017	68.3135	71.8127	61.3578	58.2545	51.1613	49.5456	52.2736	53.6824	61.4452	67.2618	76.5250 (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	169.7029	169.7029	169.7029	169.7029	169.7029	169.7029	169.7029	169.7029	169.7029	169.7029	169.7029	169.7029 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	35.7888	31.7873	25.8511	19.5710	14.6295	12.3509	13.3456	17.3471	23.2832	29.5633	34.5048	36.7834 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	410.3463	414.6044	403.8741	381.0306	352.1947	325.0931	306.9875	302.7294	313.4597	336.3032	365.1391	392.2407 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7987	54.7987	54.7987	54.7987	54.7987	54.7987	54.7987	54.7987	54.7987	54.7987	54.7987	54.7987 (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)	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353 (71)
Water heating gains (Table 5)	104.3033	101.6570	96.5225	85.2191	78.2990	71.0573	66.5935	70.2602	74.5588	82.5877	93.4192	102.8562 (72)
Total internal gains	664.8047	662.4150	640.6141	600.1870	559.4896	519.8676	498.2929	501.7030	522.6680	562.8205	607.4294	646.2467 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
East				7.2100	19.6403		0.7300		0.7000		0.7700		50.1460 (76)
South				1.4200	46.7521		0.7300		0.7000		0.7700		23.5095 (78)
West				4.8600	19.6403		0.7300		0.7000		0.7700		33.8016 (80)
Solar gains	107.4572	202.7220	319.4914	449.8614	541.1516	550.4233	525.4162	457.4163	365.7736	236.3888	132.5397		89.3489 (83)
Total gains	772.2619	865.1369	960.1055	1050.0484	1100.6412	1070.2908	1023.7091	959.1193	888.4416	799.2093	739.9691		735.5955 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												21.0000 (85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	62.3718	62.5804	62.7862	63.7713	63.9591	64.8478	64.8478	65.0151	64.5026	63.9591	63.5804	63.1893
alpha	5.1581	5.1720	5.1857	5.2514	5.2639	5.3232	5.3232	5.3343	5.3002	5.2639	5.2387	5.2126
util living area	0.9967	0.9934	0.9837	0.9507	0.8630	0.6933	0.5220	0.5755	0.8255	0.9689	0.9936	0.9974 (86)
MIT	20.4982	20.5392	20.6087	20.7005	20.7729	20.8139	20.8232	20.8222	20.7955	20.6993	20.5840	20.4943 (87)
Th 2	19.9664	19.9695	19.9726	19.9868	19.9895	20.0019	20.0019	20.0042	19.9971	19.9895	19.9841	19.9784 (88)
util rest of house	0.9956	0.9912	0.9778	0.9325	0.8146	0.6032	0.4082	0.4587	0.7502	0.9539	0.9910	0.9965 (89)
MIT 2	19.3622	19.4172	19.5082	19.6351	19.7202	19.7713	19.7771	19.7793	19.7522	19.6381	19.4883	19.3683 (90)
Living area fraction									fLA = Living area / (4) =			0.1830 (91)
MIT	19.5701	19.6226	19.7096	19.8301	19.9129	19.9621	19.9686	19.9702	19.9431	19.8324	19.6888	19.5744 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.4201	19.4726	19.5596	19.6801	19.7629	19.8121	19.8186	19.8202	19.7931	19.6824	19.5388	19.4244 (93)

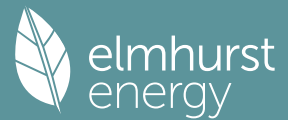
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9948	0.9898	0.9748	0.9257	0.8019	0.5846	0.3866	0.4361	0.7321	0.9478	0.9895	0.9959 (94)
Useful gains	768.2406	856.3195	935.9307	972.0150	882.5738	625.7149	395.8108	418.2578	650.4040	757.5002	732.2183	732.5991 (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	1940.9848	1864.4621	1665.4151	1353.4821	1009.3555	643.5378	397.3933	421.2044	706.6922	1136.9776	1566.4358	1929.0949 (97)
Space heating kWh	872.5217	677.4719	542.7364	274.6563	94.3256	0.0000	0.0000	0.0000	0.0000	282.3312	600.6366	890.1929 (98a)
Space heating requirement - total per year (kWh/year)												4234.8726
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	872.5217	677.4719	542.7364	274.6563	94.3256	0.0000	0.0000	0.0000	0.0000	282.3312	600.6366	890.1929 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4234.8726
Space heating per m2										(98c) / (4) =		37.6835 (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 %)	88.6000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	872.5217	677.4719	542.7364	274.6563	94.3256	0.0000	0.0000	0.0000	0.0000	282.3312	600.6366	890.1929	(98)
Space heating efficiency (main heating system 1)	88.6000	88.6000	88.6000	88.6000	88.6000	0.0000	0.0000	0.0000	0.0000	88.6000	88.6000	88.6000	(210)
Space heating fuel (main heating system)	984.7875	764.6409	612.5693	309.9958	106.4623	0.0000	0.0000	0.0000	0.0000	318.6582	677.9194	1004.7324	(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	234.0126	206.0332	216.6250	185.1366	175.8110	154.4396	149.5756	157.7840	162.0065	185.3886	202.8832	230.7698	(64)
Efficiency of water heater (217)m	86.5309	86.3239	85.8316	84.7420	82.5272	79.6000	79.6000	79.6000	79.6000	84.7997	86.1408	86.5846	(216)
Fuel for water heating, kWh/month	270.4381	238.6746	252.3839	218.4708	213.0340	194.0196	187.9091	198.2211	203.5257	218.6195	235.5250	266.5252	(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	31.3257	25.1306	22.6274	16.5778	12.8051	10.4619	11.6813	15.1838	19.7222	25.8766	29.2276	32.1963	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-33.2922	-51.8822	-82.7170	-100.1762	-111.7310	-105.2964	-103.4832	-95.5492	-81.1852	-62.1962	-37.9098	-27.9634	(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)	-14.6928	-35.7412	-84.9074	-148.4227	-214.1785	-222.3327	-216.8062	-172.1400	-111.3822	-54.9785	-20.5365	-11.1379	(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												4779.7659	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.6000	
Water heating fuel used												2697.3465	(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)												252.8163	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2200.6387	(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												5615.2901	(238)

10a. Fuel costs - using BEDF prices (554)													
						Fuel		Fuel price				Fuel cost	
						kWh/year		p/kWh				£/year	
Space heating - main system 1						4779.7659		5.6000				267.6669	(240)
Total CO2 associated with community systems												0.0000	(473)
Water heating (other fuel)						2697.3465		5.6000				151.0514	(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						252.8163		26.0600				65.8839	(250)
Additional standing charges												99.0000	(251)
Energy saving/generation technologies													
PV Unit electricity used in dwelling						-893.3820		26.0600				-232.8154	
PV Unit electricity exported						-1307.2566		5.8100				-75.9516	
Total												-308.7670	(252)
Total energy cost												297.2469	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP													
						Energy		Emission factor				Emissions	
						kWh/year		kg CO2/kWh				kg CO2/year	
Space heating - main system 1						4779.7659		0.2100				1003.7508	(261)
Total CO2 associated with community systems												0.0000	(373)
Water heating (other fuel)						2697.3465		0.2100				566.4428	(264)
Space and water heating												1570.1936	(265)
Pumps, fans and electric keep-hot						86.0000		0.1387				11.9293	(267)
Energy for lighting						252.8163		0.1443				36.4892	(268)
Energy saving/generation technologies													
PV Unit electricity used in dwelling						-893.3820		0.1331				-118.9266	
PV Unit electricity exported						-1307.2566		0.1223				-159.8935	
Total												-278.8201	(269)
Total CO2, kg/year												1339.7920	(272)

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

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	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	4779.7659	1.1300	5401.1355 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2697.3465	1.1300	3048.0016 (278)
Space and water heating			8449.1370 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	252.8163	1.5338	387.7781 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-893.3820	1.4919	-1332.8480
PV Unit electricity exported	-1307.2566	0.4488	-586.6928
Total			-1919.5408 (283)
Total Primary energy kWh/year			7047.4751 (286)

SAP 10 EPC IMPROVEMENTS

Plot 66

Current energy efficiency rating: A 93
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: (none) SAP change Cost change CO2 change

Measures omitted - SAP change or cost saving too small:
N Solar water heating + 0.5 -£ 22 -144 kg (10.7%)

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

Potential energy efficiency rating: A 93
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	£88	£88	£0
Mains gas	£518	£518	£0
Space heating	£389	£389	£0
Water heating	£151	£151	£0
Lighting	£66	£66	£0
Generated (PV)	-£309	-£309	£0
Total cost of fuels	£297	£297	£0
Total cost of uses	£297	£297	£0
Delivered energy	50 kWh/m²	50 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.3 tonnes	1.3 tonnes	0.0 tonnes
CO2 emissions per m²	12 kg/m²	12 kg/m²	0 kg/m²
Primary energy	63 kWh/m²	63 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

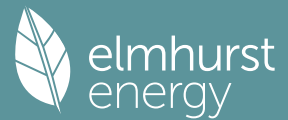
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	25.1200 (1b)	x 2.8500 (2b)	= 71.5920 (1b) - (3b)
First floor	43.6300 (1c)	x 2.4000 (2c)	= 104.7120 (1c) - (3c)
Second floor	43.6300 (1d)	x 2.6300 (2d)	= 114.7469 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.3800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	291.0509 (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	6 * 10 = 60.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

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Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 60.0000 / (5) = 0.2061 (8)
Pressure Test Yes
Pressure Test Method Blower Door
Measured/design AP50 4.0000 (17)
Infiltration rate 0.4061 (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) = 0.3757 (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	0.4790	0.4696	0.4602	0.4133	0.4039	0.3569	0.3569	0.3475	0.3757	0.4039	0.4226	0.4414	(22b)
Effective ac	0.6147	0.6103	0.6059	0.5854	0.5816	0.5637	0.5637	0.5604	0.5706	0.5816	0.5893	0.5974	(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	
Solid front door			2.1400	1.1000	2.3540			(26)
Windows (Uw = 1.30)			13.4900	1.2357	16.6702			(27)
Ground floor			25.1200	0.1300	3.2656	0.0000	0.0000	(28a)
Exposed floor			18.5100	0.2000	3.7020	20.0000	370.2000	(28b)
Brick wall	125.7900	15.6300	110.1600	0.1900	20.9304	110.0000	12117.6000	(29a)
Retaining wall	13.0200		13.0200	0.1800	2.3436	110.0000	1432.2000	(29a)
Garage wall	23.0300		23.0300	0.1400	3.2242	110.0000	2533.3000	(29a)
Plane roof	43.6300		43.6300	0.0900	3.9267	9.0000	392.6700	(30)
Total net area of external elements Aum(A, m2)			249.1000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.4167			(33)
Party Wall 1			61.4900	0.0000	0.0000	140.0000	8608.6000	(32)
Internal Wall			168.1300			9.0000	1513.1700	(32c)
Internal Floor 1			68.7600			18.0000	1237.6800	(32d)
Internal Ceiling 1			68.7600			9.0000	618.8400	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 28824.2600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 256.4892 (35)

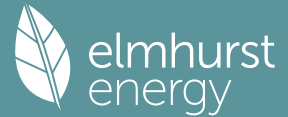
List of Thermal Bridges	Length	Psi-value	Total	
K1 Element	10.7500	0.0240	0.2580	
E2 Other lintels (including other steel lintels)	7.9200	0.0220	0.1742	
E3 Sill	30.3000	0.0170	0.5151	
E4 Jamb	25.2500	0.0920	2.3230	
E5 Ground floor (normal)	34.0600	0.0010	0.0341	
E6 Intermediate floor within a dwelling	7.5700	0.0600	0.4542	
E10 Eaves (insulation at ceiling level)	11.5800	0.0560	0.6485	
E12 Gable (insulation at ceiling level)	23.6400	0.0460	1.0874	
E16 Corner (normal)	7.8800	-0.0880	-0.6934	
E17 Corner (inverted - internal area greater than external area)	10.3400	0.0690	0.7135	
E20 Exposed floor (normal)	8.0800	0.3200	2.5856	
E21 Exposed floor (inverted)	15.7600	0.0380	0.5989	
E18 Party wall between dwellings	3.1900	0.0860	0.2743	
P1 Party wall - Ground floor	13.9200	0.0000	0.0000	
P2 Party wall - Intermediate floor within a dwelling	10.0100	0.1010	1.0110	
P4 Party wall - Roof (insulation at ceiling level)	2.8500	0.0000	0.0000	
E17 Corner (inverted - internal area greater than external area)	6.1000	0.4800	2.9280	
P7 Party Wall - Exposed floor (normal)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			12.9124	(36)
Point Thermal Bridges			0.0000	(36a) =
Total fabric heat loss			69.3290	(33) + (36) + (36a) = (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	59.0421	58.6142	58.1948	56.2249	55.8563	54.1406	54.1406	53.8229	54.8015	55.8563	56.6019	57.3814	(38)
Average = Sum(39)m / 12 =	128.3711	127.9432	127.5238	125.5539	125.1854	123.4697	123.4697	123.1519	124.1305	125.1854	125.9310	126.7104	(39)
												125.5522	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1423	1.1385	1.1348	1.1172	1.1139	1.0987	1.0987	1.0959	1.1046	1.1139	1.1206	1.1275	(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													2.8284	(42)
Hot water usage for mixer showers														
	71.6425	70.5658	68.9969	65.9952	63.7799	61.3095	59.9053	61.4623	63.1691	65.8216	68.8879	71.3680	(42a)	
Hot water usage for baths														
	30.9318	30.4725	29.8255	28.6328	27.7396	26.7493	26.2144	26.8567	27.5562	28.6159	29.8332	30.8273	(42b)	
Hot water usage for other uses														
	43.5955	42.0102	40.4249	38.8396	37.2543	35.6690	35.6690	37.2543	38.8396	40.4249	42.0102	43.5955	(42c)	
Average daily hot water use (litres/day)													134.3629	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Energy conte	146.1698	143.0485	139.2474	133.4675	128.7739	123.7278	121.7887	125.5734	129.5649	134.8623	140.7312	145.7907	(44)	
Energy content (annual)	231.4972	203.6991	214.0180	182.7104	173.3544	152.1378	147.2929	155.4861	159.7664	183.0069	200.4974	228.2730	(45)	
Distribution loss (46)m = 0.15 x (45)m													2231.7397	
	34.7246	30.5549	32.1027	27.4066	26.0032	22.8207	22.0939	23.3229	23.9650	27.4510	30.0746	34.2410	(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	2.5154	2.3341	2.6070	2.4262	2.4566	2.3018	2.2828	2.2979	2.2400	2.3817	2.3857	2.4968	(61)	
Total heat required for water heating calculated for each month	234.0126	206.0332	216.6250	185.1366	175.8110	154.4396	149.5756	157.7840	162.0065	185.3886	202.8832	230.7698	(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)	

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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)
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	234.0126	206.0332	216.6250	185.1366	175.8110	154.4396	149.5756	157.7840	162.0065	185.3886	202.8832	230.7698	(64)
Total per year (kWh/year) = Sum(64)m =													2260.4657 (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	77.6017	68.3135	71.8127	61.3578	58.2545	51.1613	49.5456	52.2736	53.6824	61.4452	67.2618	76.5250	(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	169.7029	169.7029	169.7029	169.7029	169.7029	169.7029	169.7029	169.7029	169.7029	169.7029	169.7029	169.7029	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	35.7888	31.7873	25.8511	19.5710	14.6295	12.3509	13.3456	17.3471	23.2832	29.5633	34.5048	36.7834	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	410.3463	414.6044	403.8741	381.0306	352.1947	325.0931	306.9875	302.7294	313.4597	336.3032	365.1391	392.2407	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7987	54.7987	54.7987	54.7987	54.7987	54.7987	54.7987	54.7987	54.7987	54.7987	54.7987	54.7987	(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)	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	-113.1353	(71)
Water heating gains (Table 5)	104.3033	101.6570	96.5225	85.2191	78.2990	71.0573	66.5935	70.2602	74.5588	82.5877	93.4192	102.8562	(72)
Total internal gains	664.8047	662.4150	640.6141	600.1870	559.4896	519.8676	498.2929	501.7030	522.6680	562.8205	607.4294	646.2467	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
East				7.2100	19.6403	0.7300	0.7000	0.7700	50.1460	(76)			
South				1.4200	46.7521	0.7300	0.7000	0.7700	23.5095	(78)			
West				4.8600	19.6403	0.7300	0.7000	0.7700	33.8016	(80)			
Solar gains	107.4572	202.7220	319.4914	449.8614	541.1516	550.4233	525.4162	457.4163	365.7736	236.3888	132.5397	89.3489	(83)
Total gains	772.2619	865.1369	960.1055	1050.0484	1100.6412	1070.2908	1023.7091	959.1193	888.4416	799.2093	739.9691	735.5955	(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	62.3718	62.5804	62.7862	63.7713	63.9591	64.8478	64.8478	65.0151	64.5026	63.9591	63.5804	63.1893	
alpha	5.1581	5.1720	5.1857	5.2514	5.2639	5.3232	5.3232	5.3343	5.3002	5.2639	5.2387	5.2126	
util living area	0.9967	0.9934	0.9837	0.9507	0.8630	0.6933	0.5220	0.5755	0.8255	0.9689	0.9936	0.9974	(86)
MIT	20.4982	20.5392	20.6087	20.7005	20.7729	20.8139	20.8232	20.8222	20.7955	20.6993	20.5840	20.4943	(87)
Th 2	19.9664	19.9695	19.9726	19.9868	19.9895	20.0019	20.0019	20.0042	19.9971	19.9895	19.9841	19.9784	(88)
util rest of house	0.9956	0.9912	0.9778	0.9325	0.8146	0.6032	0.4082	0.4587	0.7502	0.9539	0.9910	0.9965	(89)
MIT 2	19.3622	19.4172	19.5082	19.6351	19.7202	19.7713	19.7771	19.7793	19.7522	19.6381	19.4883	19.3683	(90)
Living area fraction									fLA = Living area / (4) =			0.1830	(91)
MIT	19.5701	19.6226	19.7096	19.8301	19.9129	19.9621	19.9686	19.9702	19.9431	19.8324	19.6888	19.5744	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.4201	19.4726	19.5596	19.6801	19.7629	19.8121	19.8186	19.8202	19.7931	19.6824	19.5388	19.4244	(93)

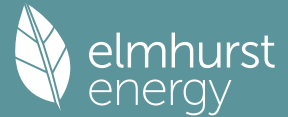
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9948	0.9898	0.9748	0.9257	0.8019	0.5846	0.3866	0.4361	0.7321	0.9478	0.9895	0.9959	(94)
Useful gains	768.2406	856.3195	935.9307	972.0150	882.5738	625.7149	395.8108	418.2578	650.4040	757.5002	732.2183	732.5991	(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	1940.9848	1864.4621	1665.4151	1353.4821	1009.3555	643.5378	397.3933	421.2044	706.6922	1136.9776	1566.4358	1929.0949	(97)
Space heating kWh	872.5217	677.4719	542.7364	274.6563	94.3256	0.0000	0.0000	0.0000	0.0000	282.3312	600.6366	890.1929	(98a)
Space heating requirement - total per year (kWh/year)													4234.8726
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	872.5217	677.4719	542.7364	274.6563	94.3256	0.0000	0.0000	0.0000	0.0000	282.3312	600.6366	890.1929	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)													4234.8726
Space heating per m2													(98c) / (4) = 37.6835 (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 %)												88.6000 (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	872.5217	677.4719	542.7364	274.6563	94.3256	0.0000	0.0000	0.0000	0.0000	282.3312	600.6366	890.1929 (98)

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Space heating efficiency (main heating system 1)	88.6000	88.6000	88.6000	88.6000	88.6000	0.0000	0.0000	0.0000	0.0000	88.6000	88.6000	88.6000	(210)
Space heating fuel (main heating system)	984.7875	764.6409	612.5693	309.9958	106.4623	0.0000	0.0000	0.0000	0.0000	318.6582	677.9194	1004.7324	(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	234.0126	206.0332	216.6250	185.1366	175.8110	154.4396	149.5756	157.7840	162.0065	185.3886	202.8832	230.7698	(64)
Efficiency of water heater	86.5309	86.3239	85.8316	84.7420	82.5272	79.6000	79.6000	79.6000	79.6000	84.7997	86.1408	86.5846	(216)
Fuel for water heating, kWh/month	270.4381	238.6746	252.3839	218.4708	213.0340	194.0196	187.9091	198.2211	203.5257	218.6195	235.5250	266.5252	(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	31.3257	25.1306	22.6274	16.5778	12.8051	10.4619	11.6813	15.1838	19.7222	25.8766	29.2276	32.1963	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-33.2922	-51.8822	-82.7170	-100.1762	-111.7310	-105.2964	-103.4832	-95.5492	-81.1852	-62.1962	-37.9098	-27.9634	(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)	-14.6928	-35.7412	-84.9074	-148.4227	-214.1785	-222.3327	-216.8062	-172.1400	-111.3822	-54.9785	-20.5365	-11.1379	(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												4779.7659	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.6000	
Water heating fuel used												2697.3465	(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)												252.8163	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2200.6387	(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												5615.2901	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4779.7659	3.6400	173.9835 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2697.3465	3.6400	98.1834 (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	252.8163	16.4900	41.6894 (250)
Additional standing charges			92.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-893.3820	16.4900	-147.3187
PV Unit electricity exported	-1307.2566	5.5900	-73.0756
Total			-220.3943 (252)
Total energy cost			199.6434 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)		0.4567 (257)
SAP value		92.5973
SAP rating (Section 12)		93 (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	4779.7659	0.2100	1003.7508 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2697.3465	0.2100	566.4428 (264)
Space and water heating			1570.1936 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	252.8163	0.1443	36.4892 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-893.3820	0.1331	-118.9266
PV Unit electricity exported	-1307.2566	0.1223	-159.8935

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Total
Total CO₂, kg/year -278.8201 (269)
CO₂ emissions per m² 1339.7920 (272)
EI value 11.9200 (273)
EI rating 88.5924
EI band 89 (274)
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	25.1200 (1b)	x 2.8500 (2b)	= 71.5920 (1b)	- (3b)
First floor	43.6300 (1c)	x 2.4000 (2c)	= 104.7120 (1c)	- (3c)
Second floor	43.6300 (1d)	x 2.6300 (2d)	= 114.7469 (1d)	- (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.3800			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 291.0509	(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	6 * 10 =	60.0000 (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) =	60.0000 / (5) =	0.2061 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	4.0000	(17)
Infiltration rate	0.4061	(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) =	0.3757 (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	0.4790	0.4696	0.4602	0.4133	0.4039	0.3569	0.3569	0.3475	0.3757	0.4039	0.4226	0.4414	(22b)
Effective ac	0.6147	0.6103	0.6059	0.5854	0.5816	0.5637	0.5637	0.5604	0.5706	0.5816	0.5893	0.5974	(25)

3. Heat losses and heat loss parameter

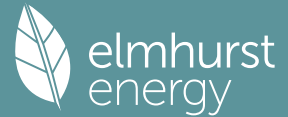
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K	
Solid front door			2.1400	1.1000	2.3540			(26)
Windows (Uw = 1.30)			13.4900	1.2357	16.6702			(27)
Ground floor			25.1200	0.1300	3.2656	0.0000	0.0000	(28a)
Exposed floor			18.5100	0.2000	3.7020	20.0000	370.2000	(28b)
Brick wall	125.7900	15.6300	110.1600	0.1900	20.9304	110.0000	12117.6000	(29a)
Retaining wall	13.0200		13.0200	0.1800	2.3436	110.0000	1432.2000	(29a)
Garage wall	23.0300		23.0300	0.1400	3.2242	110.0000	2533.3000	(29a)
Plane roof	43.6300		43.6300	0.0900	3.9267	9.0000	392.6700	(30)
Total net area of external elements Aum(A, m ²)			249.1000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.4167			(33)
Party Wall 1			61.4900	0.0000	0.0000	140.0000	8608.6000	(32)
Internal Wall			168.1300			9.0000	1513.1700	(32c)
Internal Floor 1			68.7600			18.0000	1237.6800	(32d)
Internal Ceiling 1			68.7600			9.0000	618.8400	(32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
(28)...(30) + (32) + (32a)...(32e) = 28824.2600 (34)
256.4892 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	10.7500	0.0240	0.2580
E3 Sill	7.9200	0.0220	0.1742
E4 Jamb	30.3000	0.0170	0.5151
E5 Ground floor (normal)	25.2500	0.0920	2.3230
E6 Intermediate floor within a dwelling	34.0600	0.0010	0.0341
E10 Eaves (insulation at ceiling level)	7.5700	0.0600	0.4542
E12 Gable (insulation at ceiling level)	11.5800	0.0560	0.6485
E16 Corner (normal)	23.6400	0.0460	1.0874
E17 Corner (inverted - internal area greater than external area)	7.8800	-0.0880	-0.6934
E20 Exposed floor (normal)	10.3400	0.0690	0.7135
E21 Exposed floor (inverted)	8.0800	0.3200	2.5856
E18 Party wall between dwellings	15.7600	0.0380	0.5989
P1 Party wall - Ground floor	3.1900	0.0860	0.2743
P2 Party wall - Intermediate floor within a dwelling	13.9200	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	10.0100	0.1010	1.0110
E17 Corner (inverted - internal area greater than external area)	2.8500	0.0000	0.0000

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P7 Party Wall - Exposed floor (normal) 6.1000 0.4800 2.9280
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.9124 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 69.3290 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)
 (38)m Jan 59.0421 Feb 58.6142 Mar 58.1948 Apr 56.2249 May 55.8563 Jun 54.1406 Jul 54.1406 Aug 53.8229 Sep 54.8015 Oct 55.8563 Nov 56.6019 Dec 57.3814 (38)
 Heat transfer coeff 128.3711 127.9432 127.5238 125.5539 125.1854 123.4697 123.4697 123.1519 124.1305 125.1854 125.9310 126.7104 (39)
 Average = Sum(39)m / 12 = 125.5522

HLP Jan 1.1423 Feb 1.1385 Mar 1.1348 Apr 1.1172 May 1.1139 Jun 1.0987 Jul 1.0987 Aug 1.0959 Sep 1.1046 Oct 1.1139 Nov 1.1206 Dec 1.1275 (40)
 HLP (average) 1.1172
 Days in mont 31 28 31 30 31 30 31 31 30 31 30 31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8284 (42)
 Hot water usage for mixer showers 71.6425 70.5658 68.9969 65.9952 63.7799 61.3095 59.9053 61.4623 63.1691 65.8216 68.8879 71.3680 (42a)
 Hot water usage for baths 30.9318 30.4725 29.8255 28.6328 27.7396 26.7493 26.2144 26.8567 27.5562 28.6159 29.8332 30.8273 (42b)
 Hot water usage for other uses 43.5955 42.0102 40.4249 38.8396 37.2543 35.6690 35.6690 37.2543 38.8396 40.4249 42.0102 43.5955 (42c)
 Average daily hot water use (litres/day) 134.3629 (43)
 Daily hot water use Jan 146.1698 Feb 143.0485 Mar 139.2474 Apr 133.4675 May 128.7739 Jun 123.7278 Jul 121.7887 Aug 125.5734 Sep 129.5649 Oct 134.8623 Nov 140.7312 Dec 145.7907 (44)
 Energy conte 231.4972 203.6991 214.0180 182.7104 173.3544 152.1378 147.2929 155.4861 159.7664 183.0069 200.4974 228.2730 (45)
 Energy content (annual) Total = Sum(45)m = 2231.7397
 Distribution loss (46)m = 0.15 x (45)m 34.7246 30.5549 32.1027 27.4066 26.0032 22.8207 22.0939 23.3229 23.9650 27.4510 30.0746 34.2410 (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 2.5154 2.3341 2.6070 2.4262 2.4566 2.3018 2.2828 2.2979 2.2400 2.3817 2.3857 2.4968 (61)
 Total heat required for water heating calculated for each month 234.0126 206.0332 216.6250 185.1366 175.8110 154.4396 149.5756 157.7840 162.0065 185.3886 202.8832 230.7698 (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 234.0126 206.0332 216.6250 185.1366 175.8110 154.4396 149.5756 157.7840 162.0065 185.3886 202.8832 230.7698 (64)
 Total per year (kWh/year) = Sum(64)m = 2260.4657 (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 77.6017 68.3135 71.8127 61.3578 58.2545 51.1613 49.5456 52.2736 53.6824 61.4452 67.2618 76.5250 (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 169.7029 169.7029 169.7029 169.7029 169.7029 169.7029 169.7029 169.7029 169.7029 169.7029 169.7029 (66)
 Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 35.7888 31.7873 25.8511 19.5710 14.6295 12.3509 13.3456 17.3471 23.2832 29.5633 34.5048 36.7834 (67)
 Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 410.3463 414.6044 403.8741 381.0306 352.1947 325.0931 306.9875 302.7294 313.4597 336.3032 365.1391 392.2407 (68)
 Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 54.7987 54.7987 54.7987 54.7987 54.7987 54.7987 54.7987 54.7987 54.7987 54.7987 54.7987 (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) -113.1353 -113.1353 -113.1353 -113.1353 -113.1353 -113.1353 -113.1353 -113.1353 -113.1353 -113.1353 -113.1353 (71)
 Water heating gains (Table 5) 104.3033 101.6570 96.5225 85.2191 78.2990 71.0573 66.5935 70.2602 74.5588 82.5877 93.4192 102.8562 (72)
 Total internal gains 664.8047 662.4150 640.6141 600.1870 559.4896 519.8676 498.2929 501.7030 522.6680 562.8205 607.4294 646.2467 (73)

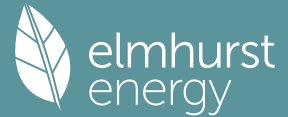
6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
East	7.2100	19.6403	0.7300	0.7000	0.7700	50.1460 (76)						
South	1.4200	46.7521	0.7300	0.7000	0.7700	23.5095 (78)						
West	4.8600	19.6403	0.7300	0.7000	0.7700	33.8016 (80)						
Solar gains	107.4572	202.7220	319.4914	449.8614	541.1516	550.4233	525.4162	457.4163	365.7736	236.3888	132.5397	89.3489 (83)
Total gains	772.2619	865.1369	960.1055	1050.0484	1100.6412	1070.2908	1023.7091	959.1193	888.4416	799.2093	739.9691	735.5955 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
 Utilisation factor for gains for living area, nil,m (see Table 9a)
 tau Jan 62.3718 Feb 62.5804 Mar 62.7862 Apr 63.7713 May 63.9591 Jun 64.8478 Jul 64.8478 Aug 65.0151 Sep 64.5026 Oct 63.9591 Nov 63.5804 Dec 63.1893
 alpha 5.1581 5.1720 5.1857 5.2514 5.2639 5.3232 5.3232 5.3343 5.3002 5.2639 5.2387 5.2126
 util living area

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	0.9967	0.9934	0.9837	0.9507	0.8630	0.6933	0.5220	0.5755	0.8255	0.9689	0.9936	0.9974 (86)
MIT	20.4982	20.5392	20.6087	20.7005	20.7729	20.8139	20.8232	20.8222	20.7955	20.6993	20.5840	20.4943 (87)
Th 2	19.9664	19.9695	19.9726	19.9868	19.9895	20.0019	20.0019	20.0042	19.9971	19.9895	19.9841	19.9784 (88)
util rest of house												
	0.9956	0.9912	0.9778	0.9325	0.8146	0.6032	0.4082	0.4587	0.7502	0.9539	0.9910	0.9965 (89)
MIT 2	19.3622	19.4172	19.5082	19.6351	19.7202	19.7713	19.7771	19.7793	19.7522	19.6381	19.4883	19.3683 (90)
Living area fraction									FLA = Living area / (4) =			0.1830 (91)
MIT	19.5701	19.6226	19.7096	19.8301	19.9129	19.9621	19.9686	19.9702	19.9431	19.8324	19.6888	19.5744 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.4201	19.4726	19.5596	19.6801	19.7629	19.8121	19.8186	19.8202	19.7931	19.6824	19.5388	19.4244 (93)

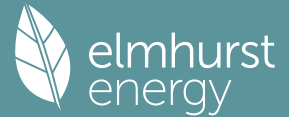
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9948	0.9898	0.9748	0.9257	0.8019	0.5846	0.3866	0.4361	0.7321	0.9478	0.9895	0.9959 (94)
Useful gains	768.2406	856.3195	935.9307	972.0150	882.5738	625.7149	395.8108	418.2578	650.4040	757.5002	732.2183	732.5991 (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	1940.9848	1864.4621	1665.4151	1353.4821	1009.3555	643.5378	397.3933	421.2044	706.6922	1136.9776	1566.4358	1929.0949 (97)
Space heating kWh	872.5217	677.4719	542.7364	274.6563	94.3256	0.0000	0.0000	0.0000	0.0000	282.3312	600.6366	890.1929 (98a)
Space heating requirement - total per year (kWh/year)												4234.8726
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	872.5217	677.4719	542.7364	274.6563	94.3256	0.0000	0.0000	0.0000	0.0000	282.3312	600.6366	890.1929 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4234.8726
Space heating per m2										(98c) / (4) =		37.6835 (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 %)												88.6000 (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	872.5217	677.4719	542.7364	274.6563	94.3256	0.0000	0.0000	0.0000	0.0000	282.3312	600.6366	890.1929 (98)
Space heating efficiency (main heating system 1)	88.6000	88.6000	88.6000	88.6000	88.6000	0.0000	0.0000	0.0000	0.0000	88.6000	88.6000	88.6000 (210)
Space heating fuel (main heating system)	984.7875	764.6409	612.5693	309.9958	106.4623	0.0000	0.0000	0.0000	0.0000	318.6582	677.9194	1004.7324 (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	234.0126	206.0332	216.6250	185.1366	175.8110	154.4396	149.5756	157.7840	162.0065	185.3886	202.8832	230.7698 (64)
Efficiency of water heater (217)m	86.5309	86.3239	85.8316	84.7420	82.5272	79.6000	79.6000	79.6000	79.6000	84.7997	86.1408	79.6000 (216)
Fuel for water heating, kWh/month	270.4381	238.6746	252.3839	218.4708	213.0340	194.0196	187.9091	198.2211	203.5257	218.6195	235.5250	266.5252 (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	31.3257	25.1306	22.6274	16.5778	12.8051	10.4619	11.6813	15.1838	19.7222	25.8766	29.2276	32.1963 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-33.2922	-51.8822	-82.7170	-100.1762	-111.7310	-105.2964	-103.4832	-95.5492	-81.1852	-62.1962	-37.9098	-27.9634 (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)	-14.6928	-35.7412	-84.9074	-148.4227	-214.1785	-222.3327	-216.8062	-172.1400	-111.3822	-54.9785	-20.5365	-11.1379 (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												4779.7659 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												79.6000
Water heating fuel used												2697.3465 (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)												252.8163 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-2200.6387 (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												5615.2901 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4779.7659	5.6000	267.6669 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2697.3465	5.6000	151.0514 (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	252.8163	26.0600	65.8839 (250)
Additional standing charges			99.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-893.3820	26.0600	-232.8154
PV Unit electricity exported	-1307.2566	5.8100	-75.9516
Total			-308.7670 (252)
Total energy cost			297.2469 (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	4779.7659	0.2100	1003.7508 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2697.3465	0.2100	566.4428 (264)
Space and water heating			1570.1936 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	252.8163	0.1443	36.4892 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-893.3820	0.1331	-118.9266
PV Unit electricity exported	-1307.2566	0.1223	-159.8935
Total			-278.8201 (269)
Total CO2, kg/year			1339.7920 (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	4779.7659	1.1300	5401.1355 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2697.3465	1.1300	3048.0016 (278)
Space and water heating			8449.1370 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	252.8163	1.5338	387.7781 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-893.3820	1.4919	-1332.8480
PV Unit electricity exported	-1307.2566	0.4488	-586.6928
Total			-1919.5408 (283)
Total Primary energy kWh/year			7047.4751 (286)

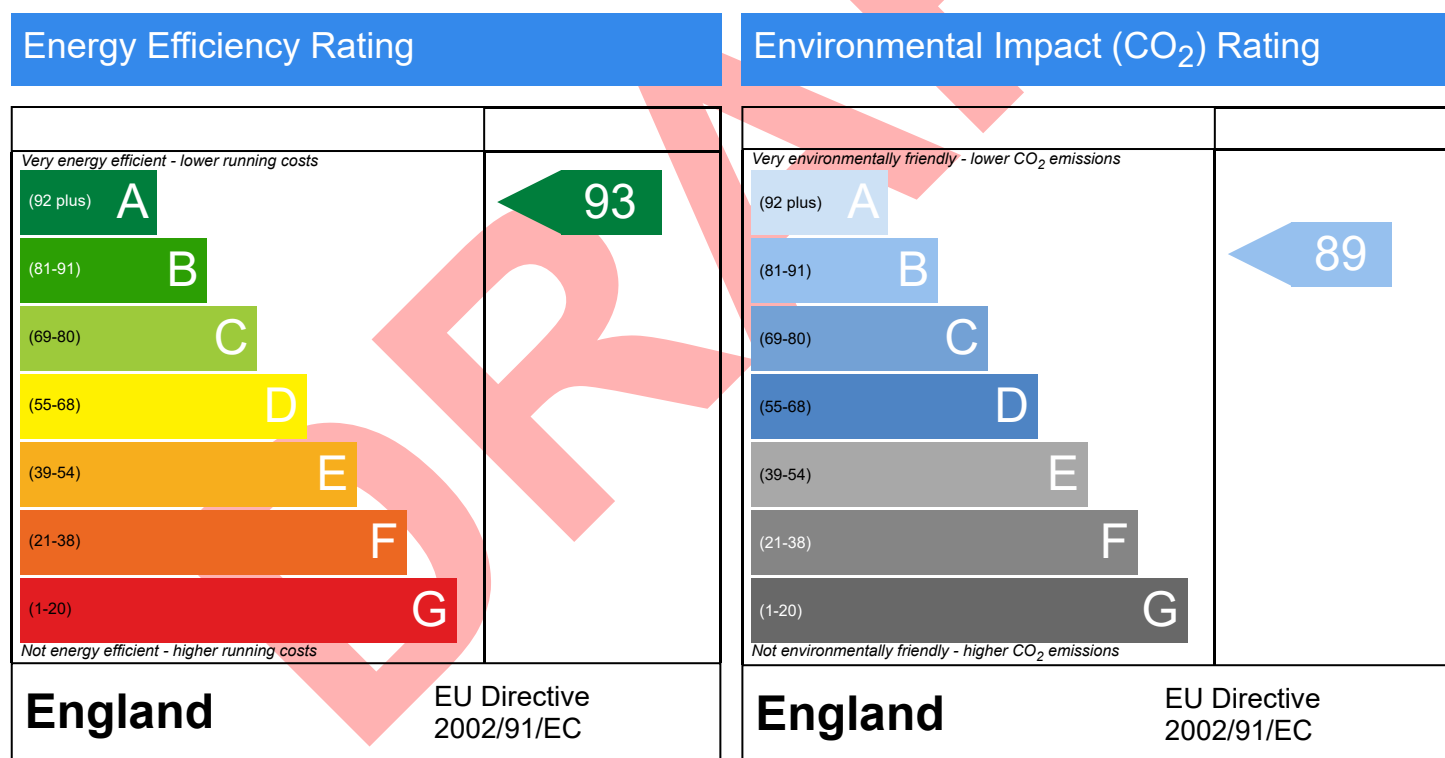
Predicted Energy Assessment



Dwelling type: House, Semi-Detached
Date of assessment: 15/11/2024
Produced by: Victoria Gartside
Total floor area: 130.89 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.