

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 10:34:24

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

Dwelling Details			
Assessment Type	As designed	Total Floor Area	127 m ²
Site Reference	SAP VG 21-0282	Plot Reference	Plot 56
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	12.63 kgCO ₂ /m ²	
Dwelling carbon dioxide emission rate	12.58 kgCO ₂ /m ²	OK

1b Target primary energy rate and dwelling primary energy		
Target primary energy	66.37 kWh _{PE} /m ²	
Dwelling primary energy	66.32 kWh _{PE} /m ²	OK

1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	47.1 kWh/m ²	
Dwelling fabric energy efficiency	42.2 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	N/A	N/A	N/A
Curtain walls	1.6	N/A	N/A	N/A
Floors	0.18	0.13	Ground floor (0.13)	OK
Roofs	0.16	0.09	Roof (1) (0.09)	OK
Windows, doors, and roof windows	1.6	1.28	Front windows render (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)	159.91	0.19
Exposed wall: Walls (2)	12.22	0.18
Exposed wall: Walls (3)	15.59	0.18
Sheltered wall: Walls (4)	21.15	0.14 (!)
Ground floor: Ground floor , Ground floor	48.4	0.13
Exposed roof: Roof (1)	48.4	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 render, Windows	4.88	West	0.7	1.3
Front windows brick, Windows	2.64	West	0.7	1.3
Side windows brick, Windows	1.42	North	0.7	1.3
Rear windows brick, Windows	8.02	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	0.085	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	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))			
Maximum permitted air permeability at 50Pa	8 m ³ /hm ²		
Dwelling air permeability at 50Pa	4 m ³ /hm ² , Design value		OK
Air permeability test certificate reference			

4 Space heating	
Main heating system 1: Boiler with radiators or underfloor heating - Mains gas	
Efficiency	88.6%
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		
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 56	Prop Type Ref	SAP VG 21-0282
Property			

SAP Rating	92 A	DER	12.58	TER	12.63
Environmental	88 B	% DER < TER			0.40
CO ₂ Emissions (t/year)	1.55	DFEE	42.24	TFEE	47.14
Compliance Check	See BREL	% DFEE < TFEE			10.39
% DPER < TPER	0.08	DPER	66.32	TPER	66.37

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, 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	0	
5.0 Sunlight/Shade	Average or unknown	
6.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	237.63	kJ/m²K
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:	27.04 m	30.55 m ²	17.85 m ²	2.85 m
1st Storey:	30.18 m	48.40 m ²		2.40 m
2nd Storey:	30.18 m	48.40 m ²		2.60 m

8.0 Living Area	14.54	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	174.13	159.91	0.00	None	14.22	Enter Gross Area
	Render wall	Cavity Wall	Cavity wall; plasterboard on dabs or battens, lightweight aggregate block, filled cavity, any outside structure	0.18	110.00	17.10	12.22	0.00	None	4.88	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	15.59	15.59	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	21.15	21.15	0.55	Garage Single 2 Inside	0.00	Enter Gross Area

9.2 Internal Walls	Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
	Internal Wall	Dense block, plasterboard on dabs	75.00	34.48
	Internal Wall	Plasterboard on timber frame	9.00	183.48

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

Plane roof	External Plane Roof	Plasterboard, insulated at ceiling level	0.09	9.00	48.40	48.40	None	0.00	Enter Gross Area	0.00
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10.2 Internal Ceilings

Description	Storey	Construction	Area (m²)
Internal Ceiling 1	Lowest occupied	Plasterboard ceiling, carpeted chipboard floor	48.40
Internal Ceiling 2	+1	Plasterboard ceiling, carpeted chipboard floor	48.40

11.0 Heat Loss Floors

Description	Type	Storey Index	Construction	U-Value (W/m²K)	Shelter Code	Shelter Factor	Kappa (kJ/m²K)	Area (m²)
Ground floor	Ground Floor - Solid	Lowest occupied	Other	0.13	None	0.00	0.00	48.40

11.2 Internal Floors

Description	Storey Index	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1		Plasterboard ceiling, carpeted chipboard floor	9.00	48.40
Internal Floor 2		Plasterboard ceiling, carpeted chipboard floor	9.00	48.40

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)
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 (m²)	Pitch
Front door	Solid front door	Brick wall	West	2.14	0
Front windows render	Windows	Render wall	West	4.88	0
Front windows brick	Windows	Brick wall	West	2.64	0
Side windows brick	Windows	Brick wall	North	1.42	0
Rear windows brick	Windows	Brick wall	East	8.02	0

14.0 Conservatory

15.0 Draught Proofing

 %

16.0 Draught Lobby

17.0 Thermal Bridging

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E2 Other lintels (including other steel lintels)	Independently assessed	13.47	0.02	0.02 MFF-150-E2-02	No
E3 Sill	Independently assessed	10.64	0.02	0.02 MFF-150-E3-01	No
E4 Jamb	Independently assessed	32.40	0.02	0.02 MFF-150-E4-01	No
E5 Ground floor (normal)	Independently assessed	30.18	0.09	0.09 Manufacturer Declaration	No
E6 Intermediate floor within a dwelling	Independently assessed	49.80	0.00	0.00 MFF-150-E6-01	No
E10 Eaves (insulation at ceiling level)	Independently assessed	10.98	0.06	0.06 MFF-150-E10-01	No
E12 Gable (insulation at ceiling level)	Independently assessed	18.88	0.06	0.06 MFF-150-E12-01	No
E16 Corner (normal)	Independently assessed	34.25	0.05	0.05 MFF-150-E16-01	No
E17 Corner (inverted – internal area greater than external area)	Independently assessed	7.85	-0.09	-0.09 MFF-150-E17-01	No
E20 Exposed floor (normal)	Independently assessed	10.56	0.07	0.07 MFF-150-E20-01	No
E21 Exposed floor (inverted)	Table K1 - Default	7.42	0.32	0.32	No

Y-value	0.03	W/m²K
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19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present	No
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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	5
Number of passive vents	0
Number of flueless gas fires	0

21.0 Fixed Cooling System

22.0 Pressure Testing

Summary for Input Data

Designed AP ₅₀	4.00	m ² /(h.m ²) @ 50 Pa
Property Tested?	Yes	
Test Method	Blower Door	

22.0 Lighting

No Fixed Lighting	No				
	Name Lighting 1	Efficacy 85.00	Power 10.00	Capacity 850.00	Count 29

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

26.0 Heat Networks

	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

28.0 Water Heating

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
Solar Panel	No
Water use <= 125 litres/person/day	Yes
Summer Immersion	No

Summary for Input Data

Cold Water Source	From mains
Bath Count	1
Supplementary Immersion	No
Immersion Only Heating Hot Water	No

28.1 Showers

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

28.3 Waste Water Heat Recovery System

29.0 Hot Water Cylinder

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

31.0 Thermal Store

None

32.0 Photovoltaic Unit

	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		

34.0 Small-scale Hydro

	None
Electricity Generated	0.00
Apportioned	0.00
Connected to dwelling's electricity meter	Yes
Electricity Generation	Annual

kWh/Year

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

Full SAP Calculation Printout



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Property						
SAP Rating	92 A	DER	12.58	TER	12.63	
Environmental	88 B	% DER < TER				0.40
CO ₂ Emissions (t/year)	1.55	DFEE	42.24	TFEE	47.14	
Compliance Check	See BREL	% DFEE < TFEE				10.39
% DPER < TPER	0.08	DPER	66.32	TPER	66.37	
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	30.5500 (1b)	x 2.8500 (2b)	= 87.0675 (1b) - (3b)
First floor	48.4000 (1c)	x 2.4000 (2c)	= 116.1600 (1c) - (3c)
Second floor	48.4000 (1d)	x 2.6000 (2d)	= 125.8400 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.3500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	329.0675 (5)

2. Ventilation rate

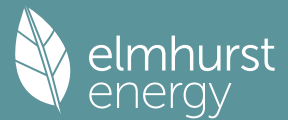
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	5 * 10 = 50.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) = 0.1519 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.3519 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3519 (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	0.4487	0.4399	0.4311	0.3871	0.3783	0.3343	0.3343	0.3255	0.3519	0.3783	0.3959	0.4135 (22b)
Effective ac	0.6007	0.5968	0.5929	0.5749	0.5716	0.5559	0.5559	0.5530	0.5619	0.5716	0.5784	0.5855 (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)			16.9600	1.2357	20.9582		(27)
Ground floor			48.4000	0.1300	6.2920	0.0000	0.0000 (28a)
Brick wall	174.1300	14.2200	159.9100	0.1900	30.3829	110.0000	17590.1000 (29a)
Render wall	17.1000	4.8800	12.2200	0.1800	2.1996	110.0000	1344.2000 (29a)
Retaining wall	15.5900		15.5900	0.1800	2.8062	110.0000	1714.9000 (29a)
Garage wall	21.1500		21.1500	0.1400	2.9610	110.0000	2326.5000 (29a)
Plane roof	48.4000		48.4000	0.0900	4.3560	9.0000	435.6000 (30)
Total net area of external elements Aum(A, m ²)			324.7700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	72.3099		(33)
Internal Wall			34.4800			75.0000	2586.0000 (32c)
Internal Wall			183.4800			9.0000	1651.3200 (32c)
Internal Floor 1			48.4000			18.0000	871.2000 (32d)
Internal Floor 2			48.4000			18.0000	871.2000 (32d)
Internal Ceiling 1			48.4000			9.0000	435.6000 (32e)
Internal Ceiling 2			48.4000			9.0000	435.6000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	30262.2200 (34)

Full SAP Calculation Printout



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

237.6303 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	13.4700	0.0240	0.3233
E2 Other lintels (including other steel lintels)	10.6400	0.0220	0.2341
E3 Sill	32.4000	0.0170	0.5508
E4 Jamb	30.1800	0.0850	2.5653
E5 Ground floor (normal)	49.8000	0.0010	0.0498
E6 Intermediate floor within a dwelling	10.9800	0.0600	0.6588
E10 Eaves (insulation at ceiling level)	18.8800	0.0560	1.0573
E12 Gable (insulation at ceiling level)	34.2500	0.0460	1.5755
E16 Corner (normal)	7.8500	-0.0880	-0.6908
E17 Corner (inverted - internal area greater than external area)	10.5600	0.0690	0.7286
E20 Exposed floor (normal)	7.4200	0.3200	2.3744
E21 Exposed floor (inverted)			

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

9.4271 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 81.7370 (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	65.2291	64.8046	64.3884	62.4339	62.0682	60.3658	60.3658	60.0505	61.0215	62.0682	62.8080	63.5814
Heat transfer coeff	146.9661	146.5415	146.1254	144.1708	143.8051	142.1028	142.1028	141.7875	142.7585	143.8051	144.5449	145.3183
Average = Sum(39)m / 12 =												144.1691

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1540	1.1507	1.1474	1.1321	1.1292	1.1158	1.1158	1.1134	1.1210	1.1292	1.1350	1.1411
HLP (average)												1.1321
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8878 (42)
Hot water usage for mixer showers	72.6383	71.5467	69.9560	66.9125	64.6665	62.1617	60.7380	62.3167	64.0472	66.7365	69.8454	72.3600	(42a)
Hot water usage for baths	31.3601	30.8943	30.2385	29.0292	28.1237	27.1196	26.5773	27.2286	27.9377	29.0121	30.2462	31.2541	(42b)
Hot water usage for other uses	44.2037	42.5963	40.9889	39.3815	37.7741	36.1667	36.1667	37.7741	39.3815	40.9889	42.5963	44.2037	(42c)
Average daily hot water use (litres/day)													136.2310 (43)
Daily hot water use	148.2021	145.0373	141.1834	135.3232	130.5642	125.4480	123.4820	127.3193	131.3663	136.7375	142.6879	147.8178	(44)
Energy conte	234.7159	206.5312	216.9936	185.2507	175.7646	154.2530	149.3407	157.6479	161.9878	185.5514	203.2851	231.4469	(45)
Energy content (annual)										Total = Sum(45)m =		2262.7689	
Distribution loss (46)m = 0.15 x (45)m	35.2074	30.9797	32.5490	27.7876	26.3647	23.1379	22.4011	23.6472	24.2982	27.8327	30.4928	34.7170	(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	2.4597	2.2886	2.5634	2.3947	2.4310	2.2834	2.2665	2.2776	2.2157	2.3487	2.3433	2.4424	(61)
Total heat required for water heating calculated for each month	237.1756	208.8198	219.5570	187.6453	178.1955	156.5364	151.6072	159.9255	164.2036	187.9001	205.6285	233.8893	(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)
FV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	237.1756	208.8198	219.5570	187.6453	178.1955	156.5364	151.6072	159.9255	164.2036	187.9001	205.6285	233.8893	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2291.0838	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
													0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													
Heat gains from water heating, kWh/month	78.6580	69.2438	72.7912	62.1945	59.0495	51.8600	50.2224	52.9873	54.4149	62.2830	68.1781	77.5667	(65)

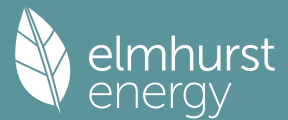
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	144.3888	144.3888	144.3888	144.3888	144.3888	144.3888	144.3888	144.3888	144.3888	144.3888	144.3888	144.3888	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	161.1118	178.3738	161.1118	166.4822	161.1118	166.4822	161.1118	161.1118	166.4822	161.1118	166.4822	161.1118	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.4975	297.5534	289.8525	273.4581	252.7632	233.3129	220.3189	217.2629	224.9638	241.3582	262.0531	281.5034	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4389	37.4389	37.4389	37.4389	37.4389	37.4389	37.4389	37.4389	37.4389	37.4389	37.4389	37.4389	(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)	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	(71)
Water heating gains (Table 5)	105.7231	103.0413	97.8377	86.3813	79.3675	72.0277	67.5032	71.2195	75.5762	83.7137	94.6919	104.2563	(72)
Total internal gains	630.6490	648.2852	618.1186	595.6382	562.5592	538.1394	515.2506	515.9109	533.3389	555.5004	592.5438	616.1882	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.4200	10.6334	0.7300	0.7000	0.7700	5.3471 (74)
East	8.0200	19.6403	0.7300	0.7000	0.7700	55.7797 (76)
West	7.5200	19.6403	0.7300	0.7000	0.7700	52.3021 (80)

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Solar gains	113.4288	221.6494	365.5603	535.7145	659.9284	677.3144	644.0903	550.8002	425.8438	263.0443	141.3615	93.3388 (83)
Total gains	744.0778	869.9345	983.6788	1131.3527	1222.4876	1215.4539	1159.3409	1066.7111	959.1827	818.5447	733.9054	709.5270 (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	57.1981	57.3638	57.5271	58.3070	58.4553	59.1556	59.1556	59.2871	58.8839	58.4553	58.1561	57.8466	
alpha	4.8132	4.8243	4.8351	4.8871	4.8970	4.9437	4.9437	4.9525	4.9256	4.8970	4.8771	4.8564	
util living area	0.9978	0.9949	0.9867	0.9541	0.8654	0.6936	0.5273	0.5895	0.8421	0.9756	0.9953	0.9982 (86)	
MIT	20.4324	20.4803	20.5563	20.6638	20.7489	20.7974	20.8090	20.8072	20.7723	20.6570	20.5287	20.4285 (87)	
Th 2	19.9570	19.9596	19.9623	19.9747	19.9770	19.9879	19.9879	19.9899	19.9837	19.9770	19.9723	19.9674 (88)	
util rest of house	0.9970	0.9932	0.9822	0.9377	0.8191	0.6046	0.4121	0.4707	0.7717	0.9640	0.9935	0.9977 (89)	
MIT 2	19.2715	19.3353	19.4343	19.5797	19.6803	19.7380	19.7457	19.7472	19.7135	19.5758	19.4090	19.2762 (90)	
Living area fraction	fLA = Living area / (4) =												0.1142 (91)
MIT	19.4041	19.4660	19.5624	19.7035	19.8023	19.8590	19.8671	19.8683	19.8344	19.6992	19.5369	19.4078 (92)	
Temperature adjustment													-0.1500
adjusted MIT	19.2541	19.3160	19.4124	19.5535	19.6523	19.7090	19.7171	19.7183	19.6844	19.5492	19.3869	19.2578 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9964	0.9918	0.9790	0.9292	0.8016	0.5776	0.3800	0.4368	0.7464	0.9573	0.9921	0.9971 (94)
Useful gains	741.3926	862.8122	963.0281	1051.2147	979.9142	701.9961	440.5892	465.8882	715.9137	783.6334	728.0886	707.5040 (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	2197.7378	2112.5424	1886.8330	1535.9210	1143.5845	726.0008	442.9495	470.4870	797.2202	1286.9469	1776.0044	2188.1749 (97)
Space heating kWh	1083.5209	839.8187	687.3108	348.9885	121.7708	0.0000	0.0000	0.0000	0.0000	374.4653	754.4994	1101.6192 (98a)
Space heating requirement - total per year (kWh/year)	5311.9935											
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	1083.5209	839.8187	687.3108	348.9885	121.7708	0.0000	0.0000	0.0000	0.0000	374.4653	754.4994	1101.6192 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	5311.9935											
Space heating per m2	(98c) / (4) = 41.7118 (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	1083.5209	839.8187	687.3108	348.9885	121.7708	0.0000	0.0000	0.0000	0.0000	374.4653	754.4994	1101.6192 (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)	1222.9355	947.8766	775.7458	393.8922	137.4388	0.0000	0.0000	0.0000	0.0000	422.6470	851.5794	1243.3625 (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	237.1756	208.8198	219.5570	187.6453	178.1955	156.5364	151.6072	159.9255	164.2036	187.9001	205.6285	233.8893 (64)
Efficiency of water heater	86.8368	86.6491	86.2393	85.2304	83.0236	79.6000	79.6000	79.6000	79.6000	85.3747	86.5053	86.8797 (216)
Fuel for water heating, kWh/month	273.1280	240.9948	254.5904	220.1625	214.6324	196.6537	190.4613	200.9114	206.2859	220.0887	237.7063	269.2106 (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	32.7916	26.3067	23.6862	17.3535	13.4044	10.9515	12.2279	15.8943	20.6451	27.0875	30.5953	33.7030 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-33.6764	-52.7456	-84.5806	-103.0886	-115.5550	-109.1009	-107.1813	-98.6430	-83.3805	-63.4278	-38.4235	-28.2578 (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)	-14.3086	-34.8779	-83.0438	-145.5103	-210.3545	-218.5281	-213.1081	-169.0461	-109.1869	-53.7470	-20.0229	-10.8435 (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												5995.4779 (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												2724.8261 (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)

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Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	264.6472 (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	6870.3125 (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	5995.4779	0.2100	1259.0504 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2724.8261	0.2100	572.2135 (264)
Space and water heating			1831.2638 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	264.6472	0.1443	38.1968 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-918.0611	0.1330	-122.1081
PV Unit electricity exported	-1282.5776	0.1223	-156.8016
Total			-278.9098 (269)
Total CO2, kg/year			1602.4801 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			12.5800 (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	5995.4779	1.1300	6774.8901 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2724.8261	1.1300	3079.0535 (278)
Space and water heating			9853.9435 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	264.6472	1.5338	405.9247 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-918.0611	1.4915	-1369.2774
PV Unit electricity exported	-1282.5776	0.4486	-575.3429
Total			-1944.6203 (283)
Total Primary energy kWh/year			8445.3488 (286)
Dwelling Primary energy Rate (DPER)			66.3200 (287)

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

1. Overall dwelling characteristics

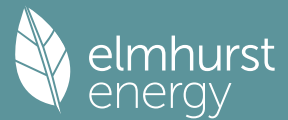
	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	30.5500 (1b)	x 2.8500 (2b)	= 87.0675 (1b) - (3b)
First floor	48.4000 (1c)	x 2.4000 (2c)	= 116.1600 (1c) - (3c)
Second floor	48.4000 (1d)	x 2.6000 (2d)	= 125.8400 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.3500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	329.0675 (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) = 0.1216 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3716 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3716 (21)

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

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Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4737	0.4644	0.4552	0.4087	0.3994	0.3530	0.3530	0.3437	0.3716	0.3994	0.4180	0.4366 (22b)
Effective ac	0.6122	0.6079	0.6036	0.5835	0.5798	0.5623	0.5623	0.5591	0.5690	0.5798	0.5874	0.5953 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1400	1.0000	2.1400		(26)
TER Opening Type (Uw = 1.20)			16.9600	1.1450	19.4198		(27)
Ground floor			48.4000	0.1300	6.2920		(28a)
Brick wall	174.1300	14.2200	159.9100	0.1800	28.7838		(29a)
Render wall	17.1000	4.8800	12.2200	0.1800	2.1996		(29a)
Retaining wall	15.5900		15.5900	0.1800	2.8062		(29a)
Garage wall	21.1500		21.1500	0.1800	3.8070		(29a)
Plane roof	48.4000		48.4000	0.1100	5.3240		(30)
Total net area of external elements Aum(A, m ²)			324.7700				(31)
Fabric heat loss, W/K = Sum (A x U)					70.7724		(33)

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

237.6303 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	13.4700	0.0500	0.6735
E3 Sill	10.6400	0.0500	0.5320
E4 Jamb	32.4000	0.0500	1.6200
E5 Ground floor (normal)	30.1800	0.1600	4.8288
E6 Intermediate floor within a dwelling	49.8000	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	10.9800	0.0600	0.6588
E12 Gable (insulation at ceiling level)	18.8800	0.0600	1.1328
E16 Corner (normal)	34.2500	0.0900	3.0825
E17 Corner (inverted - internal area greater than external area)	7.8500	-0.0900	-0.7065
E20 Exposed floor (normal)	10.5600	0.3200	3.3792
E21 Exposed floor (inverted)	7.4200	0.3200	2.3744

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

17.5755 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 88.3479 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	66.4815	66.0083	65.5445	63.3660	62.9584	61.0611	61.0611	60.7097	61.7919	62.9584	63.7830	64.6450 (38)
Heat transfer coeff	154.8294	154.3562	153.8924	151.7140	151.3064	149.4090	149.4090	149.0577	150.1399	151.3064	152.1309	152.9929 (39)
Average = Sum(39)m / 12 =												151.7120

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2158	1.2121	1.2084	1.1913	1.1881	1.1732	1.1732	1.1705	1.1790	1.1881	1.1946	1.2014 (40)
HLP (average)												1.1913
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8878 (42)
Hot water usage for mixer showers												72.3600 (42a)
72.6383	71.5467	69.9560	66.9125	64.6665	62.1617	60.7380	62.3167	64.0472	66.7365	69.8454		
Hot water usage for baths												31.2541 (42b)
31.3601	30.8943	30.2385	29.0292	28.1237	27.1196	26.5773	27.2286	27.9377	29.0121	30.2462		
Hot water usage for other uses												44.2037 (42c)
44.2037	42.5963	40.9889	39.3815	37.7741	36.1667	36.1667	37.7741	39.3815	40.9889	42.5963		
Average daily hot water use (litres/day)												136.2310 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	148.2021	145.0373	141.1834	135.3232	130.5642	125.4480	123.4820	127.3193	131.3663	136.7375	142.6879	147.8178 (44)
Energy conte	234.7159	206.5312	216.9936	185.2507	175.7646	154.2530	149.3407	157.6479	161.9878	185.5514	203.2851	231.4469 (45)
Energy content (annual)												2262.7689
Distribution loss (46)m = 0.15 x (45)m												
35.2074	30.9797	32.5490	27.7876	26.3647	23.1379	22.4011	23.6472	24.2982	27.8327	30.4928		34.7170 (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

285.6748 252.5586 267.9525 234.5657 226.7235 203.5680 200.2997 208.6068 211.3029 236.5104 252.6002 282.4058 (62)

WWHRS -33.2072 -29.3687 -30.7532 -25.4649 -23.7324 -20.3080 -19.0355 -20.2423 -21.0114 -24.7701 -28.0615 -32.5923 (63a)

PV diverter -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 (63b)

Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63c)

FGHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)

Output from w/h

252.4676 223.1899 237.1993 209.1008 202.9911 183.2601 181.2642 188.3645 190.2915 211.7402 224.5387 249.8136 (64)

Total per year (kWh/year) = Sum(64)m = 2554.2214 (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)

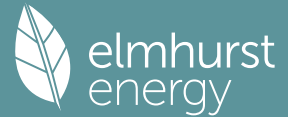
Heat gains from water heating, kWh/month

90.7828 80.1785 84.8901 73.9246 71.1814 63.6179 62.3955 65.1577 66.1897 74.4356 79.9211 89.6958 (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	144.3888	144.3888	144.3888	144.3888	144.3888	144.3888	144.3888	144.3888	144.3888	144.3888	144.3888	144.3888 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
161.1118	178.3738	161.1118	166.4822	161.1118	166.4822	161.1118	161.1118	166.4822	161.1118	166.4822	161.1118	161.1118 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
294.4975	297.5534	289.8525	273.4581	252.7632	233.3129	220.3189	217.2629	224.9638	241.3582	262.0531	281.5034	281.5034 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												

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Pumps, fans	37.4389	37.4389	37.4389	37.4389	37.4389	37.4389	37.4389	37.4389	37.4389	37.4389	37.4389	37.4389	37.4389 (69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Water heating gains (Table 5)	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110 (71)
Total internal gains	122.0198	119.3132	114.0996	102.6731	95.6740	88.3582	83.8650	87.5775	91.9302	100.0478	111.0015	120.5589	120.5589 (72)
	646.9457	664.5571	634.3805	611.9300	578.8656	554.4699	531.6123	532.2688	549.6928	571.8345	608.8535	632.4908	632.4908 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North				1.4200	10.6334	0.6300		0.7000	0.7700		4.6146 (74)	
East				8.0200	19.6403	0.6300		0.7000	0.7700		48.1386 (76)	
West				7.5200	19.6403	0.6300		0.7000	0.7700		45.1374 (80)	
Solar gains	97.8906	191.2864	315.4835	462.3289	569.5272	584.5316	555.8588	475.3481	367.5090	227.0109	121.9969	80.5526 (83)
Total gains	744.8364	855.8435	949.8640	1074.2590	1148.3929	1139.0015	1087.4711	1007.6170	917.2019	798.8453	730.8504	713.0434 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.2931	54.4596	54.6237	55.4080	55.5573	56.2628	56.2628	56.3954	55.9889	55.5573	55.2562	54.9448	
alpha	4.6195	4.6306	4.6416	4.6939	4.7038	4.7509	4.7509	4.7597	4.7326	4.7038	4.6837	4.6630	
util living area	0.9977	0.9953	0.9890	0.9648	0.8970	0.7470	0.5814	0.6414	0.8718	0.9793	0.9955	0.9982	(86)
MIT	19.4058	19.5858	19.8806	20.3052	20.6720	20.9081	20.9780	20.9657	20.7941	20.3118	19.7951	19.3876	(87)
Th 2	19.9074	19.9104	19.9133	19.9270	19.9295	19.9415	19.9415	19.9437	19.9369	19.9295	19.9243	19.9189	(88)
util rest of house	0.9970	0.9937	0.9851	0.9513	0.8563	0.6562	0.4529	0.5124	0.8062	0.9690	0.9937	0.9976	(89)
MIT 2	18.0490	18.2811	18.6586	19.2009	19.6373	19.8848	19.9339	19.9304	19.7839	19.2180	18.5591	18.0335	(90)
Living area fraction	18.2039	18.4300	18.7982	19.3270	19.7555	20.0017	20.0531	20.0486	19.8992	19.3429	18.7003	18.1881	(91)
MIT	18.2039	18.4300	18.7982	19.3270	19.7555	20.0017	20.0531	20.0486	19.8992	19.3429	18.7003	18.1881	(92)
Temperature adjustment	18.2039	18.4300	18.7982	19.3270	19.7555	20.0017	20.0531	20.0486	19.8992	19.3429	18.7003	18.1881	(93)
adjusted MIT	18.2039	18.4300	18.7982	19.3270	19.7555	20.0017	20.0531	20.0486	19.8992	19.3429	18.7003	18.1881	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9951	0.9905	0.9793	0.9413	0.8483	0.6619	0.4671	0.5262	0.8034	0.9609	0.9905	0.9960	(94)
Useful gains	741.2099	847.6735	930.1715	1011.2530	974.1764	753.9603	507.9713	530.1587	736.8860	767.5777	723.9109	710.2103	(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	2152.7287	2088.4454	1892.5924	1581.9214	1218.8439	807.0563	515.9285	543.8481	870.6908	1322.8520	1764.7576	2140.0855	(97)
Space heating kWh	1050.1700	833.7987	716.0411	410.8813	182.0326	0.0000	0.0000	0.0000	0.0000	413.1240	749.4096	1063.8271	(98a)
Space heating requirement - total per year (kWh/year)												5419.2845	
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	1050.1700	833.7987	716.0411	410.8813	182.0326	0.0000	0.0000	0.0000	0.0000	413.1240	749.4096	1063.8271	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5419.2845	
Space heating per m ²										(98c) / (4) =		42.5543	(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	1050.1700	833.7987	716.0411	410.8813	182.0326	0.0000	0.0000	0.0000	0.0000	413.1240	749.4096	1063.8271	(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)	1136.5476	902.3796	774.9363	444.6767	197.0050	0.0000	0.0000	0.0000	0.0000	447.1039	811.0494	1151.3281	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	252.4676	223.1899	237.1993	209.1008	202.9911	183.2601	181.2642	188.3645	190.2915	211.7402	224.5387	249.8136	(64)
Efficiency of water heater (217)m	87.0922	86.9340	86.5923	85.8008	84.1486	80.3000	80.3000	80.3000	80.3000	85.7867	86.7579	87.1255	(216)
Fuel for water heating, kWh/month	289.8854	256.7348	273.9264	243.7050	241.2292	228.2193	225.7337	234.5760	236.9757	246.8217	258.8107	286.7283	(219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	33.4759	26.8556	24.1805	17.7156	13.6841	11.1800	12.4831	16.2260	21.0759	27.6528	31.2337	34.4063	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-46.0181	-65.2493	-94.2858	-106.5369	-115.2493	-107.6235	-106.2321	-100.0893	-89.3406	-74.8013	-50.7011	-39.7366	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													

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(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	-24.8490	-52.4133	-104.4635	-157.3413	-208.5150	-209.7514	-207.3460	-175.3929	-128.2941	-75.1746	-33.2418	-19.6444	(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												5865.0265	(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												3023.3463	(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)												270.1693	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2392.2913	(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												6852.2508	(238)

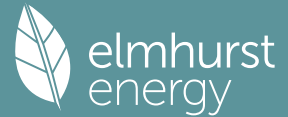
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5865.0265	0.2100	1231.6556	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3023.3463	0.2100	634.9027	(264)
Space and water heating			1866.5583	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	270.1693	0.1443	38.9938	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-995.8639	0.1345	-133.9363	
PV Unit electricity exported	-1396.4274	0.1258	-175.6770	
Total			-309.6133	(269)
Total CO2, kg/year			1607.8680	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.6300	(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	5865.0265	1.1300	6627.4799	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3023.3463	1.1300	3416.3813	(278)
Space and water heating			10043.8612	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	270.1693	1.5338	414.3947	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-995.8639	1.4971	-1490.8648	
PV Unit electricity exported	-1396.4274	0.4618	-644.8483	
Total			-2135.7131	(283)
Total Primary energy kWh/year			8452.6436	(286)
Target Primary Energy Rate (TPER)			66.3700	(287)

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Property Reference	SAP VG 21-0282				Issued on Date	15/11/2024	
Assessment Reference	Plot 56			Prop Type Ref	SAP VG 21-0282		
Property							
SAP Rating	92 A	DER	12.58	TER	12.63		
Environmental	88 B	% DER < TER				0.40	
CO ₂ Emissions (t/year)	1.55	DFEE	42.24	TFEE	47.14		
Compliance Check	See BREL	% DFEE < TFEE				10.39	
% DPER < TPER	0.08	DPER	66.32	TPER	66.37		
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	30.5500 (1b)	x 2.8500 (2b)	= 87.0675 (1b) - (3b)
First floor	48.4000 (1c)	x 2.4000 (2c)	= 116.1600 (1c) - (3c)
Second floor	48.4000 (1d)	x 2.6000 (2d)	= 125.8400 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.3500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	329.0675 (5)

2. Ventilation rate

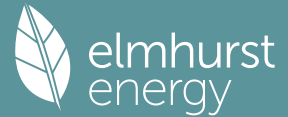
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
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) = 0.1216 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.3216 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3216 (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	0.4100	0.4019	0.3939	0.3537	0.3457	0.3055	0.3055	0.2974	0.3216	0.3457	0.3618	0.3778 (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	0.5840	0.5808	0.5776	0.5626	0.5597	0.5467	0.5467	0.5442	0.5517	0.5597	0.5654	0.5714 (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)			16.9600	1.2357	20.9582		(27)
Ground floor			48.4000	0.1300	6.2920	0.0000	0.0000 (28a)
Brick wall	174.1300	14.2200	159.9100	0.1900	30.3829	110.0000	17590.1000 (29a)
Render wall	17.1000	4.8800	12.2200	0.1800	2.1996	110.0000	1344.2000 (29a)
Retaining wall	15.5900		15.5900	0.1800	2.8062	110.0000	1714.9000 (29a)
Garage wall	21.1500		21.1500	0.1400	2.9610	110.0000	2326.5000 (29a)
Plane roof	48.4000		48.4000	0.0900	4.3560	9.0000	435.6000 (30)
Total net area of external elements A _{um} (A, m ²)			324.7700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	72.3099		(33)
Internal Wall			34.4800			75.0000	2586.0000 (32c)
Internal Wall			183.4800			9.0000	1651.3200 (32c)
Internal Floor 1			48.4000			18.0000	871.2000 (32d)
Internal Floor 2			48.4000			18.0000	871.2000 (32d)
Internal Ceiling 1			48.4000			9.0000	435.6000 (32e)
Internal Ceiling 2			48.4000			9.0000	435.6000 (32e)

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

K1 Element
E2 Other lintels (including other steel lintels)
E3 Sill
E4 Jamb
E5 Ground floor (normal)
E6 Intermediate floor within a dwelling
E10 Eaves (insulation at ceiling level)
E12 Gable (insulation at ceiling level)
E16 Corner (normal)
E17 Corner (inverted - internal area greater than external area)
E20 Exposed floor (normal)
E21 Exposed floor (inverted)

(28)...(30) + (32) + (32a)...(32e) = 30262.2200 (34)
237.6303 (35)

Length	Psi-value	Total
13.4700	0.0240	0.3233
10.6400	0.0220	0.2341
32.4000	0.0170	0.5508
30.1800	0.0850	2.5653
49.8000	0.0010	0.0498
10.9800	0.0600	0.6588
18.8800	0.0560	1.0573
34.2500	0.0460	1.5755
7.8500	-0.0880	-0.6908
10.5600	0.0690	0.7286
7.4200	0.3200	2.3744

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

(36a) = 9.4271 (36)
(33) + (36) + (36a) = 81.7370 (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	63.4226	63.0682	62.7208	61.0892	60.7839	59.3629	59.3629	59.0997	59.9103	60.7839	61.4015	62.0471	(38)
Heat transfer coeff	145.1595	144.8051	144.4578	142.8262	142.5209	141.0998	141.0998	140.8367	141.6472	142.5209	143.1385	143.7841	(39)
Average = Sum(39)m / 12 =												142.8247	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1398	1.1371	1.1343	1.1215	1.1191	1.1080	1.1080	1.1059	1.1123	1.1191	1.1240	1.1290	(40)
HLP (average)												1.1215	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8878 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	31.3601	30.8943	30.2385	29.0292	28.1237	27.1196	26.5773	27.2286	27.9377	29.0121	30.2462	31.2541	(42b)
Hot water usage for other uses	44.2037	42.5963	40.9889	39.3815	37.7741	36.1667	36.1667	37.7741	39.3815	40.9889	42.5963	44.2037	(42c)
Average daily hot water use (litres/day)												69.2609	(43)
Daily hot water use	75.5638	73.4906	71.2274	68.4107	65.8978	63.2863	62.7439	65.0026	67.3192	70.0009	72.8425	75.4578	(44)
Energy content	119.6746	104.6497	109.4738	93.6508	88.7110	77.8179	75.8834	80.4868	83.0113	94.9906	103.7776	118.1486	(45)
Energy content (annual)										Total = Sum(45)m =		1150.2760	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	101.7234	88.9522	93.0527	79.6032	75.4044	66.1452	64.5009	68.4138	70.5596	80.7420	88.2109	100.4263	(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	101.7234	88.9522	93.0527	79.6032	75.4044	66.1452	64.5009	68.4138	70.5596	80.7420	88.2109	100.4263	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		977.7346	(64)
Electric shower(s)	58.1712	51.8310	56.5975	54.0103	55.0238	52.4873	54.2369	55.0238	54.0103	56.5975	55.5332	58.1712	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		661.6939	(64a)
Heat gains from water heating, kWh/month	39.9736	35.1958	37.4126	33.4034	32.6070	29.6581	29.6844	30.8594	31.1425	34.3349	35.9360	39.6494	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	144.3888	144.3888	144.3888	144.3888	144.3888	144.3888	144.3888	144.3888	144.3888	144.3888	144.3888	144.3888	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	161.1118	178.3738	161.1118	166.4822	161.1118	166.4822	161.1118	161.1118	166.4822	161.1118	166.4822	161.1118	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.4975	297.5534	289.8525	273.4581	252.7632	233.3129	220.3189	217.2629	224.9638	241.3582	262.0531	281.5034	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4389	37.4389	37.4389	37.4389	37.4389	37.4389	37.4389	37.4389	37.4389	37.4389	37.4389	37.4389	(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)	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	(71)
Water heating gains (Table 5)	53.7280	52.3747	50.2857	46.3936	43.8267	41.1918	39.8984	41.4777	43.2534	46.1490	49.9112	53.2922	(72)
Total internal gains	575.6539	594.6186	567.5666	552.6505	524.0183	507.3036	487.6458	486.1690	501.0161	514.9357	544.7631	562.2241	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.4200	10.6334	0.7300	0.7000	0.7700	5.3471 (74)
East	8.0200	19.6403	0.7300	0.7000	0.7700	55.7797 (76)
West	7.5200	19.6403	0.7300	0.7000	0.7700	52.3021 (80)

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Solar gains	113.4288	221.6494	365.5603	535.7145	659.9284	677.3144	644.0903	550.8002	425.8438	263.0443	141.3615	93.3388 (83)
Total gains	689.0827	816.2679	933.1269	1088.3650	1183.9467	1184.6180	1131.7361	1036.9693	926.8599	777.9800	686.1247	655.5628 (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	57.9099	58.0516	58.1912	58.8560	58.9820	59.5761	59.5761	59.6874	59.3458	58.9820	58.7276	58.4639
alpha	4.8607	4.8701	4.8794	4.9237	4.9321	4.9717	4.9717	4.9792	4.9564	4.9321	4.9152	4.8976
util living area	0.9984	0.9961	0.9892	0.9594	0.8747	0.7037	0.5357	0.6008	0.8534	0.9798	0.9965	0.9988 (86)
MIT	19.4762	19.6667	19.9706	20.3975	20.7446	20.9387	20.9871	20.9780	20.8355	20.3656	19.8503	19.4513 (87)
Th 2	19.9684	19.9707	19.9729	19.9833	19.9852	19.9943	19.9943	19.9960	19.9908	19.9852	19.9813	19.9772 (88)
util rest of house	0.9979	0.9948	0.9854	0.9446	0.8303	0.6151	0.4198	0.4812	0.7856	0.9699	0.9951	0.9984 (89)
MIT 2	18.5757	18.7673	19.0707	19.4945	19.8110	19.9656	19.9909	19.9895	19.8971	19.4715	18.9592	18.5576 (90)
Living area fraction	18.6785	18.8700	19.1735	19.5976	19.9176	20.0767	20.1047	20.1023	20.0042	19.5736	19.0609	18.6597 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6785	18.8700	19.1735	19.5976	19.9176	20.0767	20.1047	20.1023	20.0042	19.5736	19.0609	18.6597 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9969	0.9928	0.9814	0.9375	0.8269	0.6229	0.4329	0.4945	0.7867	0.9644	0.9933	0.9976 (94)
Useful gains	686.9667	810.3794	915.7262	1020.3160	978.9894	737.9280	489.9347	512.8304	729.1186	750.2747	681.5109	653.9865 (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	2087.1763	2022.9276	1830.7838	1527.9001	1171.1761	772.7676	494.5069	521.4250	836.3139	1278.9219	1712.0672	2079.0717 (97)
Space heating kWh	1041.7559	814.8324	680.8028	365.4605	142.9869	0.0000	0.0000	0.0000	0.0000	393.3135	742.0005	1060.2634 (98a)
Space heating requirement - total per year (kWh/year)												5241.4160
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	1041.7559	814.8324	680.8028	365.4605	142.9869	0.0000	0.0000	0.0000	0.0000	393.3135	742.0005	1060.2634 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5241.4160
Space heating per m2												(98c) / (4) = 41.1576 (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	1326.3384	1044.1387	1070.3587	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8267	0.8977	0.8586	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1096.5442	937.3536	919.0420	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1308.1528	1249.7673	1142.3121	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	152.3582	232.4358	166.1130	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	38.0895	58.1090	41.5282	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												137.7267 (107)
Energy for space heating												41.1576 (99)
Energy for space cooling												1.0815 (108)
Total												42.2390 (109)
Fabric Energy Efficiency (DFEE)												42.2 (109)

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

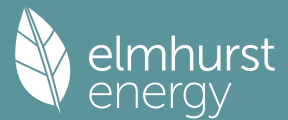
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	30.5500 (1b)	x 2.8500 (2b)	= 87.0675 (1b) - (3b)
First floor	48.4000 (1c)	x 2.4000 (2c)	= 116.1600 (1c) - (3c)
Second floor	48.4000 (1d)	x 2.6000 (2d)	= 125.8400 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.3500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	329.0675 (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)

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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) =	0.1216 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3716	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3716	(21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
	0.4737	0.4644	0.4552	0.4087	0.3994	0.3530	0.3530	0.3437	0.3716	0.3994	0.4180	0.4366	(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	0.6122	0.6079	0.6036	0.5835	0.5798	0.5623	0.5623	0.5591	0.5690	0.5798	0.5874	0.5953	(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)			16.9600	1.1450	19.4198			(27)
Ground floor			48.4000	0.1300	6.2920			(28a)
Brick wall	174.1300	14.2200	159.9100	0.1800	28.7838			(29a)
Render wall	17.1000	4.8800	12.2200	0.1800	2.1996			(29a)
Retaining wall	15.5900		15.5900	0.1800	2.8062			(29a)
Garage wall	21.1500		21.1500	0.1800	3.8070			(29a)
Plane roof	48.4000		48.4000	0.1100	5.3240			(30)
Total net area of external elements Aum(A, m2)			324.7700					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	70.7724		(33)

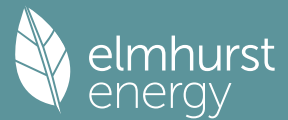
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K													237.6303 (35)
List of Thermal Bridges													
K1 Element													
E2 Other lintels (including other steel lintels)													
E3 Sill													
E4 Jamb													
E5 Ground floor (normal)													
E6 Intermediate floor within a dwelling													
E10 Eaves (insulation at ceiling level)													
E12 Gable (insulation at ceiling level)													
E16 Corner (normal)													
E17 Corner (inverted - internal area greater than external area)													
E20 Exposed floor (normal)													
E21 Exposed floor (inverted)													
Thermal bridges (Sum(L x Psi) calculated using Appendix K)													17.5755 (36)
Point Thermal bridges													0.0000 (36a)
Total fabric heat loss													(33) + (36) + (36a) = 88.3479 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	66.4815	66.0083	65.5445	63.3660	62.9584	61.0611	61.0611	60.7097	61.7919	62.9584	63.7830	64.6450	(38)
Average = Sum(39)m / 12 =	154.8294	154.3562	153.8924	151.7140	151.3064	149.4090	149.4090	149.0577	150.1399	151.3064	152.1309	152.9929	(39)
													151.7120
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.2158	1.2121	1.2084	1.1913	1.1881	1.1732	1.1732	1.1705	1.1790	1.1881	1.1946	1.2014	(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													2.8878 (42)
Hot water usage for mixer showers													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths													
	31.3601	30.8943	30.2385	29.0292	28.1237	27.1196	26.5773	27.2286	27.9377	29.0121	30.2462	31.2541	(42b)
Hot water usage for other uses													
	44.2037	42.5963	40.9889	39.3815	37.7741	36.1667	36.1667	37.7741	39.3815	40.9889	42.5963	44.2037	(42c)
Average daily hot water use (litres/day)													69.2609 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	75.5638	73.4906	71.2274	68.4107	65.8978	63.2863	62.7439	65.0026	67.3192	70.0009	72.8425	75.4578	(44)
Energy conte	119.6746	104.6497	109.4738	93.6508	88.7110	77.8179	75.8834	80.4868	83.0113	94.9906	103.7776	118.1486	(45)
Energy content (annual)													Total = Sum(45)m = 1150.2760
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	101.7234	88.9522	93.0527	79.6032	75.4044	66.1452	64.5009	68.4138	70.5596	80.7420	88.2109	100.4263	(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)

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FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	101.7234	88.9522	93.0527	79.6032	75.4044	66.1452	64.5009	68.4138	70.5596	80.7420	88.2109	100.4263 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											977.7346 (64)
Electric shower(s)	58.1712	51.8310	56.5975	54.0103	55.0238	52.4873	54.2369	55.0238	54.0103	56.5975	55.5332	58.1712 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											661.6939 (64a)
Heat gains from water heating, kWh/month	39.9736	35.1958	37.4126	33.4034	32.6070	29.6581	29.6844	30.8594	31.1425	34.3349	35.9360	39.6494 (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	144.3888	144.3888	144.3888	144.3888	144.3888	144.3888	144.3888	144.3888	144.3888	144.3888	144.3888	144.3888	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	161.1118	178.3738	161.1118	166.4822	161.1118	166.4822	161.1118	161.1118	166.4822	161.1118	166.4822	161.1118	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.4975	297.5534	289.8525	273.4581	252.7632	233.3129	220.3189	217.2629	224.9638	241.3582	262.0531	281.5034	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4389	37.4389	37.4389	37.4389	37.4389	37.4389	37.4389	37.4389	37.4389	37.4389	37.4389	37.4389	(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)	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	(71)
Water heating gains (Table 5)	53.7280	52.3747	50.2857	46.3936	43.8267	41.1918	39.8984	41.4777	43.2534	46.1490	49.9112	53.2922	(72)
Total internal gains	575.6539	594.6186	567.5666	552.6505	524.0183	507.3036	487.6458	486.1690	501.0161	514.9357	544.7631	562.2241	(73)

6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
North			1.4200	10.6334	0.6300	0.7000	0.7700	4.6146 (74)				
East			8.0200	19.6403	0.6300	0.7000	0.7700	48.1386 (76)				
West			7.5200	19.6403	0.6300	0.7000	0.7700	45.1374 (80)				
Solar gains	97.8906	191.2864	315.4835	462.3289	569.5272	584.5316	555.8588	475.3481	367.5090	227.0109	121.9969	80.5526 (83)
Total gains	673.5445	785.9050	883.0501	1014.9795	1093.5456	1091.8352	1043.5046	961.5172	868.5251	741.9465	666.7601	642.7767 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	54.2931	54.4596	54.6237	55.4080	55.5573	56.2628	56.2628	56.3954	55.9889	55.5573	55.2562	54.9448
alpha	4.6195	4.6306	4.6416	4.6939	4.7038	4.7509	4.7509	4.7597	4.7326	4.7038	4.6837	4.6630
util living area	0.9985	0.9967	0.9918	0.9713	0.9107	0.7672	0.6021	0.6654	0.8897	0.9844	0.9969	0.9988 (86)
MIT	19.3447	19.5265	19.8254	20.2613	20.6424	20.8966	20.9746	20.9600	20.7706	20.2666	19.7405	19.3271 (87)
Th 2	19.9074	19.9104	19.9133	19.9270	19.9295	19.9415	19.9415	19.9437	19.9369	19.9295	19.9243	19.9189 (88)
util rest of house	0.9980	0.9956	0.9888	0.9600	0.8736	0.6778	0.4708	0.5346	0.8292	0.9764	0.9957	0.9984 (89)
MIT 2	18.3982	18.5817	18.8813	19.3198	19.6775	19.8909	19.9345	19.9313	19.8008	19.3318	18.8063	18.3893 (90)
Living area fraction	fLA = Living area / (4) = 0.1142 (91)											
MIT	18.5063	18.6896	18.9891	19.4273	19.7876	20.0057	20.0533	20.0488	19.9116	19.4386	18.9129	18.4964 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.5063	18.6896	18.9891	19.4273	19.7876	20.0057	20.0533	20.0488	19.9116	19.4386	18.9129	18.4964 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	671.5682	780.9718	869.9734	967.3161	948.7986	746.7037	506.6033	527.5764	718.6707	720.5310	662.7114	641.2721	(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	2199.5489	2128.5096	1921.9799	1597.1318	1223.7089	807.6638	515.9530	543.8749	872.5482	1337.3319	1797.1116	2187.2428	(97)
Space heating kWh	1136.8176	905.5455	782.6928	453.4673	204.5333	0.0000	0.0000	0.0000	0.0000	458.8999	816.7681	1150.2022	(98a)
Space heating requirement - total per year (kWh/year)													5908.9267
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	1136.8176	905.5455	782.6928	453.4673	204.5333	0.0000	0.0000	0.0000	0.0000	458.8999	816.7681	1150.2022	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)													5908.9267
Space heating per m2													(98c) / (4) =
													46.3991 (99)

8c. Space cooling requirement

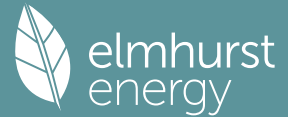
Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1404.4448	1105.6268	1132.8382	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7554	0.8408	0.7953	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1060.8755	929.6193	900.9983	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1199.7054	1146.6395	1054.1214	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	99.9575	161.4631	113.9236	0.0000	0.0000	0.0000	0.0000	(104)

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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 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	24.9894	40.3658	28.4809	0.0000	0.0000	0.0000 (107)
Space cooling requirement											93.8360 (107)
Energy for space heating											46.3991 (99)
Energy for space cooling											0.7368 (108)
Total											47.1359 (109)
Fabric Energy Efficiency (TFEE)											47.1 (109)

Full SAP Calculation Printout



Property Reference	SAP VG 21-0282				Issued on Date	15/11/2024	
Assessment Reference	Plot 56			Prop Type Ref	SAP VG 21-0282		
Property							
SAP Rating	92 A	DER	12.58	TER	12.63		
Environmental	88 B	% DER < TER				0.40	
CO ₂ Emissions (t/year)	1.55	DFEE	42.24	TFEE	47.14		
Compliance Check	See BREL	% DFEE < TFEE				10.39	
% DPER < TPER	0.08	DPER	66.32	TPER	66.37		
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	30.5500 (1b)	x 2.8500 (2b)	= 87.0675 (1b) - (3b)
First floor	48.4000 (1c)	x 2.4000 (2c)	= 116.1600 (1c) - (3c)
Second floor	48.4000 (1d)	x 2.6000 (2d)	= 125.8400 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.3500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	329.0675 (5)

2. Ventilation rate

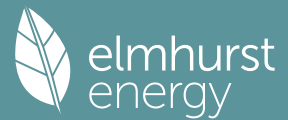
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	5 * 10 = 50.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) = 0.1519 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.3519 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3519 (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	0.4487	0.4399	0.4311	0.3871	0.3783	0.3343	0.3343	0.3255	0.3519	0.3783	0.3959	0.4135 (22b)
Effective ac	0.6007	0.5968	0.5929	0.5749	0.5716	0.5559	0.5559	0.5530	0.5619	0.5716	0.5784	0.5855 (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)			16.9600	1.2357	20.9582		(27)
Ground floor			48.4000	0.1300	6.2920	0.0000	0.0000 (28a)
Brick wall	174.1300	14.2200	159.9100	0.1900	30.3829	110.0000	17590.1000 (29a)
Render wall	17.1000	4.8800	12.2200	0.1800	2.1996	110.0000	1344.2000 (29a)
Retaining wall	15.5900		15.5900	0.1800	2.8062	110.0000	1714.9000 (29a)
Garage wall	21.1500		21.1500	0.1400	2.9610	110.0000	2326.5000 (29a)
Plane roof	48.4000		48.4000	0.0900	4.3560	9.0000	435.6000 (30)
Total net area of external elements Aum(A, m ²)			324.7700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	72.3099		(33)
Internal Wall			34.4800			75.0000	2586.0000 (32c)
Internal Wall			183.4800			9.0000	1651.3200 (32c)
Internal Floor 1			48.4000			18.0000	871.2000 (32d)
Internal Floor 2			48.4000			18.0000	871.2000 (32d)
Internal Ceiling 1			48.4000			9.0000	435.6000 (32e)
Internal Ceiling 2			48.4000			9.0000	435.6000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	30262.2200 (34)

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

237.6303 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	13.4700	0.0240	0.3233
E2 Other lintels (including other steel lintels)	10.6400	0.0220	0.2341
E3 Sill	32.4000	0.0170	0.5508
E4 Jamb	30.1800	0.0850	2.5653
E5 Ground floor (normal)	49.8000	0.0010	0.0498
E6 Intermediate floor within a dwelling	10.9800	0.0600	0.6588
E10 Eaves (insulation at ceiling level)	18.8800	0.0560	1.0573
E12 Gable (insulation at ceiling level)	34.2500	0.0460	1.5755
E16 Corner (normal)	7.8500	-0.0880	-0.6908
E17 Corner (inverted - internal area greater than external area)	10.5600	0.0690	0.7286
E20 Exposed floor (normal)	7.4200	0.3200	2.3744
E21 Exposed floor (inverted)			

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

9.4271 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 81.7370 (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	65.2291	64.8046	64.3884	62.4339	62.0682	60.3658	60.3658	60.0505	61.0215	62.0682	62.8080	63.5814
Heat transfer coeff	146.9661	146.5415	146.1254	144.1708	143.8051	142.1028	142.1028	141.7875	142.7585	143.8051	144.5449	145.3183
Average = Sum(39)m / 12 =												144.1691

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1540	1.1507	1.1474	1.1321	1.1292	1.1158	1.1158	1.1134	1.1210	1.1292	1.1350	1.1411
HLP (average)												1.1321
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8878 (42)
Hot water usage for mixer showers	72.6383	71.5467	69.9560	66.9125	64.6665	62.1617	60.7380	62.3167	64.0472	66.7365	69.8454	72.3600	(42a)
Hot water usage for baths	31.3601	30.8943	30.2385	29.0292	28.1237	27.1196	26.5773	27.2286	27.9377	29.0121	30.2462	31.2541	(42b)
Hot water usage for other uses	44.2037	42.5963	40.9889	39.3815	37.7741	36.1667	36.1667	37.7741	39.3815	40.9889	42.5963	44.2037	(42c)
Average daily hot water use (litres/day)													136.2310 (43)
Daily hot water use	148.2021	145.0373	141.1834	135.3232	130.5642	125.4480	123.4820	127.3193	131.3663	136.7375	142.6879	147.8178	(44)
Energy conte	234.7159	206.5312	216.9936	185.2507	175.7646	154.2530	149.3407	157.6479	161.9878	185.5514	203.2851	231.4469	(45)
Energy content (annual)										Total = Sum(45)m =		2262.7689	
Distribution loss (46)m = 0.15 x (45)m	35.2074	30.9797	32.5490	27.7876	26.3647	23.1379	22.4011	23.6472	24.2982	27.8327	30.4928	34.7170	(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	2.4597	2.2886	2.5634	2.3947	2.4310	2.2834	2.2665	2.2776	2.2157	2.3487	2.3433	2.4424	(61)
Total heat required for water heating calculated for each month	237.1756	208.8198	219.5570	187.6453	178.1955	156.5364	151.6072	159.9255	164.2036	187.9001	205.6285	233.8893	(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)
FV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	237.1756	208.8198	219.5570	187.6453	178.1955	156.5364	151.6072	159.9255	164.2036	187.9001	205.6285	233.8893	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2291.0838	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
													0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													
Heat gains from water heating, kWh/month	78.6580	69.2438	72.7912	62.1945	59.0495	51.8600	50.2224	52.9873	54.4149	62.2830	68.1781	77.5667	(65)

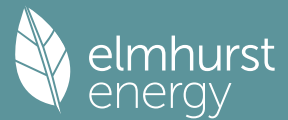
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	144.3888	144.3888	144.3888	144.3888	144.3888	144.3888	144.3888	144.3888	144.3888	144.3888	144.3888	144.3888	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	161.1118	178.3738	161.1118	166.4822	161.1118	166.4822	161.1118	161.1118	166.4822	161.1118	166.4822	161.1118	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.4975	297.5534	289.8525	273.4581	252.7632	233.3129	220.3189	217.2629	224.9638	241.3582	262.0531	281.5034	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4389	37.4389	37.4389	37.4389	37.4389	37.4389	37.4389	37.4389	37.4389	37.4389	37.4389	37.4389	(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)	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	(71)
Water heating gains (Table 5)	105.7231	103.0413	97.8377	86.3813	79.3675	72.0277	67.5032	71.2195	75.5762	83.7137	94.6919	104.2563	(72)
Total internal gains	630.6490	648.2852	618.1186	595.6382	562.5592	538.1394	515.2506	515.9109	533.3389	555.5004	592.5438	616.1882	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.4200	10.6334	0.7300	0.7000	0.7700	5.3471 (74)
East	8.0200	19.6403	0.7300	0.7000	0.7700	55.7797 (76)
West	7.5200	19.6403	0.7300	0.7000	0.7700	52.3021 (80)

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Solar gains	113.4288	221.6494	365.5603	535.7145	659.9284	677.3144	644.0903	550.8002	425.8438	263.0443	141.3615	93.3388 (83)
Total gains	744.0778	869.9345	983.6788	1131.3527	1222.4876	1215.4539	1159.3409	1066.7111	959.1827	818.5447	733.9054	709.5270 (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	57.1981	57.3638	57.5271	58.3070	58.4553	59.1556	59.1556	59.2871	58.8839	58.4553	58.1561	57.8466	
alpha	4.8132	4.8243	4.8351	4.8871	4.8970	4.9437	4.9437	4.9525	4.9256	4.8970	4.8771	4.8564	
util living area	0.9978	0.9949	0.9867	0.9541	0.8654	0.6936	0.5273	0.5895	0.8421	0.9756	0.9953	0.9982 (86)	
MIT	20.4324	20.4803	20.5563	20.6638	20.7489	20.7974	20.8090	20.8072	20.7723	20.6570	20.5287	20.4285 (87)	
Th 2	19.9570	19.9596	19.9623	19.9747	19.9770	19.9879	19.9879	19.9899	19.9837	19.9770	19.9723	19.9674 (88)	
util rest of house	0.9970	0.9932	0.9822	0.9377	0.8191	0.6046	0.4121	0.4707	0.7717	0.9640	0.9935	0.9977 (89)	
MIT 2	19.2715	19.3353	19.4343	19.5797	19.6803	19.7380	19.7457	19.7472	19.7135	19.5758	19.4090	19.2762 (90)	
Living area fraction	FLA = Living area / (4) =												0.1142 (91)
MIT	19.4041	19.4660	19.5624	19.7035	19.8023	19.8590	19.8671	19.8683	19.8344	19.6992	19.5369	19.4078 (92)	
Temperature adjustment													-0.1500
adjusted MIT	19.2541	19.3160	19.4124	19.5535	19.6523	19.7090	19.7171	19.7183	19.6844	19.5492	19.3869	19.2578 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9964	0.9918	0.9790	0.9292	0.8016	0.5776	0.3800	0.4368	0.7464	0.9573	0.9921	0.9971 (94)
Useful gains	741.3926	862.8122	963.0281	1051.2147	979.9142	701.9961	440.5892	465.8882	715.9137	783.6334	728.0886	707.5040 (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	2197.7378	2112.5424	1886.8330	1535.9210	1143.5845	726.0008	442.9495	470.4870	797.2202	1286.9469	1776.0044	2188.1749 (97)
Space heating kWh	1083.5209	839.8187	687.3108	348.9885	121.7708	0.0000	0.0000	0.0000	0.0000	374.4653	754.4994	1101.6192 (98a)
Space heating requirement - total per year (kWh/year)												5311.9935
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	1083.5209	839.8187	687.3108	348.9885	121.7708	0.0000	0.0000	0.0000	0.0000	374.4653	754.4994	1101.6192 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5311.9935
Space heating per m2												(98c) / (4) = 41.7118 (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	1083.5209	839.8187	687.3108	348.9885	121.7708	0.0000	0.0000	0.0000	0.0000	374.4653	754.4994	1101.6192 (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)	1222.9355	947.8766	775.7458	393.8922	137.4388	0.0000	0.0000	0.0000	0.0000	422.6470	851.5794	1243.3625 (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	237.1756	208.8198	219.5570	187.6453	178.1955	156.5364	151.6072	159.9255	164.2036	187.9001	205.6285	233.8893 (64)
Efficiency of water heater	86.8368	86.6491	86.2393	85.2304	83.0236	79.6000	79.6000	79.6000	79.6000	85.3747	86.5053	86.8797 (216)
Fuel for water heating, kWh/month	273.1280	240.9948	254.5904	220.1625	214.6324	196.6537	190.4613	200.9114	206.2859	220.0887	237.7063	269.2106 (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	32.7916	26.3067	23.6862	17.3535	13.4044	10.9515	12.2279	15.8943	20.6451	27.0875	30.5953	33.7030 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-33.6764	-52.7456	-84.5806	-103.0886	-115.5550	-109.1009	-107.1813	-98.6430	-83.3805	-63.4278	-38.4235	-28.2578 (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)	-14.3086	-34.8779	-83.0438	-145.5103	-210.3545	-218.5281	-213.1081	-169.0461	-109.1869	-53.7470	-20.0229	-10.8435 (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												5995.4779 (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												2724.8261 (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)

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Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	264.6472 (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	6870.3125 (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	5995.4779	0.2100	1259.0504 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2724.8261	0.2100	572.2135 (264)
Space and water heating			1831.2638 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	264.6472	0.1443	38.1968 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-918.0611	0.1330	-122.1081
PV Unit electricity exported	-1282.5776	0.1223	-156.8016
Total			-278.9098 (269)
Total CO2, kg/year			1602.4801 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			12.5800 (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	5995.4779	1.1300	6774.8901 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2724.8261	1.1300	3079.0535 (278)
Space and water heating			9853.9435 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	264.6472	1.5338	405.9247 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-918.0611	1.4915	-1369.2774
PV Unit electricity exported	-1282.5776	0.4486	-575.3429
Total			-1944.6203 (283)
Total Primary energy kWh/year			8445.3488 (286)
Dwelling Primary energy Rate (DPER)			66.3200 (287)

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

1. Overall dwelling characteristics

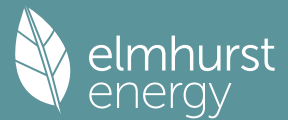
	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	30.5500 (1b)	x 2.8500 (2b)	= 87.0675 (1b) - (3b)
First floor	48.4000 (1c)	x 2.4000 (2c)	= 116.1600 (1c) - (3c)
Second floor	48.4000 (1d)	x 2.6000 (2d)	= 125.8400 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.3500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	329.0675 (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) = 0.1216 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3716 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3716 (21)

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

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Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4737	0.4644	0.4552	0.4087	0.3994	0.3530	0.3530	0.3437	0.3716	0.3994	0.4180	0.4366 (22b)
Effective ac	0.6122	0.6079	0.6036	0.5835	0.5798	0.5623	0.5623	0.5591	0.5690	0.5798	0.5874	0.5953 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1400	1.0000	2.1400		(26)
TER Opening Type (Uw = 1.20)			16.9600	1.1450	19.4198		(27)
Ground floor			48.4000	0.1300	6.2920		(28a)
Brick wall	174.1300	14.2200	159.9100	0.1800	28.7838		(29a)
Render wall	17.1000	4.8800	12.2200	0.1800	2.1996		(29a)
Retaining wall	15.5900		15.5900	0.1800	2.8062		(29a)
Garage wall	21.1500		21.1500	0.1800	3.8070		(29a)
Plane roof	48.4000		48.4000	0.1100	5.3240		(30)
Total net area of external elements Aum(A, m ²)			324.7700				(31)
Fabric heat loss, W/K = Sum (A x U)					70.7724		(33)

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

237.6303 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	13.4700	0.0500	0.6735
E3 Sill	10.6400	0.0500	0.5320
E4 Jamb	32.4000	0.0500	1.6200
E5 Ground floor (normal)	30.1800	0.1600	4.8288
E6 Intermediate floor within a dwelling	49.8000	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	10.9800	0.0600	0.6588
E12 Gable (insulation at ceiling level)	18.8800	0.0600	1.1328
E16 Corner (normal)	34.2500	0.0900	3.0825
E17 Corner (inverted - internal area greater than external area)	7.8500	-0.0900	-0.7065
E20 Exposed floor (normal)	10.5600	0.3200	3.3792
E21 Exposed floor (inverted)	7.4200	0.3200	2.3744

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

17.5755 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 88.3479 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	66.4815	66.0083	65.5445	63.3660	62.9584	61.0611	61.0611	60.7097	61.7919	62.9584	63.7830	64.6450 (38)
Heat transfer coeff	154.8294	154.3562	153.8924	151.7140	151.3064	149.4090	149.4090	149.0577	150.1399	151.3064	152.1309	152.9929 (39)
Average = Sum(39)m / 12 =												151.7120

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2158	1.2121	1.2084	1.1913	1.1881	1.1732	1.1732	1.1705	1.1790	1.1881	1.1946	1.2014 (40)
HLP (average)												1.1913
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8878 (42)
Hot water usage for mixer showers												72.3600 (42a)
72.6383	71.5467	69.9560	66.9125	64.6665	62.1617	60.7380	62.3167	64.0472	66.7365	69.8454		
Hot water usage for baths												31.2541 (42b)
31.3601	30.8943	30.2385	29.0292	28.1237	27.1196	26.5773	27.2286	27.9377	29.0121	30.2462		
Hot water usage for other uses												44.2037 (42c)
44.2037	42.5963	40.9889	39.3815	37.7741	36.1667	36.1667	37.7741	39.3815	40.9889	42.5963		
Average daily hot water use (litres/day)												136.2310 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	148.2021	145.0373	141.1834	135.3232	130.5642	125.4480	123.4820	127.3193	131.3663	136.7375	142.6879	147.8178 (44)
Energy conte	234.7159	206.5312	216.9936	185.2507	175.7646	154.2530	149.3407	157.6479	161.9878	185.5514	203.2851	231.4469 (45)
Energy content (annual)												2262.7689
Distribution loss (46)m = 0.15 x (45)m												
35.2074	30.9797	32.5490	27.7876	26.3647	23.1379	22.4011	23.6472	24.2982	27.8327	30.4928		34.7170 (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

285.6748 252.5586 267.9525 234.5657 226.7235 203.5680 200.2997 208.6068 211.3029 236.5104 252.6002 282.4058 (62)

WWHRS -33.2072 -29.3687 -30.7532 -25.4649 -23.7324 -20.3080 -19.0355 -20.2423 -21.0114 -24.7701 -28.0615 -32.5923 (63a)

PV diverter -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 (63b)

Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63c)

FGHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)

Output from w/h

252.4676 223.1899 237.1993 209.1008 202.9911 183.2601 181.2642 188.3645 190.2915 211.7402 224.5387 249.8136 (64)

Total per year (kWh/year) = Sum(64)m = 2554.2214 (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

90.7828 80.1785 84.8901 73.9246 71.1814 63.6179 62.3955 65.1577 66.1897 74.4356 79.9211 89.6958 (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	144.3888	144.3888	144.3888	144.3888	144.3888	144.3888	144.3888	144.3888	144.3888	144.3888	144.3888	144.3888 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
161.1118	178.3738	161.1118	166.4822	161.1118	166.4822	161.1118	161.1118	166.4822	161.1118	166.4822	161.1118	161.1118 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
294.4975	297.5534	289.8525	273.4581	252.7632	233.3129	220.3189	217.2629	224.9638	241.3582	262.0531	281.5034	281.5034 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												

elmhurst
energy

6. Solar gains

Solar gains	97.8906	191.2864	315.4835	462.3289	569.5272	584.5316	555.8588	475.3481	367.5090	227.0109	121.9969	80.5526 (83)
Total gains	744.8364	855.8435	949.8640	1074.2590	1148.3929	1139.0015	1087.4711	1007.6170	917.2019	798.8453	730.8504	713.0434 (84)

Electricity generated by wind turbines (Appendix M) (negative quantity)

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(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	-24.8490	-52.4133	-104.4635	-157.3413	-208.5150	-209.7514	-207.3460	-175.3929	-128.2941	-75.1746	-33.2418	-19.6444	(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												5865.0265	(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												3023.3463	(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)												270.1693	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2392.2913	(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												6852.2508	(238)

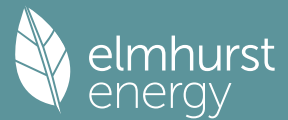
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5865.0265	0.2100	1231.6556 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3023.3463	0.2100	634.9027 (264)
Space and water heating			1866.5583 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	270.1693	0.1443	38.9938 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-995.8639	0.1345	-133.9363
PV Unit electricity exported	-1396.4274	0.1258	-175.6770
Total			-309.6133 (269)
Total CO2, kg/year			1607.8680 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.6300 (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	5865.0265	1.1300	6627.4799 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3023.3463	1.1300	3416.3813 (278)
Space and water heating			10043.8612 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	270.1693	1.5338	414.3947 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-995.8639	1.4971	-1490.8648
PV Unit electricity exported	-1396.4274	0.4618	-644.8483
Total			-2135.7131 (283)
Total Primary energy kWh/year			8452.6436 (286)
Target Primary Energy Rate (TPER)			66.3700 (287)

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Property Reference	SAP VG 21-0282				Issued on Date	15/11/2024	
Assessment Reference	Plot 56			Prop Type Ref	SAP VG 21-0282		
Property							
SAP Rating	92 A	DER	12.58	TER	12.63		
Environmental	88 B	% DER < TER				0.40	
CO ₂ Emissions (t/year)	1.55	DFEE	42.24	TFEE	47.14		
Compliance Check	See BREL	% DFEE < TFEE				10.39	
% DPER < TPER	0.08	DPER	66.32	TPER	66.37		
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	30.5500 (1b)	x 2.8500 (2b)	= 87.0675 (1b) - (3b)
First floor	48.4000 (1c)	x 2.4000 (2c)	= 116.1600 (1c) - (3c)
Second floor	48.4000 (1d)	x 2.6000 (2d)	= 125.8400 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.3500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	329.0675 (5)

2. Ventilation rate

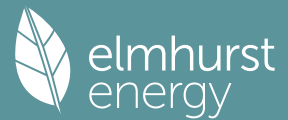
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	5 * 10 = 50.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) = 0.1519 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.3519 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3519 (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	0.4487	0.4399	0.4311	0.3871	0.3783	0.3343	0.3343	0.3255	0.3519	0.3783	0.3959	0.4135 (22b)
Effective ac	0.6007	0.5968	0.5929	0.5749	0.5716	0.5559	0.5559	0.5530	0.5619	0.5716	0.5784	0.5855 (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)			16.9600	1.2357	20.9582		(27)
Ground floor			48.4000	0.1300	6.2920	0.0000	0.0000 (28a)
Brick wall	174.1300	14.2200	159.9100	0.1900	30.3829	110.0000	17590.1000 (29a)
Render wall	17.1000	4.8800	12.2200	0.1800	2.1996	110.0000	1344.2000 (29a)
Retaining wall	15.5900		15.5900	0.1800	2.8062	110.0000	1714.9000 (29a)
Garage wall	21.1500		21.1500	0.1400	2.9610	110.0000	2326.5000 (29a)
Plane roof	48.4000		48.4000	0.0900	4.3560	9.0000	435.6000 (30)
Total net area of external elements Aum(A, m ²)			324.7700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	72.3099		(33)
Internal Wall			34.4800			75.0000	2586.0000 (32c)
Internal Wall			183.4800			9.0000	1651.3200 (32c)
Internal Floor 1			48.4000			18.0000	871.2000 (32d)
Internal Floor 2			48.4000			18.0000	871.2000 (32d)
Internal Ceiling 1			48.4000			9.0000	435.6000 (32e)
Internal Ceiling 2			48.4000			9.0000	435.6000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	30262.2200 (34)

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

237.6303 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	13.4700	0.0240	0.3233
E2 Other lintels (including other steel lintels)	10.6400	0.0220	0.2341
E3 Sill	32.4000	0.0170	0.5508
E4 Jamb	30.1800	0.0850	2.5653
E5 Ground floor (normal)	49.8000	0.0010	0.0498
E10 Eaves (insulation at ceiling level)	10.9800	0.0600	0.6588
E12 Gable (insulation at ceiling level)	18.8800	0.0560	1.0573
E16 Corner (normal)	34.2500	0.0460	1.5755
E17 Corner (inverted - internal area greater than external area)	7.8500	-0.0880	-0.6908
E20 Exposed floor (normal)	10.5600	0.0690	0.7286
E21 Exposed floor (inverted)	7.4200	0.3200	2.3744

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

9.4271 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 81.7370 (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	65.2291	64.8046	64.3884	62.4339	62.0682	60.3658	60.3658	60.0505	61.0215	62.0682	62.8080	63.5814
Heat transfer coeff	146.9661	146.5415	146.1254	144.1708	143.8051	142.1028	142.1028	141.7875	142.7585	143.8051	144.5449	145.3183
Average = Sum(39)m / 12 =												144.1691

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1540	1.1507	1.1474	1.1321	1.1292	1.1158	1.1158	1.1134	1.1210	1.1292	1.1350	1.1411
HLP (average)												1.1321
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8878 (42)
Hot water usage for mixer showers	72.6383	71.5467	69.9560	66.9125	64.6665	62.1617	60.7380	62.3167	64.0472	66.7365	69.8454	72.3600	(42a)
Hot water usage for baths	31.3601	30.8943	30.2385	29.0292	28.1237	27.1196	26.5773	27.2286	27.9377	29.0121	30.2462	31.2541	(42b)
Hot water usage for other uses	44.2037	42.5963	40.9889	39.3815	37.7741	36.1667	36.1667	37.7741	39.3815	40.9889	42.5963	44.2037	(42c)
Average daily hot water use (litres/day)													136.2310 (43)
Daily hot water use	148.2021	145.0373	141.1834	135.3232	130.5642	125.4480	123.4820	127.3193	131.3663	136.7375	142.6879	147.8178	(44)
Energy conte	234.7159	206.5312	216.9936	185.2507	175.7646	154.2530	149.3407	157.6479	161.9878	185.5514	203.2851	231.4469	(45)
Energy content (annual)										Total = Sum(45)m =		2262.7689	
Distribution loss (46)m = 0.15 x (45)m	35.2074	30.9797	32.5490	27.7876	26.3647	23.1379	22.4011	23.6472	24.2982	27.8327	30.4928	34.7170	(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	2.4597	2.2886	2.5634	2.3947	2.4310	2.2834	2.2665	2.2776	2.2157	2.3487	2.3433	2.4424	(61)
Total heat required for water heating calculated for each month	237.1756	208.8198	219.5570	187.6453	178.1955	156.5364	151.6072	159.9255	164.2036	187.9001	205.6285	233.8893	(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)
FV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	237.1756	208.8198	219.5570	187.6453	178.1955	156.5364	151.6072	159.9255	164.2036	187.9001	205.6285	233.8893	(64)
								Total per year (kWh/year) = Sum(64)m =				2291.0838	(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	78.6580	69.2438	72.7912	62.1945	59.0495	51.8600	50.2224	52.9873	54.4149	62.2830	68.1781	77.5667	(65)

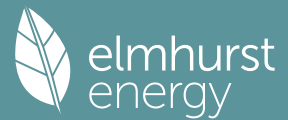
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	173.2665	173.2665	173.2665	173.2665	173.2665	173.2665	173.2665	173.2665	173.2665	173.2665	173.2665	173.2665	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	37.4635	33.2748	27.0609	20.4868	15.3141	12.9288	13.9701	18.1588	24.3727	30.9468	36.1195	38.5048	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	439.5484	444.1096	432.6157	408.1465	377.2585	348.2282	328.8341	324.2730	335.7669	360.2361	391.1241	420.1544	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2144	55.2144	55.2144	55.2144	55.2144	55.2144	55.2144	55.2144	55.2144	55.2144	55.2144	55.2144	(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)	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	(71)
Water heating gains (Table 5)	105.7231	103.0413	97.8377	86.3813	79.3675	72.0277	67.5032	71.2195	75.5762	83.7137	94.6919	104.2563	(72)
Total internal gains	698.7050	696.3956	673.4841	630.9845	587.9101	546.1547	523.2774	526.6213	548.6858	590.8666	637.9053	678.8854	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				1.4200	10.6334	0.7300		0.7000		0.7700		5.3471 (74)
East				8.0200	19.6403	0.7300		0.7000		0.7700		55.7797 (76)
West				7.5200	19.6403	0.7300		0.7000		0.7700		52.3021 (80)
Solar gains	113.4288	221.6494	365.5603	535.7145	659.9284	677.3144	644.0903	550.8002	425.8438	263.0443	141.3615	93.3388 (83)

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Total gains 812.1338 918.0450 1039.0444 1166.6989 1247.8385 1223.4691 1167.3677 1077.4215 974.5296 853.9109 779.2669 772.2242 (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	57.1981	57.3638	57.5271	58.3070	58.4553	59.1556	59.1556	59.2871	58.8839	58.4553	58.1561	57.8466
alpha	4.8132	4.8243	4.8351	4.8871	4.8970	4.9437	4.9437	4.9525	4.9256	4.8970	4.8771	4.8564
util living area	0.9967	0.9935	0.9835	0.9488	0.8579	0.6902	0.5240	0.5844	0.8357	0.9714	0.9939	0.9974 (86)
MIT	20.4471	20.4906	20.5675	20.6698	20.7516	20.7977	20.8091	20.8074	20.7738	20.6638	20.5384	20.4421 (87)
Th 2	19.9570	19.9596	19.9623	19.9747	19.9770	19.9879	19.9879	19.9879	19.9837	19.9770	19.9723	19.9674 (88)
util rest of house	0.9957	0.9915	0.9779	0.9310	0.8102	0.6012	0.4094	0.4663	0.7641	0.9580	0.9916	0.9966 (89)
MIT 2	19.2903	19.3482	19.4484	19.5869	19.6830	19.7382	19.7457	19.7473	19.7148	19.5840	19.4213	19.2936 (90)
Living area fraction	19.4223	19.4787	19.5762	19.7105	19.8050	19.8592	19.8671	19.8683	19.8357	19.7073	19.5489	19.4248 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.2723	19.3287	19.4262	19.5605	19.6550	19.7092	19.7171	19.7183	19.6857	19.5573	19.3989	19.2748 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9948	0.9898	0.9742	0.9220	0.7924	0.5743	0.3775	0.4326	0.7386	0.9506	0.9899	0.9959 (94)
Useful gains	807.8936	908.6913	1012.2386	1075.6435	988.8200	702.6081	440.6640	466.0901	719.8046	811.7308	771.3656	769.0559 (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	2200.4244	2114.3987	1888.8388	1536.9335	1143.9760	726.0319	442.9546	470.4999	797.4021	1288.0998	1777.7376	2190.6378 (97)
Space heating kWh	1036.0429	810.2353	652.1905	332.1288	115.4361	0.0000	0.0000	0.0000	0.0000	354.4185	724.5879	1057.6569 (98a)
Space heating requirement - total per year (kWh/year)												5082.6970
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	1036.0429	810.2353	652.1905	332.1288	115.4361	0.0000	0.0000	0.0000	0.0000	354.4185	724.5879	1057.6569 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5082.6970
Space heating per m2										(98c) / (4) =		39.9112 (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	1036.0429	810.2353	652.1905	332.1288	115.4361	0.0000	0.0000	0.0000	0.0000	354.4185	724.5879	1057.6569 (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)	1169.3487	914.4868	736.1067	374.8632	130.2890	0.0000	0.0000	0.0000	0.0000	400.0209	817.8193	1193.7437 (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	237.1756	208.8198	219.5570	187.6453	178.1955	156.5364	151.6072	159.9255	164.2036	187.9001	205.6285	233.8893 (64)
Efficiency of water heater	86.7724	86.5937	86.1468	85.1253	82.9110	79.6000	79.6000	79.6000	79.6000	85.2600	86.4396	79.6000 (216)
Fuel for water heating, kWh/month	273.3307	241.1489	254.8636	220.4341	214.9239	196.6537	190.4613	200.9114	206.2859	220.3849	237.8870	269.3885 (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	32.7916	26.3067	23.6862	17.3535	13.4044	10.9515	12.2279	15.8943	20.6451	27.0875	30.5953	33.7030 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-33.6764	-52.7456	-84.5806	-103.0886	-115.5550	-109.1009	-107.1813	-98.6430	-83.3805	-63.4278	-38.4235	-28.2578 (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	-14.3086	-34.8779	-83.0438	-145.5103	-210.3545	-218.5281	-213.1081	-169.0461	-109.1869	-53.7470	-20.0229	-10.8435 (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												5736.6783 (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												2726.6739 (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)

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Electricity for lighting (calculated in Appendix L)	264.6472 (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	6613.3607 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5736.6783	3.6400	208.8151 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2726.6739	3.6400	99.2509 (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	264.6472	16.4900	43.6403 (250)
Additional standing charges			92.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-918.0611	16.4900	-151.3883
PV Unit electricity exported	-1282.5776	5.5900	-71.6961
Total			-223.0844 (252)
Total energy cost			234.8034 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.4905 (257)
SAP value		92.0498
SAP rating (Section 12)		92 (258)
SAP band		A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5736.6783	0.2100	1204.7024 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2726.6739	0.2100	572.6015 (264)
Space and water heating			1777.3040 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	264.6472	0.1443	38.1968 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-918.0611	0.1330	-122.1081
PV Unit electricity exported	-1282.5776	0.1223	-156.8016
Total			-278.9098 (269)
Total CO2, kg/year			1548.5202 (272)
CO2 emissions per m2			12.1600 (273)
EI value			87.9604
EI rating			88 (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

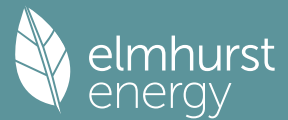
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	30.5500 (1b)	x 2.8500 (2b)	= 87.0675 (1b) - (3b)
First floor	48.4000 (1c)	x 2.4000 (2c)	= 116.1600 (1c) - (3c)
Second floor	48.4000 (1d)	x 2.6000 (2d)	= 125.8400 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.3500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	329.0675 (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	5 * 10 = 50.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Full SAP Calculation Printout



Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 50.0000 / (5) = 0.1519 (8)

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

Blower Door
Yes
4.0000 (17)
0.3519 (18)
0 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3519 (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	0.4487	0.4399	0.4311	0.3871	0.3783	0.3343	0.3343	0.3255	0.3519	0.3783	0.3959	0.4135	(22b)
	0.6007	0.5968	0.5929	0.5749	0.5716	0.5559	0.5559	0.5530	0.5619	0.5716	0.5784	0.5855	(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)			16.9600	1.2357	20.9582			(27)
Ground floor			48.4000	0.1300	6.2920	0.0000	0.0000	(28a)
Brick wall	174.1300	14.2200	159.9100	0.1900	30.3829	110.0000	17590.1000	(29a)
Render wall	17.1000	4.8800	12.2200	0.1800	2.1996	110.0000	1344.2000	(29a)
Retaining wall	15.5900		15.5900	0.1800	2.8062	110.0000	1714.9000	(29a)
Garage wall	21.1500		21.1500	0.1400	2.9610	110.0000	2326.5000	(29a)
Plane roof	48.4000		48.4000	0.0900	4.3560	9.0000	435.6000	(30)
Total net area of external elements Aum(A, m2)			324.7700					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 72.3099			(33)
Internal Wall			34.4800			75.0000	2586.0000	(32c)
Internal Wall			183.4800			9.0000	1651.3200	(32c)
Internal Floor 1			48.4000			18.0000	871.2000	(32d)
Internal Floor 2			48.4000			18.0000	871.2000	(32d)
Internal Ceiling 1			48.4000			9.0000	435.6000	(32e)
Internal Ceiling 2			48.4000			9.0000	435.6000	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 30262.2200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 237.6303 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	13.4700	0.0240	0.3233	
E3 Sill	10.6400	0.0220	0.2341	
E4 Jamb	32.4000	0.0170	0.5508	
E5 Ground floor (normal)	30.1800	0.0850	2.5653	
E6 Intermediate floor within a dwelling	49.8000	0.0010	0.0498	
E10 Eaves (insulation at ceiling level)	10.9800	0.0600	0.6588	
E12 Gable (insulation at ceiling level)	18.8800	0.0560	1.0573	
E16 Corner (normal)	34.2500	0.0460	1.5755	
E17 Corner (inverted - internal area greater than external area)	7.8500	-0.0880	-0.6908	
E20 Exposed floor (normal)	10.5600	0.0690	0.7286	
E21 Exposed floor (inverted)	7.4200	0.3200	2.3744	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.4271 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 81.7370 (37)

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

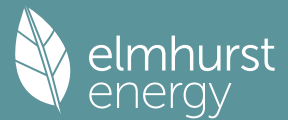
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	65.2291	64.8046	64.3884	62.4339	62.0682	60.3658	60.3658	60.0505	61.0215	62.0682	62.8080	63.5814	(38)
Heat transfer coeff	146.9661	146.5415	146.1254	144.1708	143.8051	142.1028	142.1028	141.7875	142.7585	143.8051	144.5449	145.3183	(39)
Average = Sum(39)m / 12 =												144.1691	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1540	1.1507	1.1474	1.1321	1.1292	1.1158	1.1158	1.1134	1.1210	1.1292	1.1350	1.1411	(40)
HLP (average)												1.1321	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8878 (42)
Hot water usage for mixer showers													
72.6383	71.5467	69.9560	66.9125	64.6665	62.1617	60.7380	62.3167	64.0472	66.7365	69.8454	72.3600	72.3600	(42a)
Hot water usage for baths													
31.3601	30.8943	30.2385	29.0292	28.1237	27.1196	26.5773	27.2286	27.9377	29.0121	30.2462	31.2541	31.2541	(42b)
Hot water usage for other uses													
44.2037	42.5963	40.9889	39.3815	37.7741	36.1667	36.1667	37.7741	39.3815	40.9889	42.5963	44.2037	44.2037	(42c)
Average daily hot water use (litres/day)												136.2310	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	148.2021	145.0373	141.1834	135.3232	130.5642	125.4480	123.4820	127.3193	131.3663	136.7375	142.6879	147.8178	(44)
Energy conte	234.7159	206.5312	216.9936	185.2507	175.7646	154.2530	149.3407	157.6479	161.9878	185.5514	203.2851	231.4469	(45)
Energy content (annual)										Total = Sum(45)m =		2262.7689	
Distribution loss (46)m = 0.15 x (45)m	35.2074	30.9797	32.5490	27.7876	26.3647	23.1379	22.4011	23.6472	24.2982	27.8327	30.4928	34.7170	(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	2.4597	2.2886	2.5634	2.3947	2.4310	2.2834	2.2665	2.2776	2.2157	2.3487	2.3433	2.4424	(61)
Total heat required for water heating calculated for each month	237.1756	208.8198	219.5570	187.6453	178.1955	156.5364	151.6072	159.9255	164.2036	187.9001	205.6285	233.8893	(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	237.1756	208.8198	219.5570	187.6453	178.1955	156.5364	151.6072	159.9255	164.2036	187.9001	205.6285	233.8893	(64)

Full SAP Calculation Printout



Electric shower(s)											Total per year (kWh/year) = Sum(64)m = 2291.0838 (64)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month											Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
78.6580	69.2438	72.7912	62.1945	59.0495	51.8600	50.2224	52.9873	54.4149	62.2830	68.1781	77.5667 (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	173.2665	173.2665	173.2665	173.2665	173.2665	173.2665	173.2665	173.2665	173.2665	173.2665	173.2665	173.2665 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	37.4635	33.2748	27.0609	20.4868	15.3141	12.9288	13.9701	18.1588	24.3727	30.9468	36.1195	38.5048 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	439.5484	444.1096	432.6157	408.1465	377.2585	348.2282	328.8341	324.2730	335.7669	360.2361	391.1241	420.1544 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2144	55.2144	55.2144	55.2144	55.2144	55.2144	55.2144	55.2144	55.2144	55.2144	55.2144	55.2144 (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)	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110 (71)
Water heating gains (Table 5)	105.7231	103.0413	97.8377	86.3813	79.3675	72.0277	67.5032	71.2195	75.5762	83.7137	94.6919	104.2563 (72)
Total internal gains	698.7050	696.3956	673.4841	630.9845	587.9101	546.1547	523.2774	526.6213	548.6858	590.8666	637.9053	678.8854 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North					1.4200	10.6334		0.7300	0.7000	0.7700	5.3471 (74)	
East					8.0200	19.6403		0.7300	0.7000	0.7700	55.7797 (76)	
West					7.5200	19.6403		0.7300	0.7000	0.7700	52.3021 (80)	
Solar gains	113.4288	221.6494	365.5603	535.7145	659.9284	677.3144	644.0903	550.8002	425.8438	263.0443	141.3615	93.3388 (83)
Total gains	812.1338	918.0450	1039.0444	1166.6989	1247.8385	1223.4691	1167.3677	1077.4215	974.5296	853.9109	779.2669	772.2242 (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	57.1981	57.3638	57.5271	58.3070	58.4553	59.1556	59.1556	59.2871	58.8839	58.4553	58.1561	57.8466
alpha	4.8132	4.8243	4.8351	4.8871	4.8970	4.9437	4.9437	4.9525	4.9256	4.8970	4.8771	4.8564
util living area	0.9967	0.9935	0.9835	0.9488	0.8579	0.6902	0.5240	0.5844	0.8357	0.9714	0.9939	0.9974 (86)
MIT	20.4471	20.4906	20.5675	20.6698	20.7516	20.7977	20.8091	20.8074	20.7738	20.6638	20.5384	20.4421 (87)
Th 2	19.9570	19.9596	19.9623	19.9747	19.9770	19.9879	19.9879	19.9899	19.9837	19.9770	19.9723	19.9674 (88)
util rest of house	0.9957	0.9915	0.9779	0.9310	0.8102	0.6012	0.4094	0.4663	0.7641	0.9580	0.9916	0.9966 (89)
MIT 2	19.2903	19.3482	19.4484	19.5869	19.6830	19.7382	19.7457	19.7473	19.7148	19.5840	19.4213	19.2936 (90)
Living area fraction	fLA = Living area / (4) = 0.1142 (91)											
MIT	19.4223	19.4787	19.5762	19.7105	19.8050	19.8592	19.8671	19.8683	19.8357	19.7073	19.5489	19.4248 (92)
Temperature adjustment	-0.1500											
adjusted MIT	19.2723	19.3287	19.4262	19.5605	19.6550	19.7092	19.7171	19.7183	19.6857	19.5573	19.3989	19.2748 (93)

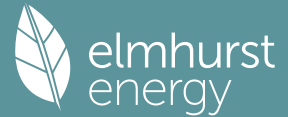
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9948	0.9898	0.9742	0.9220	0.7924	0.5743	0.3775	0.4326	0.7386	0.9506	0.9899	0.9959 (94)
Useful gains	807.8936	908.6913	1012.2386	1075.6435	988.8200	702.6081	440.6640	466.0901	719.8046	811.7308	771.3656	769.0559 (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	2200.4244	2114.3987	1888.8388	1536.9335	1143.9760	726.0319	442.9546	470.4999	797.4021	1288.0998	1777.7376	2190.6378 (97)
Space heating kWh	1036.0429	810.2353	652.1905	332.1288	115.4361	0.0000	0.0000	0.0000	0.0000	354.4185	724.5879	1057.6569 (98a)
Space heating requirement - total per year (kWh/year)												5082.6970
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 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	1036.0429	810.2353	652.1905	332.1288	115.4361	0.0000	0.0000	0.0000	0.0000	354.4185	724.5879	1057.6569 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5082.6970
Space heating per m2											(98c) / (4) =	39.9112 (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	1036.0429	810.2353	652.1905	332.1288	115.4361	0.0000	0.0000	0.0000	0.0000	354.4185	724.5879	1057.6569 (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)	1169.3487	914.4868	736.1067	374.8632	130.2890	0.0000	0.0000	0.0000	0.0000	400.0209	817.8193	1193.7437 (211)
Space heating efficiency (main heating system 2)												

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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	(212)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
	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	237.1756	208.8198	219.5570	187.6453	178.1955	156.5364	151.6072	159.9255	164.2036	187.9001	205.6285	233.8893 (64)
Efficiency of water heater (217)m	86.7724	86.5937	86.1468	85.1253	82.9110	79.6000	79.6000	79.6000	79.6000	85.2600	86.4396	79.6000 (216)
Fuel for water heating, kWh/month	273.3307	241.1489	254.8636	220.4341	214.9239	196.6537	190.4613	200.9114	206.2859	220.3849	237.8870	86.8223 (217)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	32.7916	26.3067	23.6862	17.3535	13.4044	10.9515	12.2279	15.8943	20.6451	27.0875	30.5953	33.7030 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-33.6764	-52.7456	-84.5806	-103.0886	-115.5550	-109.1009	-107.1813	-98.6430	-83.3805	-63.4278	-38.4235	-28.2578 (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	-14.3086	-34.8779	-83.0438	-145.5103	-210.3545	-218.5281	-213.1081	-169.0461	-109.1869	-53.7470	-20.0229	-10.8435 (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												5736.6783 (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												2726.6739 (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)												264.6472 (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												6613.3607 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5736.6783	5.6000	321.2540 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2726.6739	5.6000	152.6937 (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	264.6472	26.0600	68.9671 (250)
Additional standing charges			99.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-918.0611	26.0600	-239.2467
PV Unit electricity exported	-1282.5776	5.8100	-74.5178
Total			-313.7645 (252)
Total energy cost			350.5619 (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	5736.6783	0.2100	1204.7024 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2726.6739	0.2100	572.6015 (264)
Space and water heating			1777.3040 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	264.6472	0.1443	38.1968 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-918.0611	0.1330	-122.1081
PV Unit electricity exported	-1282.5776	0.1223	-156.8016
Total			-278.9098 (269)
Total CO2, kg/year			1548.5202 (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	5736.6783	1.1300	6482.4465 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2726.6739	1.1300	3081.1415 (278)
Space and water heating			9563.5880 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	264.6472	1.5338	405.9247 (282)

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Energy saving/generation technologies			
PV Unit electricity used in dwelling	-918.0611	1.4915	-1369.2774
PV Unit electricity exported	-1282.5776	0.4486	-575.3429
Total			-1944.6203 (283)
Total Primary energy kWh/year			8154.9932 (286)

SAP 10 EPC IMPROVEMENTS

Plot 56

Current energy efficiency rating: A 92
Current environmental impact rating: B 88

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

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

Measures omitted - SAP change or cost saving too small:
N Solar water heating + 0.5 -£ 22 -144 kg (9.3%)

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

Potential energy efficiency rating: A 92
Potential environmental impact rating: B 88

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	£91	£91	£0
Mains gas	£573	£573	£0
Space heating	£443	£443	£0
Water heating	£153	£153	£0
Lighting	£69	£69	£0
Generated (PV)	-£314	-£314	£0
Total cost of fuels	£350	£350	£0
Total cost of uses	£351	£351	£0
Delivered energy	52 kWh/m²	52 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.5 tonnes	1.5 tonnes	0.0 tonnes
CO2 emissions per m²	12 kg/m²	12 kg/m²	0 kg/m²
Primary energy	64 kWh/m²	64 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

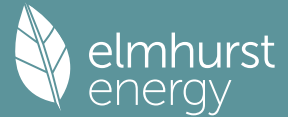
1. Overall dwelling characteristics

	Area (m²)	Storey height (m)	Volume (m³)
Ground floor	30.5500 (1b)	x 2.8500 (2b)	= 87.0675 (1b) - (3b)
First floor	48.4000 (1c)	x 2.4000 (2c)	= 116.1600 (1c) - (3c)
Second floor	48.4000 (1d)	x 2.6000 (2d)	= 125.8400 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.3500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	329.0675 (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	5 * 10 = 50.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) = 0.1519 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.3519 (18)
Number of sides sheltered	0 (19)

Full SAP Calculation Printout



Shelter factor
Infiltration rate adjusted to include shelter factor

$$(20) = 1 - [0.075 \times (19)] = 1.0000 \quad (20)$$
$$(21) = (18) \times (20) = 0.3519 \quad (21)$$

Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4487	0.4399	0.4311	0.3871	0.3783	0.3343	0.3343	0.3255	0.3519	0.3783	0.3959	0.4135	(22b)
Effective ac	0.6007	0.5968	0.5929	0.5749	0.5716	0.5559	0.5559	0.5530	0.5619	0.5716	0.5784	0.5855	(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)			16.9600	1.2357	20.9582			(27)
Ground floor			48.4000	0.1300	6.2920	0.0000	0.0000	(28a)
Brick wall	174.1300	14.2200	159.9100	0.1900	30.3829	110.0000	17590.1000	(29a)
Render wall	17.1000	4.8800	12.2200	0.1800	2.1996	110.0000	1344.2000	(29a)
Retaining wall	15.5900		15.5900	0.1800	2.8062	110.0000	1714.9000	(29a)
Garage wall	21.1500		21.1500	0.1400	2.9610	110.0000	2326.5000	(29a)
Plane roof	48.4000		48.4000	0.0900	4.3560	9.0000	435.6000	(30)
Total net area of external elements Aum(A, m2)			324.7700					(31)
Fabric heat loss, W/K = Sum(A x U)					72.3099			(33)
Internal Wall			34.4800			75.0000	2586.0000	(32c)
Internal Wall			183.4800			9.0000	1651.3200	(32c)
Internal Floor 1			48.4000			18.0000	871.2000	(32d)
Internal Floor 2			48.4000			18.0000	871.2000	(32d)
Internal Ceiling 1			48.4000			9.0000	435.6000	(32e)
Internal Ceiling 2			48.4000			9.0000	435.6000	(32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
(28)...(30) + (32) + (32a)...(32e) = 30262.2200 (34)

List of Thermal Bridges	Length	Psi-value	Total	
K1 Element	13.4700	0.0240	0.3233	
E2 Other lintels (including other steel lintels)	10.6400	0.0220	0.2341	
E3 Sill	32.4000	0.0170	0.5508	
E4 Jamb	30.1800	0.0850	2.5653	
E5 Ground floor (normal)	49.8000	0.0010	0.0498	
E6 Intermediate floor within a dwelling	10.9800	0.0600	0.6588	
E10 Eaves (insulation at ceiling level)	18.8800	0.0560	1.0573	
E12 Gable (insulation at ceiling level)	34.2500	0.0460	1.5755	
E16 Corner (normal)	7.8500	-0.0880	-0.6908	
E17 Corner (inverted - internal area greater than external area)	10.5600	0.0690	0.7286	
E20 Exposed floor (normal)	7.4200	0.3200	2.3744	
E21 Exposed floor (inverted)				

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Point Thermal bridges
Total fabric heat loss
(33) + (36) + (36a) = 81.7370 (37)

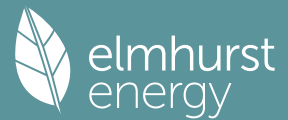
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 65.2291	Feb 64.8046	Mar 64.3884	Apr 62.4339	May 62.0682	Jun 60.3658	Jul 60.3658	Aug 60.0505	Sep 61.0215	Oct 62.0682	Nov 62.8080	Dec 63.5814	(38)
Heat transfer coeff	146.9661	146.5415	146.1254	144.1708	143.8051	142.1028	142.1028	141.7875	142.7585	143.8051	144.5449	145.3183	(39)
Average = Sum(39)m / 12 =												144.1691	

HLP	Jan 1.1540	Feb 1.1507	Mar 1.1474	Apr 1.1321	May 1.1292	Jun 1.1158	Jul 1.1158	Aug 1.1134	Sep 1.1210	Oct 1.1292	Nov 1.1350	Dec 1.1411	(40)
HLP (average)												1.1321	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8878	(42)
Hot water usage for mixer showers	72.6383	71.5467	69.9560	66.9125	64.6665	62.1617	60.7380	62.3167	64.0472	66.7365	69.8454	72.3600	(42a)	
Hot water usage for baths	31.3601	30.8943	30.2385	29.0292	28.1237	27.1196	26.5773	27.2286	27.9377	29.0121	30.2462	31.2541	(42b)	
Hot water usage for other uses	44.2037	42.5963	40.9889	39.3815	37.7741	36.1667	36.1667	37.7741	39.3815	40.9889	42.5963	44.2037	(42c)	
Average daily hot water use (litres/day)													136.2310	(43)
Daily hot water use	Jan 148.2021	Feb 145.0373	Mar 141.1834	Apr 135.3232	May 130.5642	Jun 125.4480	Jul 123.4820	Aug 127.3193	Sep 131.3663	Oct 136.7375	Nov 142.6879	Dec 147.8178	(44)	
Energy conte	234.7159	206.5312	216.9936	185.2507	175.7646	154.2530	149.3407	157.6479	161.9878	185.5514	203.2851	231.4469	(45)	
Energy content (annual)										Total = Sum(45)m =		2262.7689		
Distribution loss (46)m = 0.15 x (45)m	35.2074	30.9797	32.5490	27.7876	26.3647	23.1379	22.4011	23.6472	24.2982	27.8327	30.4928	34.7170	(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	2.4597	2.2886	2.5634	2.3947	2.4310	2.2834	2.2665	2.2776	2.2157	2.3487	2.3433	2.4424	(61)	
Total heat required for water heating calculated for each month	237.1756	208.8198	219.5570	187.6453	178.1955	156.5364	151.6072	159.9255	164.2036	187.9001	205.6285	233.8893	(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	237.1756	208.8198	219.5570	187.6453	178.1955	156.5364	151.6072	159.9255	164.2036	187.9001	205.6285	233.8893	(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	78.6580	69.2438	72.7912	62.1945	59.0495	51.8600	50.2224	52.9873	54.4149	62.2830	68.1781	77.5667	(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	173.2665	173.2665	173.2665	173.2665	173.2665	173.2665	173.2665	173.2665	173.2665	173.2665	173.2665	173.2665 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	37.4635	33.2748	27.0609	20.4868	15.3141	12.9288	13.9701	18.1588	24.3727	30.9468	36.1195	38.5048 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	439.5484	444.1096	432.6157	408.1465	377.2585	348.2282	328.8341	324.2730	335.7669	360.2361	391.1241	420.1544 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2144	55.2144	55.2144	55.2144	55.2144	55.2144	55.2144	55.2144	55.2144	55.2144	55.2144	55.2144 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110 (71)
Water heating gains (Table 5)	105.7231	103.0413	97.8377	86.3813	79.3675	72.0277	67.5032	71.2195	75.5762	83.7137	94.6919	104.2563 (72)
Total internal gains	698.7050	696.3956	673.4841	630.9845	587.9101	546.1547	523.2774	526.6213	548.6858	590.8666	637.9053	678.8854 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North					1.4200	10.6334	0.7300	0.7000			0.7700			5.3471 (74)
East					8.0200	19.6403	0.7300	0.7000			0.7700			55.7797 (76)
West					7.5200	19.6403	0.7300	0.7000			0.7700			52.3021 (80)
Solar gains	113.4288	221.6494	365.5603	535.7145	659.9284	677.3144	644.0903	550.8002	425.8438	263.0443	141.3615			93.3388 (83)
Total gains	812.1338	918.0450	1039.0444	1166.6989	1247.8385	1223.4691	1167.3677	1077.4215	974.5296	853.9109	779.2669			772.2242 (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	57.1981	57.3638	57.5271	58.3070	58.4553	59.1556	59.1556	59.2871	58.8839	58.4553	58.1561	57.8466
alpha	4.8132	4.8243	4.8351	4.8871	4.8970	4.9437	4.9437	4.9525	4.9256	4.8970	4.8771	4.8564
util living area	0.9967	0.9935	0.9835	0.9488	0.8579	0.6902	0.5240	0.5844	0.8357	0.9714	0.9939	0.9974 (86)
MIT	20.4471	20.4906	20.5675	20.6698	20.7516	20.7977	20.8091	20.8074	20.7738	20.6638	20.5384	20.4421 (87)
Th 2	19.9570	19.9596	19.9623	19.9747	19.9770	19.9879	19.9879	19.9879	19.9837	19.9770	19.9723	19.9674 (88)
util rest of house	0.9957	0.9915	0.9779	0.9310	0.8102	0.6012	0.4094	0.4663	0.7641	0.9580	0.9916	0.9966 (89)
MIT 2	19.2903	19.3482	19.4484	19.5869	19.6830	19.7382	19.7457	19.7473	19.7148	19.5840	19.4213	19.2936 (90)
Living area fraction	19.4223	19.4787	19.5762	19.7105	19.8050	19.8592	19.8671	19.8683	19.8357	19.7073	19.5489	19.4248 (91)
MIT	19.4223	19.4787	19.5762	19.7105	19.8050	19.8592	19.8671	19.8683	19.8357	19.7073	19.5489	19.4248 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.2723	19.3287	19.4262	19.5605	19.6550	19.7092	19.7171	19.7183	19.6857	19.5573	19.3989	19.2748 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9948	0.9898	0.9742	0.9220	0.7924	0.5743	0.3775	0.4326	0.7386	0.9506	0.9899	0.9959 (94)
Useful gains	807.8936	908.6913	1012.2386	1075.6435	988.8200	702.6081	440.6640	466.0901	719.8046	811.7308	771.3656	769.0559 (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	2200.4244	2114.3987	1888.8388	1536.9335	1143.9760	726.0319	442.9546	470.4999	797.4021	1288.0998	1777.7376	2190.6378 (97)
Space heating kWh	1036.0429	810.2353	652.1905	332.1288	115.4361	0.0000	0.0000	0.0000	0.0000	354.4185	724.5879	1057.6569 (98a)
Space heating requirement - total per year (kWh/year)												5082.6970
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	1036.0429	810.2353	652.1905	332.1288	115.4361	0.0000	0.0000	0.0000	0.0000	354.4185	724.5879	1057.6569 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5082.6970
Space heating per m ²												39.9112 (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	1036.0429	810.2353	652.1905	332.1288	115.4361	0.0000	0.0000	0.0000	0.0000	354.4185	724.5879	1057.6569 (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)	1169.3487	914.4868	736.1067	374.8632	130.2890	0.0000	0.0000	0.0000	0.0000	400.0209	817.8193	1193.7437 (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

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Water heating requirement	237.1756	208.8198	219.5570	187.6453	178.1955	156.5364	151.6072	159.9255	164.2036	187.9001	205.6285	233.8893	(64)
Efficiency of water heater												79.6000	(216)
(217)m	86.7724	86.5937	86.1468	85.1253	82.9110	79.6000	79.6000	79.6000	79.6000	85.2600	86.4396	86.8223	(217)
Fuel for water heating, kWh/month	273.3307	241.1489	254.8636	220.4341	214.9239	196.6537	190.4613	200.9114	206.2859	220.3849	237.8870	269.3885	(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	32.7916	26.3067	23.6862	17.3535	13.4044	10.9515	12.2279	15.8943	20.6451	27.0875	30.5953	33.7030	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-33.6764	-52.7456	-84.5806	-103.0886	-115.5550	-109.1009	-107.1813	-98.6430	-83.3805	-63.4278	-38.4235	-28.2578	(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	-14.3086	-34.8779	-83.0438	-145.5103	-210.3545	-218.5281	-213.1081	-169.0461	-109.1869	-53.7470	-20.0229	-10.8435	(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												5736.6783	(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												2726.6739	(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)												264.6472	(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												6613.3607	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5736.6783	3.6400	208.8151	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2726.6739	3.6400	99.2509	(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	264.6472	16.4900	43.6403	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-918.0611	16.4900	-151.3883	
PV Unit electricity exported	-1282.5776	5.5900	-71.6961	
Total			-223.0844	(252)
Total energy cost			234.8034	(255)

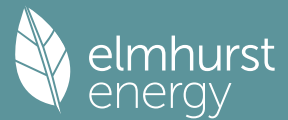
11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.4905	(257)
SAP value		92.0498	
SAP rating (Section 12)		92	(258)
SAP band		A	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5736.6783	0.2100	1204.7024	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2726.6739	0.2100	572.6015	(264)
Space and water heating			1777.3040	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	264.6472	0.1443	38.1968	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-918.0611	0.1330	-122.1081	
PV Unit electricity exported	-1282.5776	0.1223	-156.8016	
Total			-278.9098	(269)
Total CO2, kg/year			1548.5202	(272)
CO2 emissions per m2			12.1600	(273)
EI value			87.9604	
EI rating			88	(274)
EI band			B	

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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	30.5500 (1b)	x	2.8500 (2b)	=	87.0675 (1b)	- (3b)
First floor	48.4000 (1c)	x	2.4000 (2c)	=	116.1600 (1c)	- (3c)
Second floor	48.4000 (1d)	x	2.6000 (2d)	=	125.8400 (1d)	- (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.3500				(4)	
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	329.0675 (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												5 * 10 = 50.0000 (7a)
Number of passive vents												0 * 10 = 0.0000 (7b)
Number of flueless gas fires												0 * 40 = 0.0000 (7c)
Air changes per hour												
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =												50.0000 / (5) = 0.1519 (8)
Pressure test												Yes
Pressure Test Method												Blower Door
Measured/design AP50												4.0000 (17)
Infiltration rate												0.3519 (18)
Number of sides sheltered												0 (19)
Shelter factor												(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) = 0.3519 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Effective ac	0.4487	0.4399	0.4311	0.3871	0.3783	0.3343	0.3343	0.3255	0.3519	0.3783	0.3959	0.4135 (22b)
	0.6007	0.5968	0.5929	0.5749	0.5716	0.5559	0.5559	0.5530	0.5619	0.5716	0.5784	0.5855 (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)			16.9600	1.2357	20.9582			(27)
Ground floor			48.4000	0.1300	6.2920	0.0000	0.0000	(28a)
Brick wall	174.1300	14.2200	159.9100	0.1900	30.3829	110.0000	17590.1000	(29a)
Render wall	17.1000	4.8800	12.2200	0.1800	2.1996	110.0000	1344.2000	(29a)
Retaining wall	15.5900		15.5900	0.1800	2.8062	110.0000	1714.9000	(29a)
Garage wall	21.1500		21.1500	0.1400	2.9610	110.0000	2326.5000	(29a)
Plane roof	48.4000		48.4000	0.0900	4.3560	9.0000	435.6000	(30)
Total net area of external elements Aum(A, m ²)			324.7700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	72.3099			(33)
Internal Wall			34.4800			75.0000	2586.0000	(32c)
Internal Wall			183.4800			9.0000	1651.3200	(32c)
Internal Floor 1			48.4000			18.0000	871.2000	(32d)
Internal Floor 2			48.4000			18.0000	871.2000	(32d)
Internal Ceiling 1			48.4000			9.0000	435.6000	(32e)
Internal Ceiling 2			48.4000			9.0000	435.6000	(32e)

Heat capacity Cm = Sum(A x K) (28)...(30) + (32) + (32a)...(32e) = 30262.2200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 237.6303 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	13.4700	0.0240	0.3233
E3 Sill	10.6400	0.0220	0.2341
E4 Jamb	32.4000	0.0170	0.5508
E5 Ground floor (normal)	30.1800	0.0850	2.5653
E6 Intermediate floor within a dwelling	49.8000	0.0010	0.0498
E10 Eaves (insulation at ceiling level)	10.9800	0.0600	0.6588
E12 Gable (insulation at ceiling level)	18.8800	0.0560	1.0573
E16 Corner (normal)	34.2500	0.0460	1.5755
E17 Corner (inverted - internal area greater than external area)	7.8500	-0.0880	-0.6908
E20 Exposed floor (normal)	10.5600	0.0690	0.7286
E21 Exposed floor (inverted)	7.4200	0.3200	2.3744

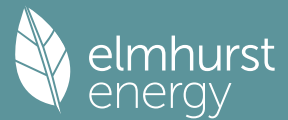
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.4271 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 81.7370 (37)

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	65.2291	64.8046	64.3884	62.4339	62.0682	60.3658	60.3658	60.0505	61.0215	62.0682	62.8080	63.5814 (38)
Average = Sum(39)m / 12 =	146.9661	146.5415	146.1254	144.1708	143.8051	142.1028	142.1028	141.7875	142.7585	143.8051	144.5449	145.3183 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1540	1.1507	1.1474	1.1321	1.1292	1.1158	1.1158	1.1134	1.1210	1.1292	1.1350	1.1411 (40)
HLP (average)												1.1321
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8878 (42)
Hot water usage for mixer showers	72.6383	71.5467	69.9560	66.9125	64.6665	62.1617	60.7380	62.3167	64.0472	66.7365	69.8454	72.3600 (42a)
Hot water usage for baths	31.3601	30.8943	30.2385	29.0292	28.1237	27.1196	26.5773	27.2286	27.9377	29.0121	30.2462	31.2541 (42b)
Hot water usage for other uses	44.2037	42.5963	40.9889	39.3815	37.7741	36.1667	36.1667	37.7741	39.3815	40.9889	42.5963	44.2037 (42c)
Average daily hot water use (litres/day)												136.2310 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	148.2021	145.0373	141.1834	135.3232	130.5642	125.4480	123.4820	127.3193	131.3663	136.7375	142.6879	147.8178 (44)
Energy content (annual)	234.7159	206.5312	216.9936	185.2507	175.7646	154.2530	149.3407	157.6479	161.9878	185.5514	203.2851	231.4469 (45)
Distribution loss (46)m = 0.15 x (45)m	35.2074	30.9797	32.5490	27.7876	26.3647	23.1379	22.4011	23.6472	24.2982	27.8327	30.4928	34.7170 (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	2.4597	2.2886	2.5634	2.3947	2.4310	2.2834	2.2665	2.2776	2.2157	2.3487	2.3433	2.4424 (61)
Total heat required for water heating calculated for each month	237.1756	208.8198	219.5570	187.6453	178.1955	156.5364	151.6072	159.9255	164.2036	187.9001	205.6285	233.8893 (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	237.1756	208.8198	219.5570	187.6453	178.1955	156.5364	151.6072	159.9255	164.2036	187.9001	205.6285	233.8893 (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	78.6580	69.2438	72.7912	62.1945	59.0495	51.8600	50.2224	52.9873	54.4149	62.2830	68.1781	77.5667 (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	173.2665	173.2665	173.2665	173.2665	173.2665	173.2665	173.2665	173.2665	173.2665	173.2665	173.2665	173.2665 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	37.4635	33.2748	27.0609	20.4868	15.3141	12.9288	13.9701	18.1588	24.3727	30.9468	36.1195	38.5048 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	439.5484	444.1096	432.6157	408.1465	377.2585	348.2282	328.8341	324.2730	335.7669	360.2361	391.1241	420.1544 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2144	55.2144	55.2144	55.2144	55.2144	55.2144	55.2144	55.2144	55.2144	55.2144	55.2144	55.2144 (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)	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110	-115.5110 (71)
Water heating gains (Table 5)	105.7231	103.0413	97.8377	86.3813	79.3675	72.0277	67.5032	71.2195	75.5762	83.7137	94.6919	104.2563 (72)
Total internal gains	698.7050	696.3956	673.4841	630.9845	587.9101	546.1547	523.2774	526.6213	548.6858	590.8666	637.9053	678.8854 (73)

6. Solar gains

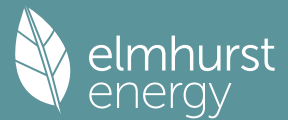
[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
North					1.4200	10.6334		0.7300	0.7000	0.7700		5.3471 (74)
East					8.0200	19.6403		0.7300	0.7000	0.7700		55.7797 (76)
West					7.5200	19.6403		0.7300	0.7000	0.7700		52.3021 (80)
Solar gains	113.4288	221.6494	365.5603	535.7145	659.9284	677.3144	644.0903	550.8002	425.8438	263.0443	141.3615	93.3388 (83)
Total gains	812.1338	918.0450	1039.0444	1166.6989	1247.8385	1223.4691	1167.3677	1077.4215	974.5296	853.9109	779.2669	772.2242 (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	57.1981	57.3638	57.5271	58.3070	58.4553	59.1556	59.1556	59.2871	58.8839	58.4553	58.1561	57.8466
alpha	4.8132	4.8243	4.8351	4.8871	4.8970	4.9437	4.9437	4.9525	4.9256	4.8970	4.8771	4.8564
util living area	0.9967	0.9935	0.9835	0.9488	0.8579	0.6902	0.5240	0.5844	0.8357	0.9714	0.9939	0.9974 (86)
MIT	20.4471	20.4906	20.5675	20.6698	20.7516	20.7977	20.8091	20.8074	20.7738	20.6638	20.5384	20.4421 (87)
Th 2	19.9570	19.9596	19.9623	19.9747	19.9770	19.9879	19.9879	19.9899	19.9837	19.9770	19.9723	19.9674 (88)
util rest of house	0.9957	0.9915	0.9779	0.9310	0.8102	0.6012	0.4094	0.4663	0.7641	0.9580	0.9916	0.9966 (89)
MIT 2	19.2903	19.3482	19.4484	19.5869	19.6830	19.7382	19.7457	19.7473	19.7148	19.5840	19.4213	19.2936 (90)
Living area fraction	19.4223	19.4787	19.5762	19.7105	19.8050	19.8592	19.8671	19.8683	FLA = Living area / (4) =	19.8357	19.7073	19.5489
MIT	19.4223	19.4787	19.5762	19.7105	19.8050	19.8592	19.8671	19.8683	19.8357	19.7073	19.5489	19.4248 (91)
Temperature adjustment												-0.1500
adjusted MIT	19.2723	19.3287	19.4262	19.5605	19.6550	19.7092	19.7171	19.7183	19.6857	19.5573	19.3989	19.2748 (92)
										</		

8. Space heating requirement

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9948	0.9898	0.9742	0.9220	0.7924	0.5743	0.3775	0.4326	0.7386	0.9506	0.9899	0.9959	(94)
Useful gains	807.8936	908.6913	1012.2386	1075.6435	988.8200	702.6081	440.6640	466.0901	719.8046	811.7308	771.3656	769.0559	(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	2200.4244	2114.3987	1888.8388	1536.9335	1143.9760	726.0319	442.9546	470.4999	797.4021	1288.0998	1777.7376	2190.6378	(97)
Space heating kWh	1036.0429	810.2353	652.1905	332.1288	115.4361	0.0000	0.0000	0.0000	0.0000	354.4185	724.5879	1057.6569	(98a)
Space heating requirement - total per year (kWh/year)												5082.6970	
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	1036.0429	810.2353	652.1905	332.1288	115.4361	0.0000	0.0000	0.0000	0.0000	354.4185	724.5879	1057.6569	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5082.6970	
Space heating per m2											(98c) / (4) =	39.9112	(99)

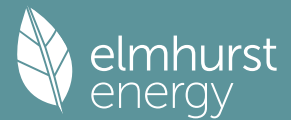
9a. Energy requirements - Individual heating systems, including micro-CHP

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	1036.0429	810.2353	652.1905	332.1288	115.4361	0.0000	0.0000	0.0000	0.0000	354.4185	724.5879	1057.6569	(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)	1169.3487	914.4868	736.1067	374.8632	130.2890	0.0000	0.0000	0.0000	0.0000	400.0209	817.8193	1193.7437	(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	237.1756	208.8198	219.5570	187.6453	178.1955	156.5364	151.6072	159.9255	164.2036	187.9001	205.6285	233.8893	(64)	
Efficiency of water heater (217)m	86.7724	86.5937	86.1468	85.1253	82.9110	79.6000	79.6000	79.6000	79.6000	85.2600	86.4396	86.8223	(216)	
Fuel for water heating, kWh/month	273.3307	241.1489	254.8636	220.4341	214.9239	196.6537	190.4613	200.9114	206.2859	220.3849	237.8870	269.3885	(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	32.7916	26.3067	23.6862	17.3535	13.4044	10.9515	12.2279	15.8943	20.6451	27.0875	30.5953	33.7030	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)m	-33.6764	-52.7456	-84.5806	-103.0886	-115.5550	-109.1009	-107.1813	-98.6430	-83.3805	-63.4278	-38.4235	-28.2578	(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	-14.3086	-34.8779	-83.0438	-145.5103	-210.3545	-218.5281	-213.1081	-169.0461	-109.1869	-53.7470	-20.0229	-10.8435	(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													5736.6783	(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													2726.6739	(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)													264.6472	(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													6613.3607	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5736.6783	5.6000	321.2540	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2726.6739	5.6000	152.6937	(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	264.6472	26.0600	68.9671	(250)
Additional standing charges			99.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-918.0611	26.0600	-239.2467	

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PV Unit electricity exported	-1282.5776	5.8100	-74.5178
Total			-313.7645 (252)
Total energy cost			350.5619 (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	5736.6783	0.2100	1204.7024 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2726.6739	0.2100	572.6015 (264)
Space and water heating			1777.3040 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	264.6472	0.1443	38.1968 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-918.0611	0.1330	-122.1081
PV Unit electricity exported	-1282.5776	0.1223	-156.8016
Total			-278.9098 (269)
Total CO2, kg/year			1548.5202 (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	5736.6783	1.1300	6482.4465 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2726.6739	1.1300	3081.1415 (278)
Space and water heating			9563.5880 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	264.6472	1.5338	405.9247 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-918.0611	1.4915	-1369.2774
PV Unit electricity exported	-1282.5776	0.4486	-575.3429
Total			-1944.6203 (283)
Total Primary energy kWh/year			8154.9932 (286)

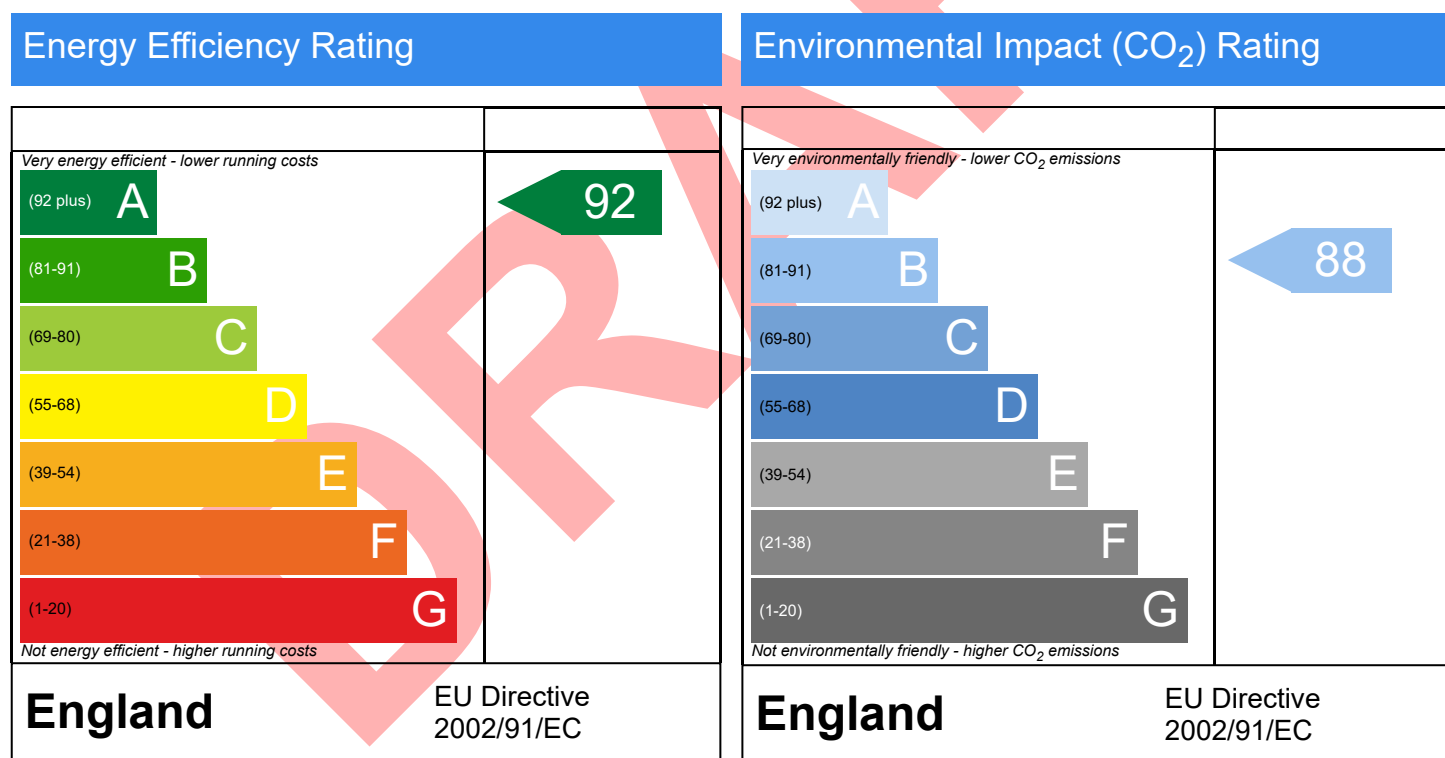
Predicted Energy Assessment



Dwelling type: House, Detached
Date of assessment: 15/11/2024
Produced by: Victoria Gartside
Total floor area: 145.2 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.