



SAP10 Report Submission for Building Regulations Compliance

Client: Volumetric

Project: ModulHaus 1 Person

Contact: Colin Padwick
SapCode
Colin@sapcode.co.uk

Date: 17/01/2023

EXCELLENCE
IN ENERGY
ASSESSMENT

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Overview Report

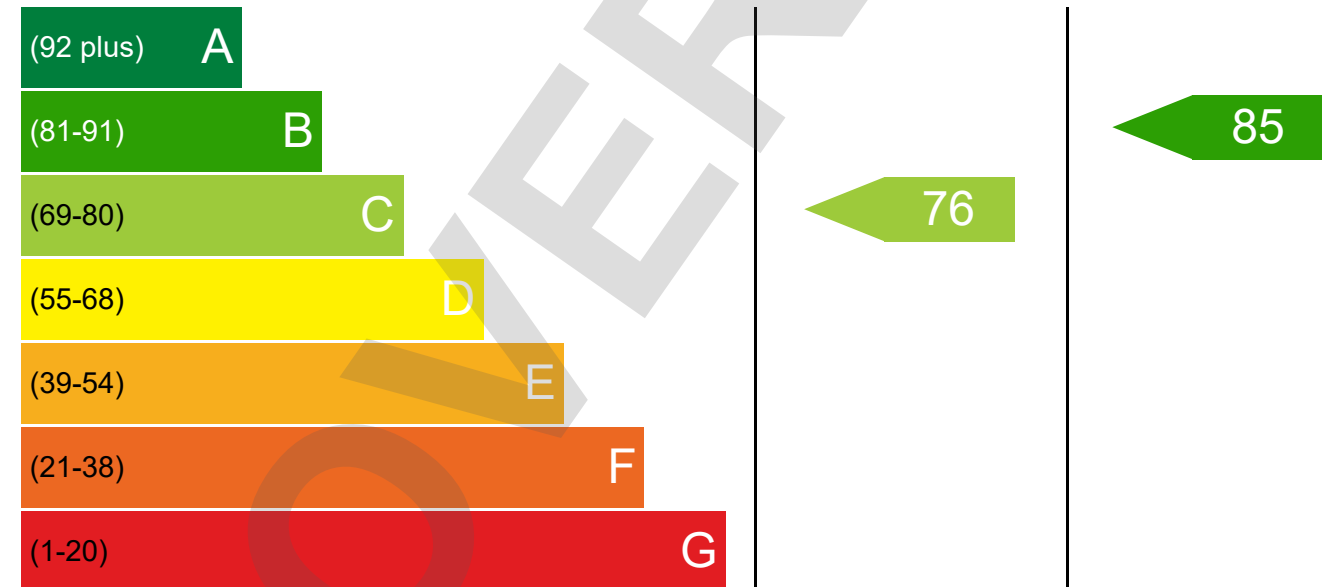
Dwelling Address	ModulHaus, Thames Valley
Report Date	17/01/2023
Property Type	Bungalow, Detached
Floor Area [m ²]	24

This document is not an Energy Performance Certificate (EPC) as required by the Energy Performance of Buildings Regulations

Energy Rating

The current energy rating represents the overall energy efficiency of the dwelling. The potential energy rating is the overall energy rating of the dwelling after all of the recommend measures provided on the next page have been installed. A higher score represents a more energy efficient dwelling with lower fuel bills.

Most energy efficient - lower running costs



Least energy efficient - higher running costs

Breakdown of property's energy performance

Each feature is assessed as one of the following:

Very Poor	Poor	Average	Good	Very Good
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Feature	Description	Energy Performance
Walls	Average thermal transmittance 0.15 W/m ² K	Very Good
Roof	Average thermal transmittance 0.16 W/m ² K	Very Good
Floor	Average thermal transmittance 0.1 W/m ² K	Very Good
Windows	High performance glazing	Good
Main heating	Community scheme	Average
Main heating controls	Charging system linked to use of community heating, programmer and room thermostat	Average
Secondary heating	None	
Hot water	Community scheme	Average
Lighting	Good lighting efficiency	Good
Air tightness	Air permeability [AP50] = 3.0 m ³ /h.m ² (assumed)	Good

Primary Energy use

The primary energy use for this property per year is 82 kilowatt hour (kWh) per square metre

Estimated CO₂ emissions of the dwelling

The estimated CO rating provides an indication of the dwelling's impact on the environment in terms of carbon dioxide emissions; the higher the rating the less impact it has on the environment.

The estimated CO emissions for this dwellings is: **0.2** per year

With the recommended measures the potential CO emissions could be: **0.1** per year

Recommendations

The recommended measures provided below will help to improve the energy efficiency of the dwelling. To reach the dwelling's potential energy rating all of the recommended measures shown below would need to be installed. Having these measures installed individually or in any other order may give a different result when compared with the cumulative potential rating.

Recommended measure	Typical Yearly Saving	Potential Rating after measure installed	Cumulative savings (per year)	Cumulative Potential Rating
Solar water heating	£19	 2	£19	 C 78
Photovoltaic	£92	 7	£110	 B 85

Estimated energy use and potential savings

Estimated energy cost for this property over a year

£249

Over a year you could save

£110

The estimated cost and savings show how much the average household would spend in this property for heating, lighting and hot water. It is not based on how energy is used by the people living at the property.

Contacting the assessor and the accreditation scheme

Assessor contact details	
Assessor name	Mr. Colin Padwick
Assessor's accreditation number	EES/022713
Email Address	colin@sapcode.co.uk

Accreditation scheme contact details

Accreditation scheme	Elmhurst Energy Systems Ltd
Telephone	01604 875005. 07979 394074.
Email Address	colin@sapcode.co.uk

Assessment details

Related party disclosure	No related party
Date of assessment	17/01/2023
Date of certificate	17/01/2023
Type of assessment	SAP, new dwelling

Building Regulations England Part L (BREL) Compliance Report

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

Date: Tue 17 Jan 2023 16:51:29

Project Information			
Assessed By	Colin Padwick	Building Type	Bungalow, Detached
OCDEA Registration	EES/022713	Assessment Date	2023-01-17

Dwelling Details			
Assessment Type	As designed	Total Floor Area	24 m ²
Site Reference	2633 Mdlhs V3.002	Plot Reference	SAP 10
Address	ModulHaus, Thames Valley		

Client Details	
Name	Volumetric
Company	Volumetric
Address	101 Longden Road , Shrewsbury , Shrewsbury, SY3 5PS

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	Heat network		
Target carbon dioxide emission rate	23.34 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	8.17 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	124.66 kWh _{PE} /m ²		
Dwelling primary energy	86.93 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	67.0 kWh/m ²		
Dwelling fabric energy efficiency	51.2 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	0.15	Walls (1) (0.15)	OK
Party walls	0.2	N/A	N/A	N/A
Curtain walls	1.6	N/A	N/A	N/A
Floors	0.18	0.1	Heat Loss Floor 1 (0.1)	OK
Roofs	0.16	0.16	Roof (1) (0.16)	OK
Windows, doors, and roof windows	1.6	1.23	Window Rear (1.42)	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)	45.08	0.15	
Upper floor: Heat Loss Floor 1, Heat Loss Floor 1	23.67	0.1 (!)	
Exposed roof: Roof (1)	23.67	0.16	

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]
Door, Door	2.15	South East	N/A	1 (!)
Window Front, Nordan Front	2.15	South East	0.74	1.35
Window Rear, Nordan Back	1.33	North West	0.64	1.42

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	0.029 (!)	Bespoke Psi
External wall	E3: Sill	Calculated by person with suitable expertise	0.035 (!)	Bespoke Psi
External wall	E4: Jamb	Calculated by person with suitable expertise	0.031 (!)	Bespoke Psi

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E20: Exposed floor (normal)	Calculated by person with suitable expertise	0.018 (!)	Bespoke Psi
External wall	E14: Flat roof	Calculated by person with suitable expertise	0.036 (!)	Bespoke PSI
External wall	E16: Corner (normal)	SAP table default	0.18	

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	3 m ³ /hm ² , Design value (!)	OK
Air permeability test certificate reference		

4 Space heating

Main heating system 1: Heat network - Heat network

Efficiency	
Emitter type	
Flow temperature	
System type	
Manufacturer	
Model	
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: Charging system linked to use of heating, programmer and room thermostat

Function	
Ecodesign class	
Manufacturer	
Model	

Water heating - type: Cylinder thermostat and HW separately timed

Manufacturer	
Model	

7 Lighting

Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	81 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation

System type: Balanced whole-house mechanical ventilation with heat recovery

Maximum permitted specific fan power	1.5 W/(l/s)	
Specific fan power	0.73 W/(l/s)	OK
Minimum permitted heat recovery efficiency	73%	
Heat recovery efficiency	81%	OK
Manufacturer/Model	MRXBOXAB-ECO2	
Commissioning		

9 Local generation

N/A

10 Heat networks	
Network name: Array	
Service provision	Space and water heating
Status	New heat network
Carbon dioxide emission factor for delivered heat	0.044 kgCO ₂ /kWh
Primary energy factor for delivered heat	0.467 kWh _{PE} /kWh
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:  34ea1574-40be-48b4-9b33-3086bb4faeea 2023.01.17 17:03:03	Assessor ID: EES/022713
Name: Colin Padwick	Date: 17/01/23
b. Client Declaration	
N/A	

Predicted Energy Assessment



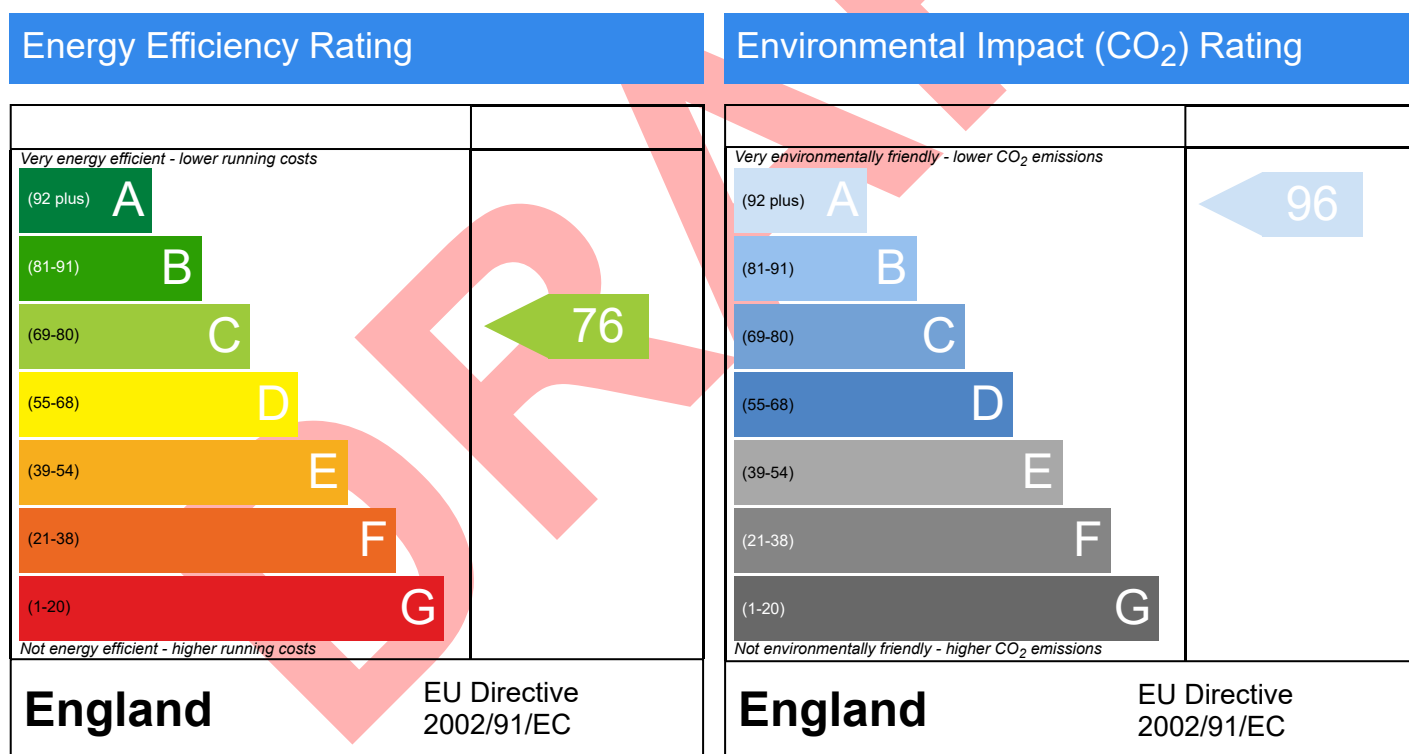
ModulHaus, Thames Valley

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

Bungalow, Detached
17/01/2023
Colin Padwick
23.67 m²

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

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



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.

Full SAP Calculation Printout



Property Reference	2633 Mdlns V3.002				Issued on Date	17/01/2023
Assessment Reference	SAP 10		Prop Type Ref	ModulHaus V3.002		
Property	ModulHaus, Thames Valley					
SAP Rating	76 C	DER	8.17	TER	23.34	
Environmental	96 A	% DER < TER			65.00	
CO ₂ Emissions (t/year)	0.18	DFEE	51.21	TFEE	67.00	
Compliance Check	See BREL	% DFEE < TFEE			23.58	
% DPER < TPER	30.27	DPER	86.93	TPER	124.66	
Assessor Details	Mr. Colin Padwick				Assessor ID	L855-0001
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	23.6700 (1b)	x 2.4000 (2b)	= 56.8080 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.6700		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 56.8080 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

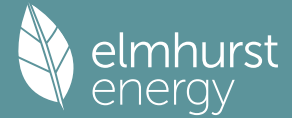
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	3.0000 (17)
Number of sides sheltered	0.1500 (18)
	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1500 (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	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												64.8000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.3672	0.3635	0.3598	0.3410	0.3372	0.3185	0.3185	0.3147	0.3260	0.3372	0.3448	0.3522 (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
Door			2.1500	1.0000	2.1500		(26)
Nordan Front (Uw = 1.35)			2.1500	1.2808	2.7538		(27)
Nordan Back (Uw = 1.42)			1.3300	1.3437	1.7871		(27)

Full SAP Calculation Printout



Heat Loss Floor 1				23.6700	0.1000	2.3670	30.6000	724.3020 (28b)
Ext Wall 1 Sides	50.7100	5.6300		45.0800	0.1500	6.7620	29.1700	1314.9836 (29a)
External Roof 1	23.6700			23.6700	0.1600	3.7872	24.4700	579.2049 (30)
Total net area of external elements Aum(A, m2)				98.0500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	19.6071			(33)
Ptn1 Std Wall				33.9600			27.0500	918.6180 (32c)
Ptn2 Shower				12.5700			27.0200	339.6414 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 3876.7499 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 163.7833 (35)

List of Thermal Bridges								
K1 Element					Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)					2.6700	0.0290	0.0774	
E3 Sill					2.6700	0.0350	0.0935	
E4 Jamb					12.6600	0.0310	0.3925	
E20 Exposed floor (normal)					18.4700	0.0180	0.3325	
E14 Flat roof					21.1400	0.0360	0.7610	
E16 Corner (normal)					9.6000	0.1800	1.7280	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.3848 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 22.9919 (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	6.8847	6.8144	6.7441	6.3926	6.3223	5.9708	5.9708	5.9005	6.1114	6.3223	6.4629	6.6035 (38)	
Average = Sum(39)m / 12 =	29.8766	29.8063	29.7360	29.3845	29.3142	28.9627	28.9627	28.8924	29.1033	29.3142	29.4548	29.5954 (39)	29.3670

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.2622	1.2592	1.2563	1.2414	1.2385	1.2236	1.2236	1.2206	1.2295	1.2385	1.2444	1.2503 (40)	1.2407
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.0704 (42)
Hot water usage for mixer showers													
	60.8144	59.9005	58.5687	56.0206	54.1402	52.0432	50.8512	52.1729	53.6217	55.8733	58.4761	60.5814 (42a)	
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)	
Hot water usage for other uses	25.5916	24.6610	23.7304	22.7998	21.8692	20.9386	20.9386	21.8692	22.7998	23.7304	24.6610	25.5916 (42c)	
Average daily hot water use (litres/day)												79.3340 (43)	

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	86.4060	84.5615	82.2991	78.8205	76.0094	72.9818	71.7898	74.0421	76.4215	79.6037	83.1371	86.1730 (44)	
Energy conte	136.8461	120.4145	126.4907	107.9013	102.3233	89.7396	86.8236	91.6796	94.2354	108.0215	118.4441	134.9262 (45)	
Energy content (annual)										Total = Sum(45)m =		1317.8458	
Distribution loss (46)m = 0.15 x (45)m	20.5269	18.0622	18.9736	16.1852	15.3485	13.4609	13.0235	13.7519	14.1353	16.2032	17.7666	20.2389 (46)	
Water storage loss:													
Store volume													110.0000 (47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0152 (51)
Volume factor from Table 2a													1.0294 (52)
Temperature factor from Table 2b													0.6000 (53)
Enter (49) or (54) in (55)													1.0327 (55)

Total storage loss	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)	
If cylinder contains dedicated solar storage													
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (57)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)	
Total heat required for water heating calculated for each month	192.1229	170.3419	181.7675	161.3949	157.6001	143.2333	142.1004	146.9564	147.7291	163.2983	171.9378	190.2030 (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	192.1229	170.3419	181.7675	161.3949	157.6001	143.2333	142.1004	146.9564	147.7291	163.2983	171.9378	190.2030 (64)	

12Total per year (kWh/year) Total per year (kWh/year) = Sum(64)m = 1968.6856 (64)
 1969 (64)

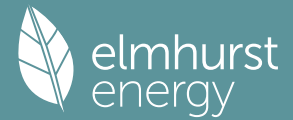
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													

Heat gains from water heating, kWh/month	89.7228	79.9798	86.2796	78.6721	78.2439	72.6334	73.0903	74.7049	74.1282	80.1386	82.1776	89.0844 (65)	
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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.5183	53.5183	53.5183	53.5183	53.5183	53.5183	53.5183	53.5183	53.5183	53.5183	53.5183	53.5183 (66)	
	44.6555	49.4400	44.6555	46.1440	44.6555	46.1440	44.6555	44.6555	46.1440	44.6555	46.1440	44.6555 (67)	

Full SAP Calculation Printout



Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	83.4438	84.3097	82.1277	77.4825	71.6187	66.1076	62.4258	61.5599	63.7419	68.3872	74.2509	79.7620 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.3518	28.3518	28.3518	28.3518	28.3518	28.3518	28.3518	28.3518	28.3518	28.3518	28.3518	28.3518 (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)	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146 (71)
Water heating gains (Table 5)	120.5951	119.0175	115.9672	109.2668	105.1666	100.8797	98.2396	100.4098	102.9559	107.7132	114.1356	119.7371 (72)
Total internal gains	287.7499	291.8227	281.8059	271.9488	260.4962	252.1867	244.3764	245.6807	251.8973	259.8113	273.5860	283.2101 (73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		FF Access factor Table 6d		Gains W	
Southeast			2.1500		36.7938		0.5800		0.7400		0.7700		23.5292 (77)	
Northwest			1.3300		11.2829		0.5800		0.6400		0.7700		3.8602 (81)	
Solar gains			27.3894	47.9365	68.9946	91.1963	107.3581	108.8737	104.0120	91.6043	76.6281	53.8984	33.0397	23.2885 (83)
Total gains			315.1393	339.7592	350.8005	363.1451	367.8543	361.0604	348.3884	337.2850	328.5253	313.7096	306.6257	306.4986 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)											
Utilisation factor for gains for living area, n _{l1} ,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	36.0441	36.1291	36.2145	36.6477	36.7356	37.1814	37.1814	37.2719	37.0018	36.7356	36.5602	36.3865
alpha	3.4029	3.4086	3.4143	3.4432	3.4490	3.4788	3.4788	3.4848	3.4668	3.4490	3.4373	3.4258
util living area	0.9111	0.8849	0.8458	0.7667	0.6484	0.4875	0.3587	0.3846	0.5627	0.7640	0.8714	0.9171 (86)
MIT	19.7172	19.9138	20.1845	20.5305	20.7922	20.9429	20.9849	20.9805	20.9027	20.6029	20.1349	19.6875 (87)
Th 2	19.8706	19.8729	19.8752	19.8870	19.8894	19.9012	19.9012	19.9035	19.8964	19.8894	19.8846	19.8799 (88)
util rest of house	0.8955	0.8653	0.8194	0.7274	0.5914	0.4125	0.2722	0.2969	0.4874	0.7176	0.8468	0.9025 (89)
MIT 2	18.7623	18.9499	19.2063	19.5297	19.7523	19.8730	19.8964	19.8970	19.8441	19.6018	19.1734	18.7414 (90)
Living area fraction	f _{LA} = Living area / (4) =											
MIT	19.3190	19.5119	19.7766	20.1132	20.3586	20.4968	20.5310	20.5287	20.4613	20.1855	19.7340	19.2930 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.3190	19.5119	19.7766	20.1132	20.3586	20.4968	20.5310	20.5287	20.4613	20.1855	19.7340	19.2930 (93)

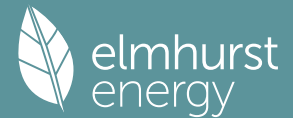
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8866	0.8582	0.8168	0.7359	0.6164	0.4539	0.3223	0.3475	0.5270	0.7308	0.8431	0.8935 (94)
Ext temp.	279.4173	291.5961	286.5397	267.2286	226.7429	163.8891	112.2766	117.2074	173.1448	229.2521	258.5012	273.8653 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	448.7181	435.5261	394.7940	329.4932	253.8197	170.7865	113.8531	119.2878	185.1343	280.9908	372.1322	446.6831 (97)
Space heating requirement - total per year (kWh/year)	125.9598	96.7210	80.5412	44.8306	20.1452	0.0000	0.0000	0.0000	0.0000	38.4935	81.8143	128.5765 (98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	125.9598	96.7210	80.5412	44.8306	20.1452	0.0000	0.0000	0.0000	0.0000	38.4935	81.8143	128.5765 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	(98c) / (4) =											
Space heating per m ²	26.0702 (99)											

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)											
Fraction of space heat from community system	1.0000 (302)											
Fraction of heat from community Heat pump-Space and Water	1.0000 (303a)											
Factor for control and charging method (Table 4c(3)) for space heating	1.0500 (305)											
Factor for charging method (Table 4c(3)) for water heating	1.0000 (305a)											
Distribution loss factor (Table 12c) for community heating system	1.5000 (306)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
Space heating:												
Space heating requirement	125.9598	96.7210	80.5412	44.8306	20.1452	0.0000	0.0000	0.0000	0.0000	38.4935	81.8143	128.5765 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.50	198.3867	152.3355	126.8523	70.6081	31.7286	0.0000	0.0000	0.0000	0.0000	60.6273	128.8575	202.5079
Space heating requirement	198.3867	152.3355	126.8523	70.6081	31.7286	0.0000	0.0000	0.0000	0.0000	60.6273	128.8575	202.5079 (307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)											

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Space heating fuel for secondary/supplementary system												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)
Water heating												
Annual water heating requirement												
	192.1229	170.3419	181.7675	161.3949	157.6001	143.2333	142.1004	146.9564	147.7291	163.2983	171.9378	190.2030 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.50												
310a	288.1843	255.5129	272.6513	242.0924	236.4001	214.8500	213.1506	220.4346	221.5936	244.9474	257.9067	285.3044
Water heating fuel												
	288.1843	255.5129	272.6513	242.0924	236.4001	214.8500	213.1506	220.4346	221.5936	244.9474	257.9067	285.3044 (310)
Cooling System Energy Efficiency Ratio												
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (314)
Pumps and Fa	6.0157	5.4336	6.0157	5.8217	6.0157	5.8217	6.0157	5.8217	5.8217	6.0157	5.8217	6.0157 (315)
Lighting	9.2387	7.4116	6.6734	4.8892	3.7766	3.0855	3.4451	4.4781	5.8166	7.6317	8.6199	9.4955 (332)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333a)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 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334a)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 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335a)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 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333b)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 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334b)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 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335b)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 (335b)
Annual totals kWh/year												
Space heating fuel - community heating												971.9040 (307)
Space heating fuel - secondary												0.0000 (309)
Water heating fuel - community heating												2953.0283 (310)
Efficiency of water heater												0.0000 (311)
Electricity used for heat distribution												9.7190 (313)
Space cooling fuel												0.0000 (321)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0220)												
mechanical ventilation fans (SFP = 1.0220)												
												70.8305 (330a)
Total electricity for the above, kWh/year												
												70.8305 (331)
Electricity for lighting (calculated in Appendix L)												
												74.5618 (332)
Energy saving/generation technologies (Appendices M, N and Q)												
PV generation												0.0000 (333)
Wind generation												0.0000 (334)
Hydro-electric generation (Appendix N)												0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (335)
Appendix Q - special features												
Energy saved or generated												-0.0000 (336)
Energy used												0.0000 (337)
Total delivered energy for all uses												
												4070.3246 (338)

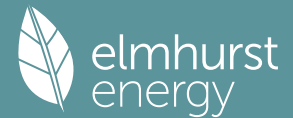
12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			339.0000 (367)
Space and Water heating from Heat pump	1157.7972	0.1555	44.5769 (367)
Electrical energy for heat distribution (space & water)	9.7190	0.0000	5.6644 (372)
Overall CO2 factor for heat network			0.0440 (386)
Total CO2 associated with community systems			172.7552 (373)
Space and water heating			172.7552 (376)
Pumps, fans and electric keep-hot	70.8305	0.1387	9.8251 (378)
Energy for lighting	74.5618	0.1443	10.7616 (379)
Total CO2, kg/year			193.3418 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			8.1700 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			339.0000 (467a)
Space and Water heating from Heat pump	1157.7972	1.5756	451.7308 (467)
Electrical energy for heat distribution (space & water)	9.7190	0.0000	60.2007 (472)
Overall CO2 factor for heat network			0.4678 (486)
Total CO2 associated with community systems			1836.0321 (473)
Space and water heating			1836.0321 (476)
Pumps, fans and electric keep-hot	70.8305	1.5128	107.1524 (478)
Energy for lighting	74.5618	1.5338	114.3653 (479)
Total Primary energy kWh/year			2057.5498 (483)
Dwelling Primary energy Rate (DPER)			86.9300 (484)

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1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	23.6700 (1b)	x 2.4000 (2b)	= 56.8080 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.6700		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 56.8080 (5)
Dwelling volume			

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour 20.0000 / (5) = 0.3521 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.6021 (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) = 0.6021 (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	0.7676	0.7526	0.7375	0.6623	0.6472	0.5720	0.5720	0.5569	0.6021	0.6472	0.6773	0.7074 (22b)
Effective ac	0.7946	0.7832	0.7720	0.7193	0.7094	0.6636	0.6636	0.6551	0.6812	0.7094	0.7294	0.7502 (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			2.1500	1.0000	2.1500		(26)
TER Opening Type (Uw = 1.20)			3.4800	1.1450	3.9847		(27)
Heat Loss Floor 1			23.6700	0.1300	3.0771		(28b)
Ext Wall 1 Sides	50.7100	5.6300	45.0800	0.1800	8.1144		(29a)
External Roof 1	23.6700		23.6700	0.1100	2.6037		(30)
Total net area of external elements Aum(A, m ²)			98.0500				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 19.9299		(33)

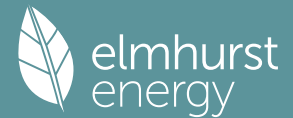
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K

List of Thermal Bridges						163.7833 (35)
K1 Element	Length	Psi-value	Total			
E2 Other lintels (including other steel lintels)	2.6700	0.0500	0.1335			
E3 Sill	2.6700	0.0500	0.1335			
E4 Jamb	12.6600	0.0500	0.6330			
E20 Exposed floor (normal)	18.4700	0.3200	5.9104			
E14 Flat roof	21.1400	0.0800	1.6912			
E16 Corner (normal)	9.6000	0.0900	0.8640			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)						9.3656 (36)
Point Thermal bridges			(36a) = 0.0000			
Total fabric heat loss			(33) + (36) + (36a) = 29.2955 (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	14.8966	14.6821	14.4719	13.4845	13.2997	12.4397	12.4397	12.2804	12.7710	13.2997	13.6735	14.0642 (38)
Heat transfer coeff	44.1921	43.9777	43.7674	42.7800	42.5953	41.7352	41.7352	41.5760	42.0665	42.5953	42.9690	43.3597 (39)
Average = Sum(39)m / 12 =												42.7791
HLP	1.8670	1.8579	1.8491	1.8074	1.7995	1.7632	1.7632	1.7565	1.7772	1.7995	1.8153	1.8318 (40)
HLP (average)												1.8073
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												1.0704 (42)
Hot water usage for mixer showers	54.0573	53.2449	52.0611	49.7961	48.1246	46.2606	45.2011	46.3759	47.6638	49.6652	51.9788	53.8502 (42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)
Hot water usage for other uses	25.5916	24.6610	23.7304	22.7998	21.8692	20.9386	20.9386	21.8692	22.7998	23.7304	24.6610	25.5916 (42c)
Average daily hot water use (litres/day)												73.1041 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	79.6489	77.9059	75.7915	72.5959	69.9938	67.1992	66.1397	68.2451	70.4636	73.3956	76.6398	79.4418 (44)
Energy content (annual)	126.1444	110.9370	116.4887	99.3802	94.2252	82.6293	79.9902	84.5017	86.8886	99.5971	109.1874	124.3866 (45)
Distribution loss (46)m = 0.15 x (45)m	18.9217	16.6405	17.4733	14.9070	14.1338	12.3944	11.9985	12.6753	13.0333	14.9396	16.3781	18.6580 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	172.7393	153.0227	163.0836	144.4721	140.8201	127.7211	126.5851	131.0966	131.9805	146.1920	154.2793	170.9815 (62)
WWHRS	-24.7127	-21.8561	-22.8865	-18.9509	-17.6616	-15.1131	-14.1662	-15.0643	-15.6366	-18.4339	-20.8833	-24.2551 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	148.0265	131.1666	140.1971	125.5211	123.1585	112.6080	112.4190	116.0323	116.3438	127.7581	133.3960	146.7264 (64)
12Total per year (kWh/year)												1533.3535 (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	79.2189	70.5551	76.0084	69.1174	68.6058	63.5477	63.8727	65.3727	64.9639	70.3920	72.3783	78.6345 (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	53.5183	53.5183	53.5183	53.5183	53.5183	53.5183	53.5183	53.5183	53.5183	53.5183	53.5183	53.5183 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	44.6796	49.4667	44.6796	46.1689	44.6796	46.1689	44.6796	44.6796	46.1689	44.6796	46.1689	44.6796 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	83.4438	84.3097	82.1277	77.4825	71.6187	66.1076	62.4258	61.5599	63.7419	68.3872	74.2509	79.7620 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.3518	28.3518	28.3518	28.3518	28.3518	28.3518	28.3518	28.3518	28.3518	28.3518	28.3518	28.3518 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146 (71)
Water heating gains (Table 5)	106.4770	104.9927	102.1619	95.9964	92.2121	88.2607	85.8504	87.8666	90.2277	94.6128	100.5254	105.6915 (72)
Total internal gains	276.6559	280.8246	271.0246	261.7032	250.5658	239.5926	232.0112	233.1616	239.1940	249.7351	263.0007	272.1886 (73)

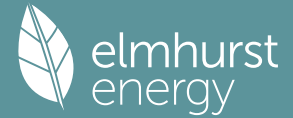
6. Solar gains

[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	
Southeast				2.1500	36.7938	0.6300		0.7000	0.7700		24.1760 (77)	
Northwest				1.3300	11.2829	0.6300		0.7000	0.7700		4.5861 (81)	
Solar gains	28.7622	50.5159	73.1643	97.4363	115.3271	117.2161	111.8756	98.1120	81.5043	56.9218	34.7279	24.4349 (83)
Total gains	305.4181	331.3405	344.1889	359.1395	365.8929	356.8087	343.8869	331.2735	320.6983	306.6569	297.7286	296.6235 (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, n11,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	24.3680	24.4869	24.6045	25.1724	25.2816	25.8025	25.8025	25.9014	25.5994	25.2816	25.0617	24.8358
alpha	2.6245	2.6325	2.6403	2.6782	2.6854	2.7202	2.7202	2.7268	2.7066	2.6854	2.6708	2.6557

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util living area	0.9397	0.9230	0.8980	0.8444	0.7569	0.6188	0.4840	0.5147	0.6929	0.8456	0.9153	0.9433 (86)
MIT	18.6193	18.8729	19.2751	19.8539	20.3617	20.7500	20.9072	20.8878	20.6337	20.0163	19.2667	18.6141 (87)
Th 2	19.4235	19.4297	19.4359	19.4649	19.4703	19.4959	19.4959	19.5006	19.4860	19.4703	19.4593	19.4478 (88)
util rest of house	0.9261	0.9059	0.8741	0.8056	0.6912	0.5112	0.3379	0.3705	0.5947	0.7996	0.8936	0.9307 (89)
MIT 2	16.8125	17.1303	17.6318	18.3490	18.9338	19.3440	19.4636	19.4577	19.2384	18.5589	17.6444	16.8199 (90)
Living area fraction									fLA = Living area / (4) =			0.5830 (91)
MIT	17.8659	18.1463	18.5899	19.2264	19.7663	20.1637	20.3052	20.2915	20.0519	19.4086	18.5902	17.8659 (92)
Temperature adjustment												0.0000
adjusted MIT	17.8659	18.1463	18.5899	19.2264	19.7663	20.1637	20.3052	20.2915	20.0519	19.4086	18.5902	17.8659 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9085	0.8879	0.8580	0.7985	0.7054	0.5622	0.4200	0.4504	0.6348	0.7974	0.8781	0.9136	(94)
Useful gains	277.4748	294.2079	295.3294	286.7719	258.0861	200.6078	144.4397	149.1916	203.5909	244.5270	261.4486	271.0005	(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	599.5056	582.5392	529.1425	441.7630	343.5855	232.2029	154.6390	161.7921	250.3760	375.2037	493.7237	592.5517	(97)
Space heating kWh	239.5908	193.7586	173.9570	111.5936	63.6116	0.0000	0.0000	0.0000	0.0000	97.2235	167.2380	239.2341	(98a)
Space heating requirement - total per year (kWh/year)												1286.2072	
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	239.5908	193.7586	173.9570	111.5936	63.6116	0.0000	0.0000	0.0000	0.0000	97.2235	167.2380	239.2341	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1286.2072	
Space heating per m2										(98c) / (4) =		54.3391	(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 %)	92.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	239.5908	193.7586	173.9570	111.5936	63.6116	0.0000	0.0000	0.0000	0.0000	97.2235	167.2380	239.2341	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	259.5784	209.9227	188.4691	120.9031	68.9183	0.0000	0.0000	0.0000	0.0000	105.3342	181.1896	259.1919	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating													
Water heating requirement	148.0265	131.1666	140.1971	125.5211	123.1585	112.6080	112.4190	116.0323	116.3438	127.7581	133.3960	146.7264	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.1333	84.9332	84.5448	83.7970	82.6531	79.8000	79.8000	79.8000	79.8000	83.4552	84.5680	85.1492	(217)
Fuel for water heating, kWh/month	173.8762	154.4350	165.8259	149.7918	149.0065	141.1128	140.8759	145.4039	145.7943	153.0860	157.7382	172.3168	(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	9.2835	7.4476	6.7057	4.9129	3.7949	3.1004	3.4618	4.4998	5.8448	7.6687	8.6617	9.5415	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-20.2662	-27.6586	-38.5657	-42.1284	-44.5664	-41.4646	-41.1077	-39.3107	-35.8806	-31.2122	-22.0245	-17.6463	(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	-14.3913	-29.8843	-58.6325	-86.9212	-113.7704	-113.7474	-112.2476	-95.4137	-70.5536	-42.1335	-19.0277	-11.3940	(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												1393.5073	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												1849.2634	(219)
Space cooling fuel												0.0000	(221)

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Electricity for pumps and fans:	
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	74.9234 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1169.9491 (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	2233.7450 (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	1393.5073	0.2100	292.6365 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1849.2634	0.2100	388.3453 (264)
Space and water heating			680.9818 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	74.9234	0.1443	10.8138 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-401.8318	0.1351	-54.3023
PV Unit electricity exported	-768.1172	0.1263	-97.0278
Total			-151.3301 (269)
Total CO2, kg/year			552.3948 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			23.3400 (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	1393.5073	1.1300	1574.6632 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1849.2634	1.1300	2089.6676 (278)
Space and water heating			3664.3308 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	74.9234	1.5338	114.9200 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-401.8318	1.4995	-602.5355
PV Unit electricity exported	-768.1172	0.4637	-356.1760
Total			-958.7115 (283)
Total Primary energy kWh/year			2950.6402 (286)
Target Primary Energy Rate (TPER)			124.6600 (287)

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Property Reference	2633 Mdlns V3.002				Issued on Date	17/01/2023
Assessment Reference	SAP 10		Prop Type Ref	ModulHaus V3.002		
Property	ModulHaus, Thames Valley					
SAP Rating	76 C	DER	8.17	TER	23.34	
Environmental	96 A	% DER < TER			65.00	
CO ₂ Emissions (t/year)	0.18	DFEE	51.21	TFEE	67.00	
Compliance Check	See BREL	% DFEE < TFEE			23.58	
% DPER < TPER	30.27	DPER	86.93	TPER	124.66	
Assessor Details	Mr. Colin Padwick				Assessor ID	L855-0001
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	23.6700 (1b)	x 2.4000 (2b)	= 56.8080 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.6700		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 56.8080 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

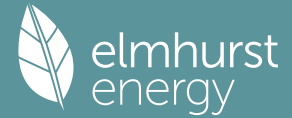
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	20.0000 / (5) = 0.3521 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	3.0000 (17)
Number of sides sheltered	0.5021 (18)
	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.5021 (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	0.6401	0.6276	0.6150	0.5523	0.5397	0.4770	0.4770	0.4644	0.5021	0.5397	0.5648	0.5899 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x F _{mv} (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	0.7049	0.6969	0.6891	0.6525	0.6456	0.6137	0.6137	0.6078	0.6260	0.6456	0.6595	0.6740 (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
Door			2.1500	1.0000	2.1500		(26)
Nordan Front (U _w = 1.35)			2.1500	1.2808	2.7538		(27)
Nordan Back (U _w = 1.42)			1.3300	1.3437	1.7871		(27)
Heat Loss Floor 1			23.6700	0.1000	2.3670	30.6000	724.3020 (28b)
Ext Wall 1 Sides	50.7100	5.6300	45.0800	0.1500	6.7620	29.1700	1314.9836 (29a)
External Roof 1	23.6700		23.6700	0.1600	3.7872	24.4700	579.2049 (30)

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Total net area of external elements Aum(A, m2)	98.0500			(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =	19.6071		(33)
Ptn1 Std Wall	33.9600		27.0500	918.6180 (32c)
Ptn2 Shower	12.5700		27.0200	339.6414 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	3876.7499	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		163.7833	(35)

List of Thermal Bridges				
K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	2.6700	0.0290	0.0774	
E3 Sill	2.6700	0.0350	0.0935	
E4 Jamb	12.6600	0.0310	0.3925	
E20 Exposed floor (normal)	18.4700	0.0180	0.3325	
E14 Flat roof	21.1400	0.0360	0.7610	
E16 Corner (normal)	9.6000	0.1800	1.7280	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				3.3848 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	22.9919 (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	13.2142	13.0651	12.9189	12.2322	12.1037	11.5057	11.5057	11.3949	11.7360	12.1037	12.3636	12.6353	(38)
Average = Sum(39)m / 12 =	36.2061	36.0570	35.9108	35.2241	35.0957	34.4976	34.4976	34.3868	34.7280	35.0957	35.3556	35.6273	(39)
													35.2235

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.5296	1.5233	1.5171	1.4881	1.4827	1.4574	1.4574	1.4528	1.4672	1.4827	1.4937	1.5052	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

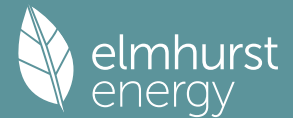
4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.0704 (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	18.2559	17.9848	17.6030	16.8990	16.3719	15.7874	15.4717	15.8508	16.2636	16.8890	17.6075	18.1942	(42b)
Hot water usage for other uses	25.5916	24.6610	23.7304	22.7998	21.8692	20.9386	20.9386	21.8692	22.7998	23.7304	24.6610	25.5916	(42c)
Average daily hot water use (litres/day)													40.1912 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	43.8475	42.6458	41.3334	39.6988	38.2411	36.7260	36.4103	37.7200	39.0634	40.6195	42.2685	43.7858	(44)
Energy content (annual)	69.4438	60.7271	63.5279	54.3457	51.4799	45.1589	44.0351	46.7052	48.1691	55.1202	60.2193	68.5580	(45)
Distribution loss (46)m = 0.15 x (45)m													667.4901
	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													
	59.0272	51.6180	53.9987	46.1939	43.7579	38.3851	37.4298	39.6995	40.9437	46.8522	51.1864	58.2743	(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	59.0272	51.6180	53.9987	46.1939	43.7579	38.3851	37.4298	39.6995	40.9437	46.8522	51.1864	58.2743	(64)
													567.3666 (64)
12Total per year (kWh/year)													567 (64)
Electric shower(s)	33.7678	30.0874	32.8543	31.3524	31.9408	30.4684	31.4840	31.9408	31.3524	32.8543	32.2365	33.7678	(64a)
													384.1068 (64a)
Heat gains from water heating, kWh/month	23.1988	20.4263	21.7132	19.3866	18.9247	17.2134	17.2284	17.9101	18.0740	19.9266	20.8557	23.0105	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.5183	53.5183	53.5183	53.5183	53.5183	53.5183	53.5183	53.5183	53.5183	53.5183	53.5183	53.5183	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	44.6555	49.4400	44.6555	46.1440	44.6555	46.1440	44.6555	44.6555	46.1440	44.6555	46.1440	44.6555	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	83.4438	84.3097	82.1277	77.4825	71.6187	66.1076	62.4258	61.5599	63.7419	68.3872	74.2509	79.7620	(68)
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)	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	(71)
Water heating gains (Table 5)	31.1811	30.3964	29.1845	26.9258	25.4364	23.9074	23.1565	24.0727	25.1028	26.7831	28.9663	30.9281	(72)

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Total internal gains
198.3359 203.2015 195.0231 189.6077 180.7660 175.2145 169.2933 169.3435 174.0442 178.8812 188.4167 194.4011 (73)

6. Solar gains

[Jan]			Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
Southeast			2.1500	36.7938	0.5800	0.7400		0.7700	23.5292 (77)
Northwest			1.3300	11.2829	0.5800	0.6400		0.7700	3.8602 (81)
Solar gains	27.3894	47.9365	68.9946	91.1963	107.3581	108.8737	104.0120	76.6281	23.2885 (83)
Total gains	225.7253	251.1380	264.0177	280.8041	288.1241	284.0882	273.3053	250.6723	217.6897 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n _{l,m} (see Table 9a)												
tau	29.7429	29.8659	29.9875	30.5721	30.6840	31.2159	31.2159	31.3165	31.0089	30.6840	30.4584	30.2262
alpha	2.9829	2.9911	2.9992	3.0381	3.0456	3.0811	3.0811	3.0878	3.0673	3.0456	3.0306	3.0151
util living area	0.9662	0.9520	0.9312	0.8821	0.7976	0.6532	0.5110	0.5477	0.7369	0.8901	0.9489	0.9693 (86)
MIT	18.8021	19.0559	19.4327	19.9753	20.4449	20.7964	20.9299	20.9117	20.6833	20.0931	19.3873	18.7842 (87)
Th 2	19.6654	19.6701	19.6747	19.6964	19.7005	19.7196	19.7196	19.7231	19.7122	19.7005	19.6922	19.6836 (88)
util rest of house	0.9585	0.9413	0.9149	0.8526	0.7430	0.5582	0.3799	0.4180	0.6527	0.8567	0.9356	0.9624 (89)
MIT 2	17.7325	17.9837	18.3543	18.8877	19.3171	19.6153	19.6977	19.6931	19.5318	19.0109	18.3277	17.7274 (90)
Living area fraction									f _{LA} = Living area / (4) =			
MIT	18.3561	18.6088	18.9830	19.5218	19.9746	20.3039	20.4161	20.4036	20.2031	19.6419	18.9455	18.3435 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3561	18.6088	18.9830	19.5218	19.9746	20.3039	20.4161	20.4036	20.2031	19.6419	18.9455	18.3435 (93)

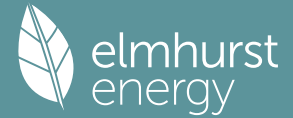
8. Space heating requirement

Utilisation	0.9488	0.9304	0.9045	0.8480	0.7558	0.6042	0.4540	0.4902	0.6877	0.8549	0.9260	0.9532 (94)
Useful gains	214.1574	233.6657	238.8018	238.1119	217.7573	171.6516	124.0752	127.9272	172.3870	198.9957	205.0682	207.4950 (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	508.9169	494.2979	448.2749	374.1429	290.4036	196.7711	131.6468	137.6701	211.9493	317.3300	418.8033	503.8955 (97)
Space heating kWh	219.3010	175.1449	155.8480	97.9423	54.0488	0.0000	0.0000	0.0000	0.0000	88.0407	153.8893	220.5220 (98a)
Space heating requirement - total per year (kWh/year)												1164.7369
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	219.3010	175.1449	155.8480	97.9423	54.0488	0.0000	0.0000	0.0000	0.0000	88.0407	153.8893	220.5220 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1164.7369
Space heating per m ²										(98c) / (4) =		49.2073 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
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	324.2774	255.2822	261.3400	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7471	0.8186	0.7960	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	242.2680	208.9708	208.0289	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	317.6375	306.0236	292.4107	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	54.2660	72.2073	62.7800	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									f _C = cooled area / (4) =			
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	13.5665	18.0518	15.6950	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												47.3133 (107)
Energy for space heating												49.2073 (99)
Energy for space cooling												1.9989 (108)
Total												51.2062 (109)
Fabric Energy Efficiency (DFEE)												51.2 (109)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	23.6700 (1b)	x 2.4000 (2b)	= 56.8080 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.6700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	56.8080 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.3521 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.6021 (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) = 0.6021 (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	0.7676	0.7526	0.7375	0.6623	0.6472	0.5720	0.5720	0.5569	0.6021	0.6472	0.6773	0.7074 (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	0.7946	0.7832	0.7720	0.7193	0.7094	0.6636	0.6636	0.6551	0.6812	0.7094	0.7294	0.7502 (25)

3. Heat losses and heat loss parameter

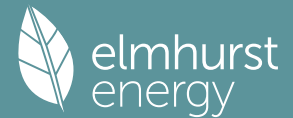
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Opening Type (Uw = 1.20)			3.4800	1.1450	3.9847		(27)
Heat Loss Floor 1			23.6700	0.1300	3.0771		(28b)
Ext Wall 1 Sides	50.7100	5.6300	45.0800	0.1800	8.1144		(29a)
External Roof 1	23.6700		23.6700	0.1100	2.6037		(30)
Total net area of external elements Aum(A, m ²)			98.0500				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	19.9299	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 163.7833 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element	2.6700	0.0500	0.1335
E2 Other lintels (including other steel lintels)	2.6700	0.0500	0.1335
E3 Sill	12.6600	0.0500	0.6330
E4 Jamb	18.4700	0.3200	5.9104
E20 Exposed floor (normal)	21.1400	0.0800	1.6912
E14 Flat roof	9.6000	0.0900	0.8640
E16 Corner (normal)			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			9.3656 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 29.2955 (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	14.8966	14.6821	14.4719	13.4845	13.2997	12.4397	12.4397	12.2804	12.7710	13.2997	13.6735	14.0642 (38)
Heat transfer coeff	44.1921	43.9777	43.7674	42.7800	42.5953	41.7352	41.7352	41.5760	42.0665	42.5953	42.9690	43.3597 (39)
Average = Sum(39)m / 12 =												42.7791

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HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.8670	1.8579	1.8491	1.8074	1.7995	1.7632	1.7632	1.7565	1.7772	1.7995	1.8153	1.8318 (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												1.0704 (42)
Hot water usage for mixer showers												0.0000 (42a)
Hot water usage for baths	18.2559	17.9848	17.6030	16.8990	16.3719	15.7874	15.4717	15.8508	16.2636	16.8890	17.6075	18.1942 (42b)
Hot water usage for other uses	25.5916	24.6610	23.7304	22.7998	21.8692	20.9386	20.9386	21.8692	22.7998	23.7304	24.6610	25.5916 (42c)
Average daily hot water use (litres/day)												40.1912 (43)
Daily hot water use	43.8475	42.6458	41.3334	39.6988	38.2411	36.7260	36.4103	37.7200	39.0634	40.6195	42.2685	43.7858 (44)
Energy conte	69.4438	60.7271	63.5279	54.3457	51.4799	45.1589	44.0351	46.7052	48.1691	55.1202	60.2193	68.5580 (45)
Energy content (annual)												667.4901
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	59.0272	51.6180	53.9987	46.1939	43.7579	38.3851	37.4298	39.6995	40.9437	46.8522	51.1864	58.2743 (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	59.0272	51.6180	53.9987	46.1939	43.7579	38.3851	37.4298	39.6995	40.9437	46.8522	51.1864	58.2743 (64)
12Total per year (kWh/year)												567.3666 (64)
Electric shower(s)	33.7678	30.0874	32.8543	31.3524	31.9408	30.4684	31.4840	31.9408	31.3524	32.8543	32.2365	33.7678 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												384.1068 (64a)
Heat gains from water heating, kWh/month	23.1988	20.4263	21.7132	19.3866	18.9247	17.2134	17.2284	17.9101	18.0740	19.9266	20.8557	23.0105 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	53.5183	53.5183	53.5183	53.5183	53.5183	53.5183	53.5183	53.5183	53.5183	53.5183	53.5183	53.5183 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	44.6796	49.4667	44.6796	46.1689	44.6796	46.1689	44.6796	44.6796	46.1689	44.6796	46.1689	44.6796 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	83.4438	84.3097	82.1277	77.4825	71.6187	66.1076	62.4258	61.5599	63.7419	68.3872	74.2509	79.7620 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.3518	28.3518	28.3518	28.3518	28.3518	28.3518	28.3518	28.3518	28.3518	28.3518	28.3518	28.3518 (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)	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146 (71)
Water heating gains (Table 5)	31.1811	30.3964	29.1845	26.9258	25.4364	23.9074	23.1565	24.0727	25.1028	26.7831	28.9663	30.9281 (72)
Total internal gains	198.3600	203.2282	195.0472	189.6326	180.7901	175.2394	169.3174	169.3676	174.0691	178.9053	188.4416	194.4252 (73)

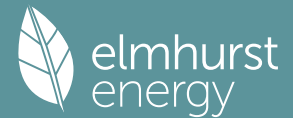
6. Solar gains

[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	
Southeast			2.1500		36.7938		0.6300		0.7000		0.7700		24.1760 (77)	
Northwest			1.3300		11.2829		0.6300		0.7000		0.7700		4.5861 (81)	
Solar gains			28.7622	50.5159	73.1643	97.4363	115.3271	117.2161	111.8756	98.1120	81.5043	56.9218	34.7279	24.4349 (83)
Total gains			227.1221	253.7441	268.2116	287.0689	296.1172	292.4555	281.1930	267.4796	255.5735	235.8271	223.1694	218.8601 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)
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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	24.3680	24.4869	24.6045	25.1724	25.2816	25.8025	25.8025	25.9014	25.5994	25.2816	25.0617	24.8358
alpha	2.6245	2.6325	2.6403	2.6782	2.6854	2.7202	2.7202	2.7268	2.7066	2.6854	2.6708	2.6557
util living area	0.9681	0.9559	0.9379	0.8963	0.8243	0.6972	0.5636	0.6006	0.7748	0.9046	0.9536	0.9709 (86)
MIT	18.2651	18.5381	18.9702	19.6082	20.1858	20.6589	20.8643	20.8346	20.5037	19.7701	18.9481	18.2561 (87)
Th 2	19.4235	19.4297	19.4359	19.4649	19.4703	19.4959	19.4959	19.5006	19.4860	19.4703	19.4593	19.4478 (88)
util rest of house	0.9604	0.9451	0.9216	0.8667	0.7678	0.5909	0.4041	0.4454	0.6849	0.8714	0.9403	0.9639 (89)
MIT 2	17.0470	17.3186	17.7457	18.3787	18.9155	19.3257	19.4568	19.4478	19.2087	18.5474	17.7449	17.0536 (90)
Living area fraction									fLA = Living area / (4) =			
MIT	17.7571	18.0296	18.4596	19.0955	19.6561	20.1030	20.2774	20.2563	19.9637	19.2603	18.4464	17.7547 (92)
Temperature adjustment												0.0000
adjusted MIT	17.7571	18.0296	18.4596	19.0955	19.6561	20.1030	20.2774	20.2563	19.9637	19.2603	18.4464	17.7547 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9490	0.9322	0.9085	0.8580	0.7758	0.6380	0.4924	0.5296	0.7171	0.8657	0.9287	0.9532 (94)
Useful gains	215.5444	236.5463	243.6827	246.3088	229.7185	186.5853	138.4716	141.6483	183.2800	204.1530	207.2537	208.6171 (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	594.6997	577.4093	523.4405	436.1633	338.8912	229.6695	153.4760	160.3304	246.6652	368.8865	487.5422	587.7260 (97)
Space heating kWh	282.0915	229.0599	208.1398	136.6953	81.2245	0.0000	0.0000	0.0000	0.0000	122.5618	201.8077	282.0570 (98a)
Space heating requirement - total per year (kWh/year)												1543.6374
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	282.0915	229.0599	208.1398	136.6953	81.2245	0.0000	0.0000	0.0000	0.0000	122.5618	201.8077	282.0570 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1543.6374
Space heating per m2										(98c) / (4) =		65.2149 (99)

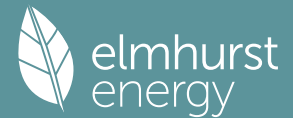
8c. Space cooling requirement

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	392.3111	308.8407	315.9773	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6622	0.7386	0.7124	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	259.7703	228.1165	225.1153	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	327.3904	315.2171	300.0200	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	48.6865	64.8029	55.7291	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	12.1716	16.2007	13.9323	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												42.3046 (107)
Energy for space heating												65.2149 (99)
Energy for space cooling												1.7873 (108)
Total												67.0022 (109)
Fabric Energy Efficiency (TFEE)												67.0 (109)

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Property Reference	2633 MdIhs V3.002				Issued on Date	17/01/2023
Assessment Reference	SAP 10	Prop Type Ref		ModulHaus V3.002		
Property	ModulHaus, Thames Valley					
SAP Rating	76 C	DER	8.17	TER	23.34	
Environmental	96 A	% DER < TER				65.00
CO ₂ Emissions (t/year)	0.18	DFEE	51.21	TFEE	67.00	
Compliance Check	See BREL	% DFEE < TFEE				23.58
% DPER < TPER	30.27	DPER	86.93	TPER	124.66	
Assessor Details	Mr. Colin Padwick				Assessor ID	L855-0001
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	23.6700 (1b)	x 2.4000 (2b)	= 56.8080 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.6700		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 56.8080 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

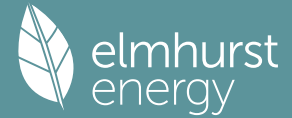
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	3.0000 (17)
Number of sides sheltered	0.1500 (18)
	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1500 (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	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												64.8000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.3672	0.3635	0.3598	0.3410	0.3372	0.3185	0.3185	0.3147	0.3260	0.3372	0.3448	0.3522 (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
Door			2.1500	1.0000	2.1500		(26)
Nordan Front (Uw = 1.35)			2.1500	1.2808	2.7538		(27)
Nordan Back (Uw = 1.42)			1.3300	1.3437	1.7871		(27)

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Heat Loss Floor 1				23.6700	0.1000	2.3670	30.6000	724.3020 (28b)
Ext Wall 1 Sides	50.7100	5.6300		45.0800	0.1500	6.7620	29.1700	1314.9836 (29a)
External Roof 1	23.6700			23.6700	0.1600	3.7872	24.4700	579.2049 (30)
Total net area of external elements Aum(A, m2)				98.0500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	19.6071			(33)
Ptn1 Std Wall				33.9600			27.0500	918.6180 (32c)
Ptn2 Shower				12.5700			27.0200	339.6414 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 3876.7499 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 163.7833 (35)

List of Thermal Bridges								
K1 Element					Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)					2.6700	0.0290	0.0774	
E3 Sill					2.6700	0.0350	0.0935	
E4 Jamb					12.6600	0.0310	0.3925	
E20 Exposed floor (normal)					18.4700	0.0180	0.3325	
E14 Flat roof					21.1400	0.0360	0.7610	
E16 Corner (normal)					9.6000	0.1800	1.7280	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.3848 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 22.9919 (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	6.8847	6.8144	6.7441	6.3926	6.3223	5.9708	5.9708	5.9005	6.1114	6.3223	6.4629	6.6035	(38)
Average = Sum(39)m / 12 =	29.8766	29.8063	29.7360	29.3845	29.3142	28.9627	28.9627	28.8924	29.1033	29.3142	29.4548	29.5954	(39)
													29.3670

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.2622	1.2592	1.2563	1.2414	1.2385	1.2236	1.2236	1.2206	1.2295	1.2385	1.2444	1.2503	(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													1.0704 (42)
Hot water usage for mixer showers													
	60.8144	59.9005	58.5687	56.0206	54.1402	52.0432	50.8512	52.1729	53.6217	55.8733	58.4761	60.5814	(42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses	25.5916	24.6610	23.7304	22.7998	21.8692	20.9386	20.9386	21.8692	22.7998	23.7304	24.6610	25.5916	(42c)
Average daily hot water use (litres/day)													79.3340 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	86.4060	84.5615	82.2991	78.8205	76.0094	72.9818	71.7898	74.0421	76.4215	79.6037	83.1371	86.1730	(44)
Energy conte	136.8461	120.4145	126.4907	107.9013	102.3233	89.7396	86.8236	91.6796	94.2354	108.0215	118.4441	134.9262	(45)
Energy content (annual)													Total = Sum(45)m = 1317.8458
Distribution loss (46)m = 0.15 x (45)m	20.5269	18.0622	18.9736	16.1852	15.3485	13.4609	13.0235	13.7519	14.1353	16.2032	17.7666	20.2389	(46)
Water storage loss:													
Store volume													110.0000 (47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0152 (51)
Volume factor from Table 2a													1.0294 (52)
Temperature factor from Table 2b													0.6000 (53)
Enter (49) or (54) in (55)													1.0327 (55)

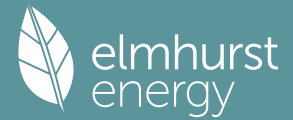
Total storage loss	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(56)
If cylinder contains dedicated solar storage													
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month	192.1229	170.3419	181.7675	161.3949	157.6001	143.2333	142.1004	146.9564	147.7291	163.2983	171.9378	190.2030	(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	192.1229	170.3419	181.7675	161.3949	157.6001	143.2333	142.1004	146.9564	147.7291	163.2983	171.9378	190.2030	(64)
Total per year (kWh/year)													1968.6856 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)

Heat gains from water heating, kWh/month	89.7228	79.9798	86.2796	78.6721	78.2439	72.6334	73.0903	74.7049	74.1282	80.1386	82.1776	89.0844	(65)
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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.5183	53.5183	53.5183	53.5183	53.5183	53.5183	53.5183	53.5183	53.5183	53.5183	53.5183	53.5183	(66)
	44.6555	49.4400	44.6555	46.1440	44.6555	46.1440	44.6555	44.6555	46.1440	44.6555	46.1440	44.6555	(67)

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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	83.4438	84.3097	82.1277	77.4825	71.6187	66.1076	62.4258	61.5599	63.7419	68.3872	74.2509	79.7620 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.3518	28.3518	28.3518	28.3518	28.3518	28.3518	28.3518	28.3518	28.3518	28.3518	28.3518	28.3518 (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)	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146 (71)
Water heating gains (Table 5)	120.5951	119.0175	115.9672	109.2668	105.1666	100.8797	98.2396	100.4098	102.9559	107.7132	114.1356	119.7371 (72)
Total internal gains	287.7499	291.8227	281.8059	271.9488	260.4962	252.1867	244.3764	245.6807	251.8973	259.8113	273.5860	283.2101 (73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d		Gains W	
Southeast			2.1500		36.7938		0.5800		0.7400		0.7700		23.5292 (77)	
Northwest			1.3300		11.2829		0.5800		0.6400		0.7700		3.8602 (81)	
Solar gains			27.3894	47.9365	68.9946	91.1963	107.3581	108.8737	104.0120	91.6043	76.6281	53.8984	33.0397	23.2885 (83)
Total gains			315.1393	339.7592	350.8005	363.1451	367.8543	361.0604	348.3884	337.2850	328.5253	313.7096	306.6257	306.4986 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)											
Utilisation factor for gains for living area, n _{li} ,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	36.0441	36.1291	36.2145	36.6477	36.7356	37.1814	37.1814	37.2719	37.0018	36.7356	36.5602	36.3865
alpha	3.4029	3.4086	3.4143	3.4432	3.4490	3.4788	3.4788	3.4848	3.4668	3.4490	3.4373	3.4258
util living area	0.9111	0.8849	0.8458	0.7667	0.6484	0.4875	0.3587	0.3846	0.5627	0.7640	0.8714	0.9171 (86)
MIT	19.7172	19.9138	20.1845	20.5305	20.7922	20.9429	20.9849	20.9805	20.9027	20.6029	20.1349	19.6875 (87)
Th 2	19.8706	19.8729	19.8752	19.8870	19.8894	19.9012	19.9012	19.9035	19.8964	19.8894	19.8846	19.8799 (88)
util rest of house	0.8955	0.8653	0.8194	0.7274	0.5914	0.4125	0.2722	0.2969	0.4874	0.7176	0.8468	0.9025 (89)
MIT 2	18.7623	18.9499	19.2063	19.5297	19.7523	19.8730	19.8964	19.8970	19.8441	19.6018	19.1734	18.7414 (90)
Living area fraction	f _{LA} = Living area / (4) =											
MIT	19.3190	19.5119	19.7766	20.1132	20.3586	20.4968	20.5310	20.5287	20.4613	20.1855	19.7340	19.2930 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.3190	19.5119	19.7766	20.1132	20.3586	20.4968	20.5310	20.5287	20.4613	20.1855	19.7340	19.2930 (93)

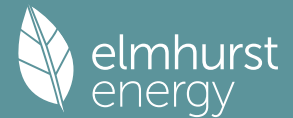
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8866	0.8582	0.8168	0.7359	0.6164	0.4539	0.3223	0.3475	0.5270	0.7308	0.8431	0.8935 (94)
Ext temp.	279.4173	291.5961	286.5397	267.2286	226.7429	163.8891	112.2766	117.2074	173.1448	229.2521	258.5012	273.8653 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	448.7181	435.5261	394.7940	329.4932	253.8197	170.7865	113.8531	119.2878	185.1343	280.9908	372.1322	446.6831 (97)
Space heating requirement - total per year (kWh/year)	125.9598	96.7210	80.5412	44.8306	20.1452	0.0000	0.0000	0.0000	0.0000	38.4935	81.8143	128.5765 (98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	125.9598	96.7210	80.5412	44.8306	20.1452	0.0000	0.0000	0.0000	0.0000	38.4935	81.8143	128.5765 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	(98c) / (4) =											
Space heating per m2	26.0702 (99)											

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)											
Fraction of space heat from community system	1.0000 (302)											
Fraction of heat from community Heat pump-Space and Water	1.0000 (303a)											
Factor for control and charging method (Table 4c(3)) for space heating	1.0500 (305)											
Factor for charging method (Table 4c(3)) for water heating	1.0000 (305a)											
Distribution loss factor (Table 12c) for community heating system	1.5000 (306)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
Space heating:												
Space heating requirement	125.9598	96.7210	80.5412	44.8306	20.1452	0.0000	0.0000	0.0000	0.0000	38.4935	81.8143	128.5765 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.50	198.3867	152.3355	126.8523	70.6081	31.7286	0.0000	0.0000	0.0000	0.0000	60.6273	128.8575	202.5079
Space heating requirement	198.3867	152.3355	126.8523	70.6081	31.7286	0.0000	0.0000	0.0000	0.0000	60.6273	128.8575	202.5079 (307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)											

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Space heating fuel for secondary/supplementary system												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)
Water heating												
Annual water heating requirement												
	192.1229	170.3419	181.7675	161.3949	157.6001	143.2333	142.1004	146.9564	147.7291	163.2983	171.9378	190.2030 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.50												
310a	288.1843	255.5129	272.6513	242.0924	236.4001	214.8500	213.1506	220.4346	221.5936	244.9474	257.9067	285.3044
Water heating fuel												
	288.1843	255.5129	272.6513	242.0924	236.4001	214.8500	213.1506	220.4346	221.5936	244.9474	257.9067	285.3044 (310)
Cooling System Energy Efficiency Ratio												
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (314)
Pumps and Fa	6.0157	5.4336	6.0157	5.8217	6.0157	5.8217	6.0157	5.8217	5.8217	6.0157	5.8217	6.0157 (315)
Lighting	9.2387	7.4116	6.6734	4.8892	3.7766	3.0855	3.4451	4.4781	5.8166	7.6317	8.6199	9.4955 (332)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333a)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 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334a)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 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335a)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 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333b)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 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334b)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 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335b)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 (335b)
Annual totals kWh/year												
Space heating fuel - community heating												971.9040 (307)
Space heating fuel - secondary												0.0000 (309)
Water heating fuel - community heating												2953.0283 (310)
Efficiency of water heater												0.0000 (311)
Electricity used for heat distribution												9.7190 (313)
Space cooling fuel												0.0000 (321)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0220)												
mechanical ventilation fans (SFP = 1.0220)												
												70.8305 (330a)
Total electricity for the above, kWh/year												
												70.8305 (331)
Electricity for lighting (calculated in Appendix L)												
												74.5618 (332)
Energy saving/generation technologies (Appendices M, N and Q)												
PV generation												
												0.0000 (333)
Wind generation												
												0.0000 (334)
Hydro-electric generation (Appendix N)												
												0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)												
												0.0000 (335)
Appendix Q - special features												
Energy saved or generated												
												-0.0000 (336)
Energy used												
												0.0000 (337)
Total delivered energy for all uses												
												4070.3246 (338)

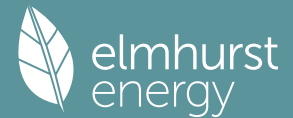
12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			339.0000 (367)
Space and Water heating from Heat pump	1157.7972	0.1555	44.5769 (367)
Electrical energy for heat distribution (space & water)	9.7190	0.0000	5.6644 (372)
Overall CO2 factor for heat network			0.0440 (386)
Total CO2 associated with community systems			172.7552 (373)
Space and water heating			172.7552 (376)
Pumps, fans and electric keep-hot	70.8305	0.1387	9.8251 (378)
Energy for lighting	74.5618	0.1443	10.7616 (379)
Total CO2, kg/year			193.3418 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			8.1700 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			339.0000 (467a)
Space and Water heating from Heat pump	1157.7972	1.5756	451.7308 (467)
Electrical energy for heat distribution (space & water)	9.7190	0.0000	60.2007 (472)
Overall CO2 factor for heat network			0.4678 (486)
Total CO2 associated with community systems			1836.0321 (473)
Space and water heating			1836.0321 (476)
Pumps, fans and electric keep-hot	70.8305	1.5128	107.1524 (478)
Energy for lighting	74.5618	1.5338	114.3653 (479)
Total Primary energy kWh/year			2057.5498 (483)
Dwelling Primary energy Rate (DPER)			86.9300 (484)

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1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	23.6700 (1b)	x 2.4000 (2b)	= 56.8080 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.6700		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 56.8080 (5)
Dwelling volume			

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour 20.0000 / (5) = 0.3521 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.6021 (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) = 0.6021 (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	0.7676	0.7526	0.7375	0.6623	0.6472	0.5720	0.5720	0.5569	0.6021	0.6472	0.6773	0.7074 (22b)
Effective ac	0.7946	0.7832	0.7720	0.7193	0.7094	0.6636	0.6636	0.6551	0.6812	0.7094	0.7294	0.7502 (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			2.1500	1.0000	2.1500		(26)
TER Opening Type (Uw = 1.20)			3.4800	1.1450	3.9847		(27)
Heat Loss Floor 1			23.6700	0.1300	3.0771		(28b)
Ext Wall 1 Sides	50.7100	5.6300	45.0800	0.1800	8.1144		(29a)
External Roof 1	23.6700		23.6700	0.1100	2.6037		(30)
Total net area of external elements Aum(A, m ²)			98.0500				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 19.9299		(33)

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

163.7833 (35)

List of Thermal Bridges

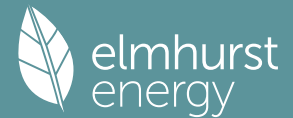
K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	2.6700	0.0500	0.1335
E3 Sill	2.6700	0.0500	0.1335
E4 Jamb	12.6600	0.0500	0.6330
E20 Exposed floor (normal)	18.4700	0.3200	5.9104
E14 Flat roof	21.1400	0.0800	1.6912
E16 Corner (normal)	9.6000	0.0900	0.8640
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			9.3656 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 29.2955 (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	14.8966	14.6821	14.4719	13.4845	13.2997	12.4397	12.4397	12.2804	12.7710	13.2997	13.6735	14.0642 (38)
Heat transfer coeff	44.1921	43.9777	43.7674	42.7800	42.5953	41.7352	41.7352	41.5760	42.0665	42.5953	42.9690	43.3597 (39)
Average = Sum(39)m / 12 =												42.7791

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.8670	1.8579	1.8491	1.8074	1.7995	1.7632	1.7632	1.7565	1.7772	1.7995	1.8153	1.8318 (40)
HLP (average)												1.8073
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												1.0704 (42)
Hot water usage for mixer showers	54.0573	53.2449	52.0611	49.7961	48.1246	46.2606	45.2011	46.3759	47.6638	49.6652	51.9788	53.8502 (42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)
Hot water usage for other uses	25.5916	24.6610	23.7304	22.7998	21.8692	20.9386	20.9386	21.8692	22.7998	23.7304	24.6610	25.5916 (42c)
Average daily hot water use (litres/day)												73.1041 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	79.6489	77.9059	75.7915	72.5959	69.9938	67.1992	66.1397	68.2451	70.4636	73.3956	76.6398	79.4418 (44)
Energy content (annual)	126.1444	110.9370	116.4887	99.3802	94.2252	82.6293	79.9902	84.5017	86.8886	99.5971	109.1874	124.3866 (45)
Distribution loss (46)m = 0.15 x (45)m	18.9217	16.6405	17.4733	14.9070	14.1338	12.3944	11.9985	12.6753	13.0333	14.9396	16.3781	18.6580 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	172.7393	153.0227	163.0836	144.4721	140.8201	127.7211	126.5851	131.0966	131.9805	146.1920	154.2793	170.9815 (62)
WWHRS	-24.7127	-21.8561	-22.8865	-18.9509	-17.6616	-15.1131	-14.1662	-15.0643	-15.6366	-18.4339	-20.8833	-24.2551 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	148.0265	131.1666	140.1971	125.5211	123.1585	112.6080	112.4190	116.0323	116.3438	127.7581	133.3960	146.7264 (64)
Total per year (kWh/year)												1533.3535 (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	79.2189	70.5551	76.0084	69.1174	68.6058	63.5477	63.8727	65.3727	64.9639	70.3920	72.3783	78.6345 (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	53.5183	53.5183	53.5183	53.5183	53.5183	53.5183	53.5183	53.5183	53.5183	53.5183	53.5183	53.5183 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	44.6796	49.4667	44.6796	46.1689	44.6796	46.1689	44.6796	44.6796	46.1689	44.6796	46.1689	44.6796 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	83.4438	84.3097	82.1277	77.4825	71.6187	66.1076	62.4258	61.5599	63.7419	68.3872	74.2509	79.7620 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.3518	28.3518	28.3518	28.3518	28.3518	28.3518	28.3518	28.3518	28.3518	28.3518	28.3518	28.3518 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146 (71)
Water heating gains (Table 5)	106.4770	104.9927	102.1619	95.9964	92.2121	88.2607	85.8504	87.8666	90.2277	94.6128	100.5254	105.6915 (72)
Total internal gains	276.6559	280.8246	271.0246	261.7032	250.5658	239.5926	232.0112	233.1616	239.1940	249.7351	263.0007	272.1886 (73)

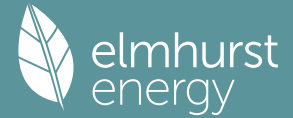
6. Solar gains

[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
Southeast				2.1500	36.7938		0.6300		0.7000		0.7700		24.1760 (77)
Northwest				1.3300	11.2829		0.6300		0.7000		0.7700		4.5861 (81)
Solar gains	28.7622	50.5159	73.1643	97.4363	115.3271	117.2161	111.8756	98.1120	81.5043	56.9218	34.7279		24.4349 (83)
Total gains	305.4181	331.3405	344.1889	359.1395	365.8929	356.8087	343.8869	331.2735	320.6983	306.6569	297.7286		296.6235 (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, n11,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	24.3680	24.4869	24.6045	25.1724	25.2816	25.8025	25.8025	25.9014	25.5994	25.2816	25.0617	24.8358
alpha	2.6245	2.6325	2.6403	2.6782	2.6854	2.7202	2.7202	2.7268	2.7066	2.6854	2.6708	2.6557

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util living area	0.9397	0.9230	0.8980	0.8444	0.7569	0.6188	0.4840	0.5147	0.6929	0.8456	0.9153	0.9433 (86)
MIT	18.6193	18.8729	19.2751	19.8539	20.3617	20.7500	20.9072	20.8878	20.6337	20.0163	19.2667	18.6141 (87)
Th 2	19.4235	19.4297	19.4359	19.4649	19.4703	19.4959	19.4959	19.5006	19.4860	19.4703	19.4593	19.4478 (88)
util rest of house	0.9261	0.9059	0.8741	0.8056	0.6912	0.5112	0.3379	0.3705	0.5947	0.7996	0.8936	0.9307 (89)
MIT 2	16.8125	17.1303	17.6318	18.3490	18.9338	19.3440	19.4636	19.4577	19.2384	18.5589	17.6444	16.8199 (90)
Living area fraction									fLA = Living area / (4) =			0.5830 (91)
MIT	17.8659	18.1463	18.5899	19.2264	19.7663	20.1637	20.3052	20.2915	20.0519	19.4086	18.5902	17.8659 (92)
Temperature adjustment												0.0000
adjusted MIT	17.8659	18.1463	18.5899	19.2264	19.7663	20.1637	20.3052	20.2915	20.0519	19.4086	18.5902	17.8659 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9085	0.8879	0.8580	0.7985	0.7054	0.5622	0.4200	0.4504	0.6348	0.7974	0.8781	0.9136	(94)
Useful gains	277.4748	294.2079	295.3294	286.7719	258.0861	200.6078	144.4397	149.1916	203.5909	244.5270	261.4486	271.0005	(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	599.5056	582.5392	529.1425	441.7630	343.5855	232.2029	154.6390	161.7921	250.3760	375.2037	493.7237	592.5517	(97)
Space heating kWh	239.5908	193.7586	173.9570	111.5936	63.6116	0.0000	0.0000	0.0000	0.0000	97.2235	167.2380	239.2341	(98a)
Space heating requirement - total per year (kWh/year)												1286.2072	
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	239.5908	193.7586	173.9570	111.5936	63.6116	0.0000	0.0000	0.0000	0.0000	97.2235	167.2380	239.2341	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1286.2072	
Space heating per m2										(98c) / (4) =		54.3391	(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 %)	92.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	239.5908	193.7586	173.9570	111.5936	63.6116	0.0000	0.0000	0.0000	0.0000	97.2235	167.2380	239.2341	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	259.5784	209.9227	188.4691	120.9031	68.9183	0.0000	0.0000	0.0000	0.0000	105.3342	181.1896	259.1919	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating													
Water heating requirement	148.0265	131.1666	140.1971	125.5211	123.1585	112.6080	112.4190	116.0323	116.3438	127.7581	133.3960	146.7264	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.1333	84.9332	84.5448	83.7970	82.6531	79.8000	79.8000	79.8000	79.8000	83.4552	84.5680	85.1492	(217)
Fuel for water heating, kWh/month	173.8762	154.4350	165.8259	149.7918	149.0065	141.1128	140.8759	145.4039	145.7943	153.0860	157.7382	172.3168	(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	9.2835	7.4476	6.7057	4.9129	3.7949	3.1004	3.4618	4.4998	5.8448	7.6687	8.6617	9.5415	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-20.2662	-27.6586	-38.5657	-42.1284	-44.5664	-41.4646	-41.1077	-39.3107	-35.8806	-31.2122	-22.0245	-17.6463	(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	-14.3913	-29.8843	-58.6325	-86.9212	-113.7704	-113.7474	-112.2476	-95.4137	-70.5536	-42.1335	-19.0277	-11.3940	(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												1393.5073	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												1849.2634	(219)
Space cooling fuel												0.0000	(221)

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Electricity for pumps and fans:	
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	74.9234 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1169.9491 (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	2233.7450 (238)

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

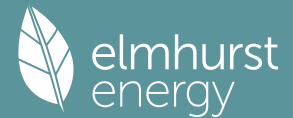
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1393.5073	0.2100	292.6365 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1849.2634	0.2100	388.3453 (264)
Space and water heating			680.9818 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	74.9234	0.1443	10.8138 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-401.8318	0.1351	-54.3023
PV Unit electricity exported	-768.1172	0.1263	-97.0278
Total			-151.3301 (269)
Total CO2, kg/year			552.3948 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			23.3400 (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	1393.5073	1.1300	1574.6632 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1849.2634	1.1300	2089.6676 (278)
Space and water heating			3664.3308 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	74.9234	1.5338	114.9200 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-401.8318	1.4995	-602.5355
PV Unit electricity exported	-768.1172	0.4637	-356.1760
Total			-958.7115 (283)
Total Primary energy kWh/year			2950.6402 (286)
Target Primary Energy Rate (TPER)			124.6600 (287)

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Property Reference	2633 MdIhs V3.002				Issued on Date	17/01/2023
Assessment Reference	SAP 10	Prop Type Ref		ModulHaus V3.002		
Property	ModulHaus, Thames Valley					
SAP Rating	76 C	DER	8.17	TER	23.34	
Environmental	96 A	% DER < TER				65.00
CO ₂ Emissions (t/year)	0.18	DFEE	51.21	TFEE	67.00	
Compliance Check	See BREL	% DFEE < TFEE				23.58
% DPER < TPER	30.27	DPER	86.93	TPER	124.66	
Assessor Details	Mr. Colin Padwick				Assessor ID	L855-0001
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	23.6700 (1b)	x 2.4000 (2b)	= 56.8080 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.6700		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 56.8080 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

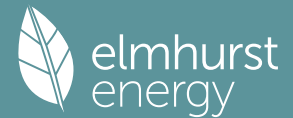
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	3.0000 (17)
Number of sides sheltered	0.1500 (18)
	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1500 (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	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												64.8000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.3672	0.3635	0.3598	0.3410	0.3372	0.3185	0.3185	0.3147	0.3260	0.3372	0.3448	0.3522 (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
Door			2.1500	1.0000	2.1500		(26)
Nordan Front (Uw = 1.35)			2.1500	1.2808	2.7538		(27)
Nordan Back (Uw = 1.42)			1.3300	1.3437	1.7871		(27)

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Heat Loss Floor 1				23.6700	0.1000	2.3670	30.6000	724.3020 (28b)
Ext Wall 1 Sides	50.7100	5.6300		45.0800	0.1500	6.7620	29.1700	1314.9836 (29a)
External Roof 1	23.6700			23.6700	0.1600	3.7872	24.4700	579.2049 (30)
Total net area of external elements Aum(A, m2)				98.0500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	19.6071			(33)
Ptn1 Std Wall				33.9600			27.0500	918.6180 (32c)
Ptn2 Shower				12.5700			27.0200	339.6414 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 3876.7499 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 163.7833 (35)

List of Thermal Bridges								
K1 Element					Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)					2.6700	0.0290	0.0774	
E3 Sill					2.6700	0.0350	0.0935	
E4 Jamb					12.6600	0.0310	0.3925	
E20 Exposed floor (normal)					18.4700	0.0180	0.3325	
E14 Flat roof					21.1400	0.0360	0.7610	
E16 Corner (normal)					9.6000	0.1800	1.7280	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								3.3848 (36)
Point Thermal bridges							(36a) =	0.0000
Total fabric heat loss							(33) + (36) + (36a) =	22.9919 (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	6.8847	6.8144	6.7441	6.3926	6.3223	5.9708	5.9708	5.9005	6.1114	6.3223	6.4629	6.6035	(38)
Average = Sum(39)m / 12 =	29.8766	29.8063	29.7360	29.3845	29.3142	28.9627	28.9627	28.8924	29.1033	29.3142	29.4548	29.5954	(39)
													29.3670

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.2622	1.2592	1.2563	1.2414	1.2385	1.2236	1.2236	1.2206	1.2295	1.2385	1.2444	1.2503	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

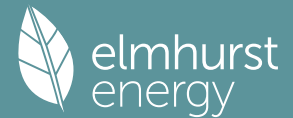
4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.0704 (42)
Hot water usage for mixer showers													
	60.8144	59.9005	58.5687	56.0206	54.1402	52.0432	50.8512	52.1729	53.6217	55.8733	58.4761	60.5814	(42a)
Hot water usage for baths													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses													
	25.5916	24.6610	23.7304	22.7998	21.8692	20.9386	20.9386	21.8692	22.7998	23.7304	24.6610	25.5916	(42c)
Average daily hot water use (litres/day)													79.3340 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	86.4060	84.5615	82.2991	78.8205	76.0094	72.9818	71.7898	74.0421	76.4215	79.6037	83.1371	86.1730	(44)
Energy conte	136.8461	120.4145	126.4907	107.9013	102.3233	89.7396	86.8236	91.6796	94.2354	108.0215	118.4441	134.9262	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m													
	20.5269	18.0622	18.9736	16.1852	15.3485	13.4609	13.0235	13.7519	14.1353	16.2032	17.7666	20.2389	(46)
Water storage loss:													
Store volume													110.0000 (47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0152 (51)
Volume factor from Table 2a													1.0294 (52)
Temperature factor from Table 2b													0.6000 (53)
Enter (49) or (54) in (55)													1.0327 (55)
Total storage loss													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(56)
If cylinder contains dedicated solar storage													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	192.1229	170.3419	181.7675	161.3949	157.6001	143.2333	142.1004	146.9564	147.7291	163.2983	171.9378	190.2030	(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													
	192.1229	170.3419	181.7675	161.3949	157.6001	143.2333	142.1004	146.9564	147.7291	163.2983	171.9378	190.2030	(64)
Total per year (kWh/year) = Sum(64)m =													1968.6856 (64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month													
	89.7228	79.9798	86.2796	78.6721	78.2439	72.6334	73.0903	74.7049	74.1282	80.1386	82.1776	89.0844	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.2220	64.2220	64.2220	64.2220	64.2220	64.2220	64.2220	64.2220	64.2220	64.2220	64.2220	64.2220	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	10.5550	9.3748	7.6241	5.7720	4.3146	3.6426	3.9359	5.1161	6.8668	8.7190	10.1763	10.8483	(67)

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	124.5430	125.8354	122.5786	115.6455	106.8936	98.6680	93.1729	91.8805	95.1372	102.0704	110.8223	119.0478 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	42.4926	42.4926	42.4926	42.4926	42.4926	42.4926	42.4926	42.4926	42.4926	42.4926	42.4926	42.4926 (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)	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146 (71)
Water heating gains (Table 5)	120.5951	119.0175	115.9672	109.2668	105.1666	100.8797	98.2396	100.4098	102.9559	107.7132	114.1356	119.7371 (72)
Total internal gains	319.5930	318.1276	310.0699	294.5841	280.2746	267.0902	259.2483	261.3063	268.8597	282.4024	299.0340	313.5331 (73)

6. Solar gains

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

Southeast				2.1500	36.7938	0.5800		0.7400	0.7700		23.5292 (77)	
Northwest				1.3300	11.2829	0.5800		0.6400	0.7700		3.8602 (81)	

Solar gains	27.3894	47.9365	68.9946	91.1963	107.3581	108.8737	104.0120	91.6043	76.6281	53.8984	33.0397	23.2885 (83)
Total gains	346.9824	366.0641	379.0645	385.7805	387.6327	375.9639	363.2603	352.9105	345.4878	336.3007	332.0738	336.8217 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	36.0441	36.1291	36.2145	36.6477	36.7356	37.1814	37.1814	37.2719	37.0018	36.7356	36.5602	36.3865
alpha	3.4029	3.4086	3.4143	3.4432	3.4490	3.4788	3.4788	3.4848	3.4668	3.4490	3.4373	3.4258
util living area	0.8891	0.8647	0.8205	0.7423	0.6250	0.4707	0.3448	0.3687	0.5405	0.7358	0.8480	0.8966 (86)
MIT	19.8467	20.0101	20.2713	20.5789	20.8150	20.9488	20.9867	20.9829	20.9141	20.6502	20.2225	19.8143 (87)
Th 2	19.8706	19.8729	19.8752	19.8870	19.8894	19.9012	19.9012	19.9035	19.8964	19.8894	19.8846	19.8799 (88)
util rest of house	0.8708	0.8430	0.7917	0.7016	0.5681	0.3975	0.2613	0.2842	0.4666	0.6876	0.8207	0.8793 (89)
MIT 2	18.8830	19.0383	19.2831	19.5694	19.7684	19.8761	19.8970	19.8978	19.8507	19.6391	19.2518	18.8603 (90)
Living area fraction									fLA = Living area / (4) =			0.5830 (91)
MIT	19.4449	19.6049	19.8592	20.1580	20.3786	20.5015	20.5323	20.5305	20.4707	20.2286	19.8177	19.4165 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4449	19.6049	19.8592	20.1580	20.3786	20.5015	20.5323	20.5305	20.4707	20.2286	19.8177	19.4165 (93)

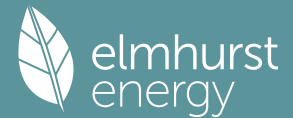
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8629	0.8372	0.7912	0.7121	0.5940	0.4382	0.3097	0.3330	0.5060	0.7031	0.8189	0.8712 (94)
Useful gains	299.4235	306.4710	299.9284	274.7098	230.2346	164.7359	112.4994	117.5192	174.8217	236.4639	271.9186	293.4332 (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	452.4776	438.2990	397.2504	330.8106	254.4059	170.9227	113.8898	119.3388	185.4084	282.2549	374.5981	450.3391 (97)
Space heating kWh	113.8723	88.5884	72.4075	40.3926	17.9835	0.0000	0.0000	0.0000	0.0000	34.0684	73.9292	116.7380 (98a)
Space heating requirement - total per year (kWh/year)												557.9800
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	113.8723	88.5884	72.4075	40.3926	17.9835	0.0000	0.0000	0.0000	0.0000	34.0684	73.9292	116.7380 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												557.9800
Space heating per m ²										(98c) / (4) =		23.5733 (99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (301)
Fraction of space heat from community system												1.0000 (302)
Fraction of heat from community Heat pump-Space and Water												1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0500 (305)
Factor for charging method (Table 4c(3)) for water heating												1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system												1.5000 (306)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating:												
Space heating requirement	113.8723	88.5884	72.4075	40.3926	17.9835	0.0000	0.0000	0.0000	0.0000	34.0684	73.9292	116.7380 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.50												
307a	179.3488	139.5268	114.0419	63.6184	28.3240	0.0000	0.0000	0.0000	0.0000	53.6578	116.4385	183.8623
Space heating requirement	179.3488	139.5268	114.0419	63.6184	28.3240	0.0000	0.0000	0.0000	0.0000	53.6578	116.4385	183.8623 (307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000 (308)
Space heating fuel for secondary/supplementary system												

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)
Water heating												
Annual water heating requirement	192.1229	170.3419	181.7675	161.3949	157.6001	143.2333	142.1004	146.9564	147.7291	163.2983	171.9378	190.2030 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.50												
310a	288.1843	255.5129	272.6513	242.0924	236.4001	214.8500	213.1506	220.4346	221.5936	244.9474	257.9067	285.3044
Water heating fuel	288.1843	255.5129	272.6513	242.0924	236.4001	214.8500	213.1506	220.4346	221.5936	244.9474	257.9067	285.3044 (310)
Cooling System Energy Efficiency Ratio												0.0000 (314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)
Pumps and Fa	6.0157	5.4336	6.0157	5.8217	6.0157	5.8217	6.0157	6.0157	5.8217	6.0157	5.8217	6.0157 (331)
Lighting	9.2387	7.4116	6.6734	4.8892	3.7766	3.0855	3.4451	4.4781	5.8166	7.6317	8.6199	9.4955 (332)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333a)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 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334a)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 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335a)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 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333b)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 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334b)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 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335b)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 (335b)
Annual totals kWh/year												
Space heating fuel - community heating												878.8184 (307)
Space heating fuel - secondary												0.0000 (309)
Water heating fuel - community heating												2953.0283 (310)
Efficiency of water heater												0.0000 (311)
Electricity used for heat distribution												8.7882 (313)
Space cooling fuel												0.0000 (321)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0220)												
mechanical ventilation fans (SFP = 1.0220)												70.8305 (330a)
Total electricity for the above, kWh/year												70.8305 (331)
Electricity for lighting (calculated in Appendix L)												74.5618 (332)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (333)
Wind generation												0.0000 (334)
Hydro-electric generation (Appendix N)												0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (335)
Appendix Q - special features												
Energy saved or generated												-0.0000 (336)
Energy used												0.0000 (337)
Total delivered energy for all uses												3977.2390 (338)

10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating from Heat pump	878.8184	4.4400	39.0195 (340a)
Space heating total			39.0195 (340)
Total CO2 associated with community systems			0.0000 (473)
Space heating - secondary	0.0000	0.0000	0.0000 (341)
Water heating from Heat pump	2953.0283	4.4400	131.1145 (342a)
Water heating total			131.1145 (342)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (347a)
Pumps, fans and electric keep-hot	70.8305	16.4900	11.6799 (349)
Energy for lighting	74.5618	16.4900	12.2952 (350)
Additional standing charges			92.0000 (351)
Total energy cost			286.1092 (355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):		0.3600 (356)
Energy cost factor (ECF)		1.4999 (357)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	75.6863
SAP rating (Section 12)		76 (358)
SAP band		C

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			339.0000 (367)
Space and Water heating from Heat pump	1130.3383	0.1555	40.3221 (367)
Electrical energy for heat distribution (space & water)	8.7882	0.0000	5.5201 (372)
Overall CO2 factor for heat network			0.0439 (386)
Total CO2 associated with community systems			168.3561 (373)
Space and water heating			168.3561 (376)
Pumps, fans and electric keep-hot	70.8305	0.1387	9.8251 (378)
Energy for lighting	74.5618	0.1443	10.7616 (379)

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Total CO₂, kg/year
CO₂ emissions per m²
EI value
EI rating
EI band

188.9427 (383)
7.9800 (384)
96.3130 (384a)
96 (385)
A

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	23.6700 (1b)	x 2.4000 (2b)	= 56.8080 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.6700		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 56.8080 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour 0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.0000 (17)
Infiltration rate	0.1500 (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) = 0.1500 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.1575	0.1500	0.1500	0.1388	0.1388	0.1237	0.1275	0.1200	0.1237	0.1313	0.1313	0.1425 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												64.8000 (23c)
Effective ac	0.3335	0.3260	0.3260	0.3147	0.3147	0.2997	0.3035	0.2960	0.2997	0.3073	0.3073	0.3185 (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
Door			2.1500	1.0000	2.1500		(26)
Nordan Front (Uw = 1.35)			2.1500	1.2808	2.7538		(27)
Nordan Back (Uw = 1.42)			1.3300	1.3437	1.7871		(27)
Heat Loss Floor 1			23.6700	0.1000	2.3670	30.6000	724.3020 (28b)
Ext Wall 1 Sides	50.7100	5.6300	45.0800	0.1500	6.7620	29.1700	1314.9836 (29a)
External Roof 1	23.6700		23.6700	0.1600	3.7872	24.4700	579.2049 (30)
Total net area of external elements Aum(A, m ²)			98.0500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	19.6071		(33)
Ptn1 Std Wall			33.9600			27.0500	918.6180 (32c)
Ptn2 Shower			12.5700			27.0200	339.6414 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	3876.7499 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		163.7833 (35)

List of Thermal Bridges

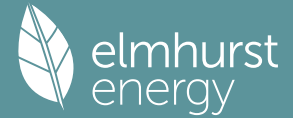
K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	2.6700	0.0290	0.0774

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
	6.2520	6.1114	6.1114	5.9005	5.9005	5.6193	5.6896	5.5490	5.6193	5.7599	5.7599	5.9708 (38)
Heat transfer coeff												
	29.2439	29.1033	29.1033	28.8924	28.8924	28.6112	28.6815	28.5409	28.6112	28.7518	28.7518	28.9627 (39)
Average = Sum(39)m / 12 =												28.8456
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1.2355	1.2295	1.2295	1.2206	1.2206	1.2088	1.2117	1.2058	1.2088	1.2147	1.2147	1.2236 (40)
HLP (average)												1.2187
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

Assumed occupancy												1.0704 (42)
Hot water usage for mixer showers	60.8144	59.9005	58.5687	56.0206	54.1402	52.0432	50.8512	52.1729	53.6217	55.8733	58.4761	60.5814 (42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)
Hot water usage for other uses	25.5916	24.6610	23.7304	22.7998	21.8692	20.9386	20.9386	21.8692	22.7998	23.7304	24.6610	25.5916 (42c)
Average daily hot water use (litres/day)												79.3340 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	86.4060	84.5615	82.2991	78.8205	76.0094	72.9818	71.7898	74.0421	76.4215	79.6037	83.1371	86.1730 (44)
Energy content (annual)	136.8461	120.4145	126.4907	107.9013	102.3233	89.7396	86.8236	91.6796	94.2354	108.0215	118.4441	134.9262 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m =											1317.8458
Water storage loss:	20.5269	18.0622	18.9736	16.1852	15.3485	13.4609	13.0235	13.7519	14.1353	16.2032	17.7666	20.2389 (46)
Store volume												110.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)
Volume factor from Table 2a												1.0294 (52)
Temperature factor from Table 2b												0.6000 (53)
Enter (49) or (54) in (55)												1.0327 (55)
Total storage loss	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)
If cylinder contains dedicated solar storage	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	192.1229	170.3419	181.7675	161.3949	157.6001	143.2333	142.1004	146.9564	147.7291	163.2983	171.9378	190.2030 (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	192.1229	170.3419	181.7675	161.3949	157.6001	143.2333	142.1004	146.9564	147.7291	163.2983	171.9378	190.2030 (64)
	Total per year (kWh/year) = Sum(64)m =											1968.6856 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)
Heat gains from water heating, kWh/month	89.7228	79.9798	86.2796	78.6721	78.2439	72.6334	73.0903	74.7049	74.1282	80.1386	82.1776	89.0844 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	64.2220	64.2220	64.2220	64.2220	64.2220	64.2220	64.2220	64.2220	64.2220	64.2220	64.2220	64.2220
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	10.5550	9.3748	7.6241	5.7720	4.3146	3.6426	3.9359	5.1161	6.8668	8.7190	10.1763	10.8483
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	124.5430	125.8354	122.5786	115.6455	106.8936	98.6680	93.1729	91.8805	95.1372	102.0704	110.8223	119.0478
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	42.4926	42.4926	42.4926	42.4926	42.4926	42.4926	42.4926	42.4926	42.4926	42.4926	42.4926	42.4926
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
Losses e.g. evaporation (negative values) (Table 5)	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146
Water heating gains (Table 5)	120.5951	119.0175	115.9672	109.2668	105.1666	100.8797	98.2396	100.4098	102.9559	107.7132	114.1356	119.7371
Total internal gains	319.5930	318.1276	310.0699	294.5841	280.2746	267.0902	259.2483	261.3063	268.8597	282.4024	299.0340	313.5331

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6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W	
Southeast				2.1500	40.4699	0.5800		0.7400		0.7700	25.8800 (77)	
Northwest				1.3300	12.9236	0.5800		0.6400		0.7700	4.4216 (81)	
Solar gains	30.3015	47.7983	68.2277	93.4682	107.6484	117.0129	110.5068	99.2082	82.3191	57.4532	37.4608	25.5086 (83)
Total gains	349.8945	365.9259	378.2975	388.0523	387.9231	384.1031	369.7551	360.5145	351.1789	339.8556	336.4949	339.0418 (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	36.8239	37.0018	37.0018	37.2719	37.2719	37.6382	37.5459	37.7309	37.6382	37.4541	37.4541	37.1814
alpha	3.4549	3.4668	3.4668	3.4848	3.4848	3.5092	3.5031	3.5154	3.5092	3.4969	3.4969	3.4788
util living area	0.8710	0.8475	0.7933	0.6980	0.5519	0.3651	0.2392	0.2518	0.4540	0.6816	0.8166	0.8782 (86)
MIT	20.0233	20.1571	20.4159	20.6950	20.8957	20.9826	20.9972	20.9966	20.9599	20.7634	20.3934	20.0049 (87)
Th 2	19.8917	19.8964	19.8964	19.9035	19.9035	19.9130	19.9106	19.9154	19.9130	19.9083	19.9083	19.9012 (88)
util rest of house	0.8498	0.8231	0.7606	0.6520	0.4883	0.2887	0.1558	0.1672	0.3756	0.6263	0.7843	0.8578 (89)
MIT 2	19.0673	19.1952	19.4328	19.6831	19.8420	19.9065	19.9102	19.9148	19.8950	19.7489	19.4275	19.0584 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	19.6247	19.7560	20.0059	20.2731	20.4563	20.5339	20.5439	20.5455	20.5159	20.3403	19.9906	19.6102 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.6247	19.7560	20.0059	20.2731	20.4563	20.5339	20.5439	20.5455	20.5159	20.3403	19.9906	19.6102 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8441	0.8197	0.7641	0.6682	0.5211	0.3327	0.2045	0.2166	0.4198	0.6492	0.7870	0.8518 (94)
Useful gains	295.3315	299.9572	289.0497	259.2796	202.1452	127.8020	75.5973	78.0729	147.4126	220.6213	264.8070	288.7957 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	424.7583	411.9861	366.8746	299.7032	215.4320	129.7203	75.8318	78.3599	152.0944	251.3009	344.7531	420.2563 (97)
Space heating kWh	96.2936	75.2834	57.9017	29.1050	9.8854	0.0000	0.0000	0.0000	0.0000	22.8257	57.5612	97.8066 (98a)
Space heating requirement - total per year (kWh/year)												446.6626
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	96.2936	75.2834	57.9017	29.1050	9.8854	0.0000	0.0000	0.0000	0.0000	22.8257	57.5612	97.8066 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												446.6626
Space heating per m2												(98c) / (4) = 18.8704 (99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (301)
Fraction of space heat from community system												1.0000 (302)
Fraction of heat from community Heat pump-Space and Water												1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0500 (305)
Factor for charging method (Table 4c(3)) for water heating												1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system												1.5000 (306)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating:												
Space heating requirement												
	96.2936	75.2834	57.9017	29.1050	9.8854	0.0000	0.0000	0.0000	0.0000	22.8257	57.5612	97.8066 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.50												
307a	151.6624	118.5714	91.1952	45.8404	15.5694	0.0000	0.0000	0.0000	0.0000	35.9504	90.6589	154.0455
Space heating requirement												
	151.6624	118.5714	91.1952	45.8404	15.5694	0.0000	0.0000	0.0000	0.0000	35.9504	90.6589	154.0455 (307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000 (308)
Space heating fuel for secondary/supplementary system												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)
Water heating												
Annual water heating requirement												
	192.1229	170.3419	181.7675	161.3949	157.6001	143.2333	142.1004	146.9564	147.7291	163.2983	171.9378	190.2030 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.50												
310a	288.1843	255.5129	272.6513	242.0924	236.4001	214.8500	213.1506	220.4346	221.5936	244.9474	257.9067	285.3044
Water heating fuel												
	288.1843	255.5129	272.6513	242.0924	236.4001	214.8500	213.1506	220.4346	221.5936	244.9474	257.9067	285.3044 (310)
Cooling System Energy Efficiency Ratio												0.0000 (314)
Space coolin												0.0000 (315)
Pumps and Fa												6.0157 (331)
Lighting												9.4955 (332)

13b. Primary energy - Community heating scheme			
	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			339.0000 (467a)
Space and Water heating from Heat pump	1078.6201	1.5786	327.5911 (467)
Electrical energy for heat distribution (space & water)	7.0349	0.0000	55.9924 (472)
Overall CO2 factor for heat network			0.4670 (486)
Total CO2 associated with community systems			1707.6841 (473)
Space and water heating			1707.6841 (476)
Pumps, fans and electric keep-hot	70.8305	1.5128	107.1524 (478)
Energy for lighting	74.5618	1.5338	114.3653 (479)
Total Primary energy kWh/year			1929.2018 (483)

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SAP 10

Current energy efficiency rating: C 76
Current environmental impact rating: A 96

N Solar water heating
U Solar photovoltaic panels
V2 Wind turbine
Recommended
Recommended
Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 2.2	-£ 19	-26 kg (14.3%)
U Solar photovoltaic panels	+ 6.8	-£ 92	-68 kg (43.8%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£19	1.09 kg/m²	C 78 A 97
Solar photovoltaic panels	£92	2.86 kg/m²	B 85 A 98
Total Savings	£110	3.96 kg/m²	

Potential energy efficiency rating: B 85
Potential environmental impact rating: A 98

Fuel prices for cost data on this page from database revision number 510 TEST (21 Dec 2022)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£27	£41	-£15
Community scheme	£222	£189	£33
Space heating	£132	£146	-£15
Water heating	£103	£70	£33
Lighting	£14	£14	£0
Generated (PV)	-£0	-£92	£92
Total cost of fuels	£249	£138	£110
Total cost of uses	£249	£138	£110
Delivered energy	161 kWh/m²	103 kWh/m²	58 kWh/m²
Carbon dioxide emissions	0.2 tonnes	0.1 tonnes	0.1 tonnes
CO2 emissions per m²	8 kg/m²	4 kg/m²	4 kg/m²
Primary energy	82 kWh/m²	37 kWh/m²	45 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

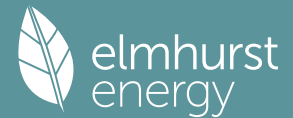
	Area (m²)	Storey height (m)	Volume (m³)
Ground floor	23.6700 (1b)	2.4000 (2b)	56.8080 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.6700		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	56.8080 (5)

2. Ventilation rate

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)
Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 3.0000 (17)

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Infiltration rate 0.1500 (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) = 0.1500 (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	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												64.8000	(23c)
Effective ac	0.3672	0.3635	0.3598	0.3410	0.3372	0.3185	0.3185	0.3147	0.3260	0.3372	0.3448	0.3522	(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	
Door			2.1500	1.0000	2.1500			(26)
Nordan Front (Uw = 1.35)			2.1500	1.2808	2.7538			(27)
Nordan Back (Uw = 1.42)			1.3300	1.3437	1.7871			(27)
Heat Loss Floor 1			23.6700	0.1000	2.3670	30.6000	724.3020	(28b)
Ext Wall 1 Sides	50.7100	5.6300	45.0800	0.1500	6.7620	29.1700	1314.9836	(29a)
External Roof 1	23.6700		23.6700	0.1600	3.7872	24.4700	579.2049	(30)
Total net area of external elements Aum(A, m2)			98.0500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	19.6071			(33)
Ptn1 Std Wall			33.9600			27.0500	918.6180	(32c)
Ptn2 Shower			12.5700			27.0200	339.6414	(32c)

Heat capacity Cm = Sum(A x k)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K (28)...(30) + (32) + (32a)...(32e) = 3876.7499 (34)
 List of Thermal Bridges 163.7833 (35)

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	2.6700	0.0290	0.0774	
E3 Sill	2.6700	0.0350	0.0935	
E4 Jamb	12.6600	0.0310	0.3925	
E20 Exposed floor (normal)	18.4700	0.0180	0.3325	
E14 Flat roof	21.1400	0.0360	0.7610	
E16 Corner (normal)	9.6000	0.1800	1.7280	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				3.3848 (36)
Point Thermal bridges				0.0000 (36a) =
Total fabric heat loss				(33) + (36) + (36a) = 22.9919 (37)

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

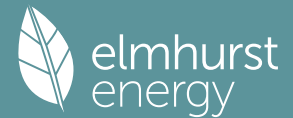
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	6.8847	6.8144	6.7441	6.3926	6.3223	5.9708	5.9708	5.9005	6.1114	6.3223	6.4629	6.6035	(38)
Heat transfer coeff	29.8766	29.8063	29.7360	29.3845	29.3142	28.9627	28.9627	28.8924	29.1033	29.3142	29.4548	29.5954	(39)
Average = Sum(39)m / 12 =												29.3670	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2622	1.2592	1.2563	1.2414	1.2385	1.2236	1.2236	1.2206	1.2295	1.2385	1.2444	1.2503	(40)
HLP (average)												1.2407	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.0704 (42)
Hot water usage for mixer showers													
60.8144	59.9005	58.5687	56.0206	54.1402	52.0432	50.8512	52.1729	53.6217	55.8733	58.4761	60.5814	60.5814	(42a)
Hot water usage for baths													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses													
25.5916	24.6610	23.7304	22.7998	21.8692	20.9386	20.9386	21.8692	22.7998	23.7304	24.6610	25.5916	25.5916	(42c)
Average daily hot water use (litres/day)												79.3340	(43)
Daily hot water use													
86.4060	84.5615	82.2991	78.8205	76.0094	72.9818	71.7898	74.0421	76.4215	79.6037	83.1371	86.1730	86.1730	(44)
Energy conte	136.8461	120.4145	126.4907	107.9013	102.3233	89.7396	86.8236	91.6796	94.2354	108.0215	118.4441	134.9262	(45)
Energy content (annual)										Total = Sum(45)m =		1317.8458	
Distribution loss (46)m = 0.15 x (45)m													
20.5269	18.0622	18.9736	16.1852	15.3485	13.4609	13.0235	13.7519	14.1353	16.2032	17.7666	20.2389	20.2389	(46)
Water storage loss:													
Store volume												110.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152	(51)
Volume factor from Table 2a												1.0294	(52)
Temperature factor from Table 2b												0.6000	(53)
Enter (49) or (54) in (55)												1.0327	(55)
Total storage loss													
32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	(56)

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If cylinder contains dedicated solar storage												
Primary loss	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (57)
Combi loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	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)
WWHRS	192.1229	170.3419	181.7675	161.3949	157.6001	143.2333	142.1004	146.9564	147.7291	163.2983	171.9378	190.2030 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Aperture area of solar collector	-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)
Zero-loss collector efficiency												3.0000 (H1)
Collector linear heat loss coefficient												0.8000 (H2)
Collector 2nd order heat loss coefficient												1.8000 (H3)
Collector loop efficiency												0.0000 (H4)
Incidence angle modifier												0.9000 (H5)
Overshading factor												1.0000 (H6)
Overall heat loss coefficient of system												0.8000 (H8)
Heat loss coefficient of collector loop												6.5000 (H10)
Dedicated solar storage volume												3.9667 (H11)
Effective solar volume												75.0000 (H12)
Reference volume												75.0000 (H14)
Storage tank correction coefficient												225.0000 (H15)
Heat delivered to hot water												1.3161 (H16)
Heat delivered to space heating												582.1667 (H24)
Solar input												0.0000 (H29)
Solar input	-0.0000	-16.3139	-55.6149	-74.9219	-96.4999	-89.0265	-88.4754	-78.1802	-54.8088	-28.3252	-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	192.1229	154.0280	126.1527	86.4731	61.1002	54.2068	53.6250	68.7762	92.9203	134.9731	171.9378	190.2030 (64)
												Total per year (kWh/year) = Sum(64)m = 1386.5189 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month	89.7228	79.9798	86.2796	78.6721	78.2439	72.6334	73.0903	74.7049	74.1282	80.1386	82.1776	89.0844 (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	64.2220	64.2220	64.2220	64.2220	64.2220	64.2220	64.2220	64.2220	64.2220	64.2220	64.2220	64.2220 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	10.5550	9.3748	7.6241	5.7720	4.3146	3.6426	3.9359	5.1161	6.8668	8.7190	10.1763	10.8483 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	124.5430	125.8354	122.5786	115.6455	106.8936	98.6680	93.1729	91.8805	95.1372	102.0704	110.8223	119.0478 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	42.4926	42.4926	42.4926	42.4926	42.4926	42.4926	42.4926	42.4926	42.4926	42.4926	42.4926	42.4926 (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)	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146 (71)
Water heating gains (Table 5)	120.5951	119.0175	115.9672	109.2668	105.1666	100.8797	98.2396	100.4098	102.9559	107.7132	114.1356	119.7371 (72)
Total internal gains	319.5930	318.1276	310.0699	294.5841	280.2746	267.0902	259.2483	261.3063	268.8597	282.4024	299.0340	313.5331 (73)

6. Solar gains

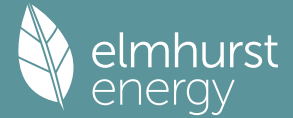
[Jan]			Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W			
-----			2.1500	36.7938	0.5800	0.7400	0.7700	23.5292 (77)				
Northwest			1.3300	11.2829	0.5800	0.6400	0.7700	3.8602 (81)				

Solar gains	27.3894	47.9365	68.9946	91.1963	107.3581	108.8737	104.0120	91.6043	76.6281	53.8984	33.0397	23.2885 (83)
Total gains	346.9824	366.0641	379.0645	385.7805	387.6327	375.9639	363.2603	352.9105	345.4878	336.3007	332.0738	336.8217 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n1,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	36.0441	36.1291	36.2145	36.6477	36.7356	37.1814	37.1814	37.2719	37.0018	36.7356	36.5602	36.3865
alpha	3.4029	3.4086	3.4143	3.4432	3.4490	3.4788	3.4788	3.4848	3.4668	3.4490	3.4373	3.4258
util living area	0.8891	0.8647	0.8205	0.7423	0.6250	0.4707	0.3448	0.3687	0.5405	0.7358	0.8480	0.8966 (86)
MIT	19.8467	20.0101	20.2713	20.5789	20.8150	20.9488	20.9867	20.9829	20.9141	20.6502	20.2225	19.8143 (87)
Th 2	19.8706	19.8729	19.8752	19.8870	19.8894	19.9012	19.9012	19.9035	19.8964	19.8894	19.8846	19.8799 (88)
util rest of house	0.8708	0.8430	0.7917	0.7016	0.5681	0.3975	0.2613	0.2842	0.4666	0.6876	0.8207	0.8793 (89)
MIT 2	18.8830	19.0383	19.2831	19.5694	19.7684	19.8761	19.8970	19.8978	19.8507	19.6391	19.2518	18.8603 (90)
Living area fraction												fLA = Living area / (4) =
MIT	19.4449	19.6049	19.8592	20.1580	20.3786	20.5015	20.5323	20.5305	20.4707	20.2286	19.8177	19.4165 (92)
Temperature adjustment												0.0000

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adjusted MIT 19.4449 19.6049 19.8592 20.1580 20.3786 20.5015 20.5323 20.5305 20.4707 20.2286 19.8177 19.4165 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8629	0.8372	0.7912	0.7121	0.5940	0.4382	0.3097	0.3330	0.5060	0.7031	0.8189	0.8712	(94)
Useful gains	299.4235	306.4710	299.9284	274.7098	230.2346	164.7359	112.4994	117.5192	174.8217	236.4639	271.9186	293.4332	(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	452.4776	438.2990	397.2504	330.8106	254.4059	170.9227	113.8898	119.3388	185.4084	282.2549	374.5981	450.3391	(97)
Space heating kWh	113.8723	88.5884	72.4075	40.3926	17.9835	0.0000	0.0000	0.0000	0.0000	34.0684	73.9292	116.7380	(98a)
Space heating requirement - total per year (kWh/year)												557.9800	
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	113.8723	88.5884	72.4075	40.3926	17.9835	0.0000	0.0000	0.0000	0.0000	34.0684	73.9292	116.7380	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												557.9800	
Space heating per m2										(98c) / (4) =		23.5733	(99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (301)
Fraction of space heat from community system													1.0000 (302)
Fraction of heat from community Heat pump-Space and Water													1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating													1.0500 (305)
Factor for charging method (Table 4c(3)) for water heating													1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system													1.5000 (306)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating:													
Space heating requirement	113.8723	88.5884	72.4075	40.3926	17.9835	0.0000	0.0000	0.0000	0.0000	34.0684	73.9292	116.7380	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.50													
307a	179.3488	139.5268	114.0419	63.6184	28.3240	0.0000	0.0000	0.0000	0.0000	53.6578	116.4385	183.8623	
Space heating requirement	179.3488	139.5268	114.0419	63.6184	28.3240	0.0000	0.0000	0.0000	0.0000	53.6578	116.4385	183.8623	(307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)													0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(309)
Water heating													
Annual water heating requirement	192.1229	154.0280	126.1527	86.4731	61.1002	54.2068	53.6250	68.7762	92.9203	134.9731	171.9378	190.2030	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.50													
310a	288.1843	231.0419	189.2290	129.7096	91.6504	81.3102	80.4375	103.1643	139.3804	202.4596	257.9067	285.3044	
Water heating fuel	288.1843	231.0419	189.2290	129.7096	91.6504	81.3102	80.4375	103.1643	139.3804	202.4596	257.9067	285.3044	(310)
Cooling System Energy Efficiency Ratio													0.0000 (314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(315)
Pumps and Fa	12.8103	11.5706	12.8103	12.3970	12.8103	12.3970	12.8103	12.3970	12.8103	12.3970	12.8103	12.8103	(331)
Lighting	9.2387	7.4116	6.6734	4.8892	3.7766	3.0855	3.4451	4.4781	5.8166	7.6317	8.6199	9.4955	(332)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333a)m	-26.5828	-35.1165	-47.4806	-50.2436	-51.8818	-47.9441	-47.6321	-46.2290	-43.1649	-38.9545	-28.5099	-23.2956	(333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334a)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	(334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335a)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	(335a)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333b)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	(333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334b)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	(334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335b)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	(335b)
Annual totals kWh/year													
Space heating fuel - community heating												878.8184	(307)
Space heating fuel - secondary												0.0000	(309)
Water heating fuel - community heating												2079.7784	(310)
Efficiency of water heater												0.0000	(311)
Electricity used for heat distribution												8.7882	(313)
Space cooling fuel												0.0000	(321)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0220)													
mechanical ventilation fans (SFP = 1.0220)													70.8305 (330a)
pump for solar water heating													80.0000 (330g)
Total electricity for the above, kWh/year													150.8305 (331)
Electricity for lighting (calculated in Appendix L)													74.5618 (332)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-487.0355 (333)
Wind generation													0.0000 (334)
Hydro-electric generation (Appendix N)													0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)													0.0000 (335)
Appendix Q - special features													
Energy saved or generated													-0.0000 (336)
Energy used													0.0000 (337)
Total delivered energy for all uses													2696.9536 (338)

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10b. Fuel costs - using Table 12 prices

	Fuel kwh/year	Fuel price p/kwh	Fuel cost £/year
Space heating from Heat pump	878.8184	4.4400	39.0195 (340a)
Space heating total			39.0195 (340)
Total CO2 associated with community systems			0.0000 (473)
Space heating - secondary	0.0000	0.0000	0.0000 (341)
Water heating from Heat pump	2079.7784	4.4400	92.3422 (342a)
Water heating total			92.3422 (342)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (347a)
Pumps, fans and electric keep-hot	70.8305	16.4900	11.6799 (349)
Pump for solar water heating	80.0000	16.4900	13.1920 (349)
Energy for lighting	74.5618	16.4900	12.2952 (350)
Additional standing charges			92.0000 (351)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-487.0355	16.4900	-80.3122
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-80.3122 (352)
Total energy cost			180.2167 (355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):		0.3600 (356)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.9448 (357)
SAP value		84.6851
SAP rating (Section 12)		85 (358)
SAP band		B

12b. Carbon dioxide emissions - Community heating scheme

	Energy kwh/year	Emission factor kg CO2/kwh	Emissions kg CO2/year
Efficiency of heat source Heat pump			339.0000 (367)
Space and Water heating from Heat pump	872.7424	0.1555	40.3221 (367)
Electrical energy for heat distribution (space & water)	8.7882	0.0000	4.4046 (372)
Overall CO2 factor for heat network			0.0454 (386)
Total CO2 associated with community systems			134.3334 (373)
Space and water heating			134.3334 (376)
Pumps, fans and electric keep-hot	150.8305	0.1387	20.9220 (378)
Energy for lighting	74.5618	0.1443	10.7616 (379)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-487.0355	0.1358	-66.1336
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-66.1336 (380)
Total CO2, kg/year			99.8834 (383)
CO2 emissions per m2			4.2200 (384)
EI value			98.0509 (384a)
EI rating			98 (385)
EI band			A

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

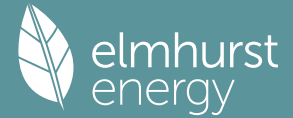
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	23.6700 (1b)	x 2.4000 (2b)	= 56.8080 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.6700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	56.8080 (5)

2. Ventilation rate

m3 per hour

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour	0.0000 / (5) =	0.0000 (8)
Pressure test	Yes		
Pressure Test Method	Blower Door		
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(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) =	0.1500	(21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.1575	0.1500	0.1500	0.1388	0.1388	0.1237	0.1275	0.1200	0.1237	0.1313	0.1313	0.1425	(22b)
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												64.8000	(23c)
Effective ac	0.3335	0.3260	0.3260	0.3147	0.3147	0.2997	0.3035	0.2960	0.2997	0.3073	0.3073	0.3185	(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	
Door			2.1500	1.0000	2.1500			(26)
Nordan Front (Uw = 1.35)			2.1500	1.2808	2.7538			(27)
Nordan Back (Uw = 1.42)			1.3300	1.3437	1.7871			(27)
Heat Loss Floor 1			23.6700	0.1000	2.3670	30.6000	724.3020	(28b)
Ext Wall 1 Sides	50.7100	5.6300	45.0800	0.1500	6.7620	29.1700	1314.9836	(29a)
External Roof 1	23.6700		23.6700	0.1600	3.7872	24.4700	579.2049	(30)
Total net area of external elements Aum(A, m2)			98.0500					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	19.6071		(33)
Ptn1 Std Wall			33.9600			27.0500	918.6180	(32c)
Ptn2 Shower			12.5700			27.0200	339.6414	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	3876.7499	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		163.7833	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	2.6700	0.0290	0.0774	
E3 Sill	2.6700	0.0350	0.0935	
E4 Jamb	12.6600	0.0310	0.3925	
E20 Exposed floor (normal)	18.4700	0.0180	0.3325	
E14 Flat roof	21.1400	0.0360	0.7610	
E16 Corner (normal)	9.6000	0.1800	1.7280	

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		3.3848	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	22.9919	(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	
	6.2520	6.1114	6.1114	5.9005	5.9005	5.6193	5.6896	5.5490	5.6193	5.7599	5.7599	5.9708	(38)
Heat transfer coeff	29.2439	29.1033	29.1033	28.8924	28.8924	28.6112	28.6815	28.5409	28.6112	28.7518	28.7518	28.9627	(39)
Average = Sum(39)m / 12 =												28.8456	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	1.2355	1.2295	1.2295	1.2206	1.2206	1.2088	1.2117	1.2058	1.2088	1.2147	1.2147	1.2236	(40)
HLP (average)												1.2187	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.0704	(42)
Hot water usage for mixer showers														
	60.8144	59.9005	58.5687	56.0206	54.1402	52.0432	50.8512	52.1729	53.6217	55.8733	58.4761	60.5814	(42a)	
Hot water usage for baths														
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)	
Hot water usage for other uses														
	25.5916	24.6610	23.7304	22.7998	21.8692	20.9386	20.9386	21.8692	22.7998	23.7304	24.6610	25.5916	(42c)	
Average daily hot water use (litres/day)													79.3340	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		

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Daily hot water use												
Energy content (annual)	86.4060	84.5615	82.2991	78.8205	76.0094	72.9818	71.7898	74.0421	76.4215	79.6037	83.1371	86.1730 (44)
Distribution loss (46)m = 0.15 x (45)m	136.8461	120.4145	126.4907	107.9013	102.3233	89.7396	86.8236	91.6796	94.2354	108.0215	118.4441	134.9262 (45)
Water storage loss:	Total = Sum(45)m =											1317.8458
Store volume	20.5269	18.0622	18.9736	16.1852	15.3485	13.4609	13.0235	13.7519	14.1353	16.2032	17.7666	20.2389 (46)
b) If manufacturer declared loss factor is not known :												110.0000 (47)
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)
Volume factor from Table 2a												1.0294 (52)
Temperature factor from Table 2b												0.6000 (53)
Enter (49) or (54) in (55)												1.0327 (55)
Total storage loss	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)
If cylinder contains dedicated solar storage	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	192.1229	170.3419	181.7675	161.3949	157.6001	143.2333	142.1004	146.9564	147.7291	163.2983	171.9378	190.2030 (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)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												633.6834 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												633.6834
Solar input	-0.0000	-17.5902	-56.5628	-78.7892	-98.3204	-97.1802	-95.4727	-87.3518	-62.5437	-34.6917	-5.1808	-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	192.1229	152.7517	125.2047	82.6058	59.2797	46.0531	46.6277	59.6046	85.1854	128.6066	166.7570	190.2030 (64)
Electric shower(s)	Total per year (kWh/year) = Sum(64)m =											1335.0021 (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)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)
Heat gains from water heating, kWh/month	89.7228	79.9798	86.2796	78.6721	78.2439	72.6334	73.0903	74.7049	74.1282	80.1386	82.1776	89.0844 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.2220	64.2220	64.2220	64.2220	64.2220	64.2220	64.2220	64.2220	64.2220	64.2220	64.2220	64.2220 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	10.5550	9.3748	7.6241	5.7720	4.3146	3.6426	3.9359	5.1161	6.8668	8.7190	10.1763	10.8483 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	124.5430	125.8354	122.5786	115.6455	106.8936	98.6680	93.1729	91.8805	95.1372	102.0704	110.8223	119.0478 (68)
Pumps, fans	42.4926	42.4926	42.4926	42.4926	42.4926	42.4926	42.4926	42.4926	42.4926	42.4926	42.4926	42.4926 (69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146	-42.8146 (71)
Total internal gains	120.5951	119.0175	115.9672	109.2668	105.1666	100.8797	98.2396	100.4098	102.9559	107.7132	114.1356	119.7371 (72)
	319.5930	318.1276	310.0699	294.5841	280.2746	267.0902	259.2483	261.3063	268.8597	282.4024	299.0340	313.5331 (73)

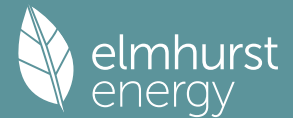
6. Solar gains

[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
Southeast				2.1500	40.4699	0.5800		0.7400		0.7700		25.8800 (77)
Northwest				1.3300	12.9236	0.5800		0.6400		0.7700		4.4216 (81)
Solar gains	30.3015	47.7983	68.2277	93.4682	107.6484	117.0129	110.5068	99.2082	82.3191	57.4532	37.4608	25.5086 (83)
Total gains	349.8945	365.9259	378.2975	388.0523	387.9231	384.1031	369.7551	360.5145	351.1789	339.8556	336.4949	339.0418 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)
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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	36.8239	37.0018	37.0018	37.2719	37.2719	37.6382	37.5459	37.7309	37.6382	37.4541	37.4541	37.1814
alpha	3.4549	3.4668	3.4668	3.4848	3.4848	3.5092	3.5031	3.5154	3.5092	3.4969	3.4969	3.4788
util living area	0.8710	0.8475	0.7933	0.6980	0.5519	0.3651	0.2392	0.2518	0.4540	0.6816	0.8166	0.8782 (86)
MIT	20.0233	20.1571	20.4159	20.6950	20.8957	20.9826	20.9972	20.9966	20.9599	20.7634	20.3934	20.0049 (87)
Th 2	19.8917	19.8964	19.8964	19.9035	19.9035	19.9130	19.9106	19.9154	19.9130	19.9083	19.9083	19.9012 (88)
util rest of house	0.8498	0.8231	0.7606	0.6520	0.4883	0.2887	0.1558	0.1672	0.3756	0.6263	0.7843	0.8578 (89)
MIT 2	19.0673	19.1952	19.4328	19.6831	19.8420	19.9065	19.9102	19.9148	19.8950	19.7489	19.4275	19.0584 (90)
Living area fraction	19.6247	19.7560	20.0059	20.2731	20.4563	20.5339	20.5439	20.5455	20.5159	20.3403	19.9906	19.6102 (92)
MIT	19.6247	19.7560	20.0059	20.2731	20.4563	20.5339	20.5439	20.5455	20.5159	20.3403	19.9906	19.6102 (93)
Temperature adjustment												0.0000
adjusted MIT	19.6247	19.7560	20.0059	20.2731	20.4563	20.5339	20.5439	20.5455	20.5159	20.3403	19.9906	19.6102 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8441	0.8197	0.7641	0.6682	0.5211	0.3327	0.2045	0.2166	0.4198	0.6492	0.7870	0.8518 (94)
Useful gains	295.3315	299.9572	289.0497	259.2796	202.1452	127.8020	75.5973	78.0729	147.4126	220.6213	264.8070	288.7957 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	424.7583	411.9861	366.8746	299.7032	215.4320	129.7203	75.8318	78.3599	152.0944	251.3009	344.7531	420.2563 (97)
Space heating kWh	96.2936	75.2834	57.9017	29.1050	9.8854	0.0000	0.0000	0.0000	0.0000	22.8257	57.5612	97.8066 (98a)
Space heating requirement - total per year (kWh/year)												446.6626
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	96.2936	75.2834	57.9017	29.1050	9.8854	0.0000	0.0000	0.0000	0.0000	22.8257	57.5612	97.8066 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												446.6626
Space heating per m2										(98c) / (4) =		18.8704 (99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (301)
Fraction of space heat from community system												1.0000 (302)
Fraction of heat from community Heat pump-Space and Water												1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0500 (305)
Factor for charging method (Table 4c(3)) for water heating												1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system												1.5000 (306)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating:												
Space heating requirement	96.2936	75.2834	57.9017	29.1050	9.8854	0.0000	0.0000	0.0000	0.0000	22.8257	57.5612	97.8066 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.50												
307a	151.6624	118.5714	91.1952	45.8404	15.5694	0.0000	0.0000	0.0000	0.0000	35.9504	90.6589	154.0455
Space heating requirement	151.6624	118.5714	91.1952	45.8404	15.5694	0.0000	0.0000	0.0000	0.0000	35.9504	90.6589	154.0455 (307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)
Water heating												
Annual water heating requirement	192.1229	152.7517	125.2047	82.6058	59.2797	46.0531	46.6277	59.6046	85.1854	128.6066	166.7570	190.2030 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.50												
310a	288.1843	229.1276	187.8071	123.9087	88.9196	69.0797	69.9415	89.4070	127.7780	192.9098	250.1355	285.3044
Water heating fuel	288.1843	229.1276	187.8071	123.9087	88.9196	69.0797	69.9415	89.4070	127.7780	192.9098	250.1355	285.3044 (310)
Cooling System Energy Efficiency Ratio												0.0000 (314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)
Pumps and Fa	12.8103	11.5706	12.8103	12.3970	12.8103	12.3970	12.8103	12.8103	12.3970	12.8103	12.3970	12.8103 (331)
Lighting	9.2387	7.4116	6.6734	4.8892	3.7766	3.0855	3.4451	4.4781	5.8166	7.6317	8.6199	9.4955 (332)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333a)m	-28.6860	-35.3049	-47.4475	-50.7074	-51.9272	-48.5692	-48.1748	-47.1418	-44.3050	-40.3761	-31.0320	-25.0371 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334a)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 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335a)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 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333b)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 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334b)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 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335b)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 (335b)
Annual totals kWh/year												
Space heating fuel - community heating												703.4936 (307)
Space heating fuel - secondary												0.0000 (309)
Water heating fuel - community heating												2002.5032 (310)
Efficiency of water heater												0.0000 (311)
Electricity used for heat distribution												7.0349 (313)
Space cooling fuel												0.0000 (321)

Electricity for pumps and fans:

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(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0220)			
mechanical ventilation fans (SFP = 1.0220)			70.8305 (330a)
pump for solar water heating			80.0000 (330g)
Total electricity for the above, kWh/year			150.8305 (331)
Electricity for lighting (calculated in Appendix L)			74.5618 (332)
Energy saving/generation technologies (Appendices M ,N and Q)			
PV generation			-498.7090 (333)
Wind generation			0.0000 (334)
Hydro-electric generation (Appendix N)			0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)			0.0000 (335)
Appendix Q - special features			
Energy saved or generated			-0.0000 (336)
Energy used			0.0000 (337)
Total delivered energy for all uses			2432.6801 (338)

10b. Fuel costs - using BEDF prices (510)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating from Heat pump	703.4936	3.5000	24.6223 (340a)
Space heating total			24.6223 (340)
Total CO2 associated with community systems			0.0000 (473)
Space heating - secondary	0.0000	0.0000	0.0000 (341)
Water heating from Heat pump	2002.5032	3.5000	70.0876 (342a)
Water heating total			70.0876 (342)
Energy for instantaneous electric shower(s)	0.0000	18.3900	0.0000 (347a)
Pumps, fans and electric keep-hot	70.8305	18.3900	13.0257 (349)
Pump for solar water heating	80.0000	18.3900	14.7120 (349)
Energy for lighting	74.5618	18.3900	13.7119 (350)
Additional standing charges			94.0000 (351)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-498.7090	18.3900	-91.7126
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-91.7126 (352)
Total energy cost			138.4469 (355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			339.0000 (367)
Space and Water heating from Heat pump	798.2292	0.1563	32.4318 (367)
Electrical energy for heat distribution (space & water)	7.0349	0.0000	4.0394 (372)
Overall CO2 factor for heat network			0.0455 (386)
Total CO2 associated with community systems			123.1943 (373)
Space and water heating			123.1943 (376)
Pumps, fans and electric keep-hot	150.8305	0.1387	20.9220 (378)
Energy for lighting	74.5618	0.1443	10.7616 (379)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-498.7090	0.1360	-67.8084
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-67.8084 (380)
Total CO2, kg/year			87.0695 (383)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			339.0000 (467a)
Space and Water heating from Heat pump	798.2292	1.5786	327.5911 (467)
Electrical energy for heat distribution (space & water)	7.0349	0.0000	42.0061 (472)
Overall CO2 factor for heat network			0.4734 (486)
Total CO2 associated with community systems			1281.1242 (473)
Space and water heating			1281.1242 (476)
Pumps, fans and electric keep-hot	150.8305	1.5128	228.1764 (478)
Energy for lighting	74.5618	1.5338	114.3653 (479)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-498.7090	1.5026	-749.3484
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-749.3484 (480)
Total Primary energy kWh/year			874.3174 (483)

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