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25 September 2025

Dear Craig

SUSTAINABILTY & ENERGY STATEMENT (PLANNING)

Report By :

Joe Solti Accredited Assessor

Further to receipt of drawings, we are pleased to present our report as follows.

Development Details

Site Location :

Welwyn Equestrian Centre, Pottersheath Road, Codicote AL6 9SZ

Development :

1 Bed Dwelling (Conversion)

Local Authority :

North Herts Council

DH-30

Site Location :

Welwyn Equestrian Centre, Pottersheath Road, Codicote AL6 9SZ

Optimise Passive Design & Fabric Insulation

Thermal Mass

The thermal mass of the building will be maximised (where possible) to ensure that heating is more evenly regulated. However, with existing buildings where there are minimal changes there is limited scope.

Insulation

A fabric first approach will be taken, taking opportunities to improve the external elements of the building where possible. This includes draught-proofing, and attention paid to building junctions to ensure minimal heat loss by good design. Existing fabric insulation will be increased where feasible such as additional roof insulation.

Air Tightness

Attention will be paid to minimise uncontrolled heat loss in the building envelope. A visual inspection will be carried out as building works progress (near completion) to ensure that any gaps (eg service entries, down-lighters, windows/doors, skirtings etc) are sealed with foam filler and/or mastic.

Overheating

The building will be low-risk for summer overheating, with solar control glass used on the south-east and south-west elevations where needed.

Achieving Low Carbon Energy

The existing electric heating system, which is 100% efficient, will be utilised, avoiding the use of fossil fuels. As the electric grid becomes progressively de-carbonised, this heating system is low carbon compared to more traditional gas or oil fired heating systems.

Minimising Carbon Footprint

The carbon footprint of the dwelling will be minimised through the following :

- > Use of the existing structure
- > Minimising or eliminating the use of cement/concrete, bricks and concrete blocks
- > Using materials that are locally sourced and/or are recycled

DH-30

Site Location : Welwyn Equestrian Centre, Pottersheath Road, Codicote AL6 9SZ

SAP 1

Energy Rating : 32 (Band F)

CO2 Emissions : 18.87 kg CO2 per m2

Energy Use Intensity : 96.88 kg kWh per m2 per year (regulated energy use)

Energy Use Intensity : 135.63 kg kWh per m2 per year (regulated & unregulated energy use)

SAP 1 = No improvements

Unregulated energy use is based on historic methodology from Code for Sustainable Homes and CIBSE guidance.

SAP 2

Energy Rating : 39 (Band E)

CO2 Emissions : 17.10 kg CO2 per m2

Energy Use Intensity : 91.41 kg kWh per m2 per year (regulated energy use)

Energy Use Intensity : 127.97 kg kWh per m2 per year (regulated & unregulated energy use)

SAP 2 = Roof insulation improved + more favourable electric tariff

Unregulated energy use is based on historic methodology from Code for Sustainable Homes and CIBSE guidance.

DH-30

Site Location :	Welwyn Equestrian Centre, Pottersheath Road, Codicote AL6 9SZ
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SAP 3

Energy Rating :	55 (Band D)
CO2 Emissions :	16.98 kg CO2 per m2
Energy Use Intensity :	91.41 kg kWh per m2 per year (regulated energy use)
Energy Use Intensity :	127.97 kg kWh per m2 per year (regulated & unregulated energy use)

SAP 3 = Roof insulation improved + high heat retention storage heaters (off-peak electric tariff)

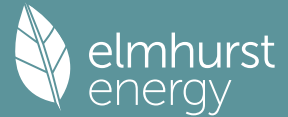
Unregulated energy use is based on historic methodology from Code for Sustainable Homes and CIBSE guidance.

Water

Water use is to be reduced and suitably minimised by the fitting of low water use sanitary fittings (taps/showers), dual flush WCs, and low water use (and energy efficient) dishwasher and washing machine.

See Water Efficiency Calculation attached to this report.

Full SAP Calculation Printout



Property Reference	DH3001			Issued on Date	25/09/2025
Assessment Reference	DH3001	Prop Type Ref	DH-30		
Property	1 Bed Dwelling, Welwyn Equestrian Centre, Pottersheath Road, Codicote, Welwyn, AL6 9SZ				
SAP Rating	32 F	DER	18.87	TER	
Environmental	85 B	% DER < TER			N/A
CO ₂ Emissions (t/year)	1.13	DFEE	96.88	TFEE	
Compliance Check	N/A	% DFEE < TFEE			
% DPER < TPER		DPER	195.58	TPER	
Assessor Details	Mr. Joe Solti			Assessor ID	5122-0001
Client	Phillips Planning Services Ltd, .				

SAP 10 WORKSHEET FOR Conversion (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)
Main dwelling			
Ground floor	64.0000 (1b)	2.4000 (2b)	153.6000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.0000		153.6000 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	153.6000 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	30.0000 / (5) = 0.1953 (8)
Pressure test	No
Pressure Test Method	Blower Door
Measured/design AP50	15.0000 (17)
Infiltration rate	0.9453 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.8035 (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	1.0245	1.0044	0.9843	0.8839	0.8638	0.7633	0.7633	0.7433	0.8035	0.8638	0.9040	0.9441 (22b)
Effective ac	1.0245	1.0044	0.9844	0.8906	0.8731	0.7913	0.7913	0.7762	0.8228	0.8731	0.9086	0.9457 (25)

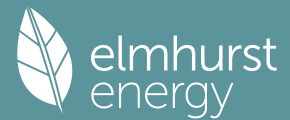
3. Heat losses and heat loss parameter

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
Main dwelling							
Doors			3.6100	1.4000	5.0540		(26a)
Windows			4.9400	1.3258	6.5492		(27)
Rooflights			1.5300	1.3258	2.0284		(27a)
Ground Floor			64.0000	0.2500	16.0000		(28a)
External Wall	85.5000	8.5500	76.9500	0.3000	23.0850		(29a)
External Roof	64.0000	1.5300	62.4700	0.2900	18.1163		(30)
Total net area of external elements Aum(A, m ²)			213.5000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	70.8330		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K	100.0000 (35)
Thermal bridges (Default value 0.200 * total exposed area)	42.7000 (36)
Point Thermal bridges	(36a) = 0.0000
Total fabric heat loss	(33) + (36) + (36a) = 113.5330 (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
	51.9290	50.9108	49.8988	45.1433	44.2535	40.1116	40.1116	39.3446	41.7070	44.2535	46.0535	47.9352 (38)
Heat transfer coeff												
	165.4619	164.4437	163.4317	158.6762	157.7865	153.6446	153.6446	152.8776	155.2400	157.7865	159.5864	161.4682 (39)
Average = Sum(39)m / 12 =												158.6707

Full SAP Calculation Printout



HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	2.5853	2.5694	2.5536	2.4793	2.4654	2.4007	2.4007	2.3887	2.4256	2.4654	2.4935	2.5229	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	2.4792	
												31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.0922	(42)
Hot water usage for mixer showers														
76.1395	74.9953	73.3279	70.1377	67.7834	65.1579	63.6656	65.3204	67.1343	69.9532	73.2120	75.8478	(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														
36.0560	34.7449	33.4338	32.1226	30.8115	29.5004	29.5004	30.8115	32.1226	33.4338	34.7449	36.0560	(42c)		
Average daily hot water use (litres/day)													102.9763	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	112.1955	109.7402	106.7617	102.2604	98.5949	94.6583	93.1660	96.1319	99.2569	103.3870	107.9569	111.9038	(44)	
Energy content	177.6903	156.2686	164.0887	139.9893	132.7277	116.3935	112.6762	119.0313	122.3937	140.2952	153.8044	175.2143	(45)	
Energy content (annual)										Total = Sum(45)m =		1710.5733		
Distribution loss (46)m = 0.15 x (45)m														
26.6535	23.4403	24.6133	20.9984	19.9092	17.4590	16.9014	17.8547	18.3591	21.0443	23.0707	26.2822	(46)		
Water storage loss:														
Store volume													210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													1.5000	(48)
Temperature factor from Table 2b													0.6000	(49)
Enter (49) or (54) in (55)													0.9000	(55)
Total storage loss														
27.9000	25.2000	27.9000	27.0000	27.9000	27.0000	27.9000	27.9000	27.9000	27.0000	27.9000	27.0000	27.9000	(56)	
If cylinder contains dedicated solar storage														
27.9000	25.2000	27.9000	27.0000	27.9000	27.0000	27.9000	27.9000	27.9000	27.0000	27.9000	27.0000	27.9000	(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														
205.5903	181.4686	191.9887	166.9893	160.6277	143.3935	140.5762	146.9313	149.3937	168.1952	180.8044	203.1143	(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														
205.5903	181.4686	191.9887	166.9893	160.6277	143.3935	140.5762	146.9313	149.3937	168.1952	180.8044	203.1143	(64)		
Total per year (kWh/year)									Total per year (kWh/year) = Sum(64)m =			2039.0733	(64)	
Electric shower(s)													2039	(64)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000	(64a)
Heat gains from water heating, kWh/month														
81.4020	72.1193	76.8795	68.1464	66.4520	60.3008	59.7848	61.8979	62.2959	68.9682	72.7399	80.5788	(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	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	105.2215	116.4952	105.2215	108.7289	105.2215	108.7289	105.2215	105.2215	108.7289	105.2215	108.7289	105.2215	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	182.9108	184.8088	180.0258	169.8433	156.9898	144.9093	136.8388	134.9408	139.7238	149.9062	162.7598	174.8402	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	(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)	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	(71)
Water heating gains (Table 5)	109.4113	107.3204	103.3327	94.6478	89.3172	83.7511	80.3560	83.1961	86.5221	92.6991	101.0277	108.3048	(72)
Total internal gains	451.9263	463.0071	442.9627	427.6028	405.9112	391.7721	376.7990	377.7411	389.3575	402.2096	426.8990	442.7492	(73)

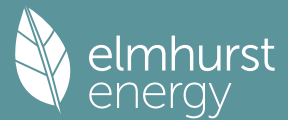
6. Solar gains

[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				3.6800	36.7938	0.6300		0.7000		0.7700		41.3804 (77)
Southwest				1.2600	36.7938	0.6300		0.7000		0.7700		14.1683 (79)
Northwest				1.5300	18.0708	0.6300		0.7000		1.0000		10.9736 (82)
Solar gains	66.5223	117.6732	172.5909	233.2699	279.0106	284.7918	271.3241	236.0069	193.4163	133.1775	80.4726	56.4154 (83)
Total gains	518.4486	580.6803	615.5536	660.8727	684.9218	676.5638	648.1231	613.7480	582.7738	535.3871	507.3716	499.1646 (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	10.7443	10.8109	10.8778	11.2038	11.2670	11.5707	11.5707	11.6288	11.4518	11.2670	11.1399	11.0101
alpha	1.7163	1.7207	1.7252	1.7469	1.7511	1.7714	1.7714	1.7753	1.7635	1.7511	1.7427	1.7340
util living area	0.9535	0.9417	0.9258	0.8925	0.8399	0.7507	0.6526	0.6823	0.8085	0.9007	0.9400	0.9562 (86)
MIT	16.2499	16.5835	17.2002	18.1362	19.0721	19.9547	20.4435	20.3726	19.6897	18.4959	17.2651	16.2426 (87)
Th 2	18.9717	18.9807	18.9898	19.0329	19.0411	19.0796	19.0796	19.0868	19.0647	19.0411	19.0246	19.0075 (88)
util rest of house	0.9436	0.9290	0.9082	0.8635	0.7869	0.6446	0.4652	0.5078	0.7232	0.8680	0.9247	0.9470 (89)

Full SAP Calculation Printout



MIT 2	13.9371	14.3469	15.1050	16.2552	17.3757	18.3885	18.8617	18.8141	18.1144	16.7092	15.2005	13.9350 (90)
Living area fraction									FLA = Living area / (4) =			0.5781 (91)
MIT	15.2742	15.6399	16.3163	17.3426	18.3564	19.2940	19.7762	19.7151	19.0251	17.7422	16.3941	15.2691 (92)
Temperature adjustment												0.0000
adjusted MIT	15.2742	15.6399	16.3163	17.3426	18.3564	19.2940	19.7762	19.7151	19.0251	17.7422	16.3941	15.2691 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9140	0.8960	0.8726	0.8278	0.7621	0.6594	0.5463	0.5773	0.7209	0.8363	0.8929	0.9186	(94)
Useful gains	473.8748	520.2670	537.1187	547.0901	521.9486	446.1316	354.0671	354.2949	420.1187	447.7389	453.0247	458.5261	(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	1815.8104	1766.1142	1604.2929	1339.6469	1050.2918	721.2016	488.0055	506.8057	764.5744	1126.9375	1483.2092	1787.3029	(97)
Space heating requirement kWh	998.4001	837.2094	793.9776	570.6409	393.0873	0.0000	0.0000	0.0000	0.0000	505.3238	741.7328	988.6099	(98a)
Space heating requirement - total per year (kWh/year)												5828.9817	
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	998.4001	837.2094	793.9776	570.6409	393.0873	0.0000	0.0000	0.0000	0.0000	505.3238	741.7328	988.6099	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5828.9817	
Space heating per m2										(98c) / (4) =		91.0778	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.1000 (201)
Fraction of space heat from main system(s)													0.9000 (202)
Efficiency of main space heating system 1 (in %)													100.0000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													100.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	998.4001	837.2094	793.9776	570.6409	393.0873	0.0000	0.0000	0.0000	0.0000	505.3238	741.7328	988.6099	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	898.5601	753.4884	714.5799	513.5768	353.7786	0.0000	0.0000	0.0000	0.0000	454.7914	667.5595	889.7489	(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)	99.8400	83.7209	79.3978	57.0641	39.3087	0.0000	0.0000	0.0000	0.0000	50.5324	74.1733	98.8610	(215)
Water heating requirement	205.5903	181.4686	191.9887	166.9893	160.6277	143.3935	140.5762	146.9313	149.3937	168.1952	180.8044	203.1143	(64)
Efficiency of water heater	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(216)
Fuel for water heating, kWh/month	205.5903	181.4686	191.9887	166.9893	160.6277	143.3935	140.5762	146.9313	149.3937	168.1952	180.8044	203.1143	(217)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(219)
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(223)
Lighting	22.3694	17.9456	16.1580	11.8380	9.1440	7.4708	8.3415	10.8426	14.0835	18.4783	20.8711	22.9911	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												5246.0836	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												582.8982	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												2039.0733	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												180.5338	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(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												8048.5888	(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	5246.0836	0.1533	804.1766	(261)
Total CO2 associated with community systems			0.0000	(373)

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Space heating - secondary	582.8982	0.1533	89.3530 (263)
Water heating (other fuel)	2039.0733	0.1411	287.7800 (264)
Space and water heating			1181.3095 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	180.5338	0.1443	26.0566 (268)
Total CO ₂ , kg/year			1207.3661 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			18.8700 (273)

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

	Energy kWh/year	Primary energy factor kg CO ₂ /kWh	Primary energy kWh/year
Space heating - main system 1	5246.0836	1.5675	8223.3240 (275)
Total CO ₂ associated with community systems			0.0000 (473)
Space heating - secondary	582.8982	1.5675	913.7027 (277)
Water heating (other fuel)	2039.0733	1.5219	3103.2027 (278)
Space and water heating			12240.2293 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	180.5338	1.5338	276.9088 (282)
Total Primary energy kWh/year			12517.1381 (286)
Dwelling Primary energy Rate (DPER)			195.5800 (287)

SAP 10 WORKSHEET FOR Conversion (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)
Main dwelling	64.0000 (1b)	x 2.4000 (2b)	= 153.6000 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	153.6000 (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) =	0.1302 (8)
Pressure test		No	
Pressure Test Method		Blower Door	
Measured/design AP50		15.0000	(17)
Infiltration rate		0.8802	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.7482 (21)

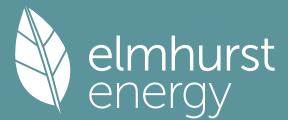
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.9539	0.9352	0.9165	0.8230	0.8043	0.7108	0.7108	0.6921	0.7482	0.8043	0.8417	0.8791 (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	0.9550	0.9373	0.9200	0.8387	0.8234	0.7526	0.7526	0.7395	0.7799	0.8234	0.8542	0.8864 (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
Main dwelling							
Doors			3.6100	1.4000	5.0540		(26a)
Windows			4.9400	1.3258	6.5492		(27)
Rooflights			1.5300	1.3258	2.0284		(27a)
Ground Floor			64.0000	0.2500	16.0000		(28a)
External Wall	85.5000	8.5500	76.9500	0.3000	23.0850		(29a)
External Roof	64.0000	1.5300	62.4700	0.2900	18.1163		(30)
Total net area of external elements Aum(A, m ²)			213.5000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	70.8330		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Default value 0.200 * total exposed area)							42.7000 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	113.5330 (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
	48.4064	47.5109	46.6330	42.5100	41.7386	38.1476	38.1476	37.4826	39.5308	41.7386	43.2991	44.9306 (38)

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Heat transfer coeff
161.9393 161.0438 160.1660 156.0430 155.2716 151.6805 151.6805 151.0155 153.0637 155.2716 156.8321 158.4636 (39)
Average = Sum(39)m / 12 = 156.0393

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.5303	2.5163	2.5026	2.4382	2.4261	2.3700	2.3700	2.3596	2.3916	2.4261	2.4505	2.4760	(40)
HLP (average)												2.4381	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0922 (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 25.6236 25.2430 24.7071 23.7191 22.9792 22.1588 21.7157 22.2478 22.8272 23.7051 24.7135 25.5369 (42b)
Hot water usage for other uses 36.0560 34.7449 33.4338 32.1226 30.8115 29.5004 29.5004 30.8115 32.1226 33.4338 34.7449 36.0560 (42c)
Average daily hot water use (litres/day) 56.5353 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	61.6796	59.9879	58.1409	55.8417	53.7907	51.6592	51.2160	53.0593	54.9498	57.1388	59.4584	61.5930	(44)
Energy conte	97.6854	85.4220	89.3604	76.4445	72.4126	63.5210	61.9414	65.6985	67.7587	77.5368	84.7094	96.4397	(45)
Energy content (annual)										Total = Sum(45)m =		938.9304	
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	83.0326	72.6087	75.9563	64.9778	61.5507	53.9928	52.6502	55.8437	57.5949	65.9063	72.0030	81.9738	(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	83.0326	72.6087	75.9563	64.9778	61.5507	53.9928	52.6502	55.8437	57.5949	65.9063	72.0030	81.9738	(64)
12Total per year (kWh/year)								Total per year (kWh/year) = Sum(64)m =				798.0908	(64)
Electric shower(s)	47.4883	42.3125	46.2036	44.0915	44.9189	42.8483	44.2765	44.9189	44.0915	46.2036	45.3348	47.4883	(64a)
								Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =				540.1766	(64a)
Heat gains from water heating, kWh/month	32.6302	28.7303	30.5400	27.2673	26.6174	24.2103	24.2317	25.1907	25.4216	28.0275	29.3344	32.3655	(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	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	105.2215	116.4952	105.2215	108.7289	105.2215	108.7289	105.2215	105.2215	108.7289	105.2215	108.7289	105.2215	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	182.9108	184.8088	180.0258	169.8433	156.9898	144.9093	136.8388	134.9408	139.7238	149.9062	162.7598	174.8402	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	(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)	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	(71)
Water heating gains (Table 5)	43.8578	42.7534	41.0484	37.8713	35.7761	33.6254	32.5695	33.8584	35.3078	37.6713	40.7423	43.5020	(72)
Total internal gains	386.3728	398.4401	380.6783	370.8262	352.3701	341.6463	329.0125	328.4034	338.1431	347.1818	366.6136	377.9465	(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	3.6800	36.7938	0.6300	0.7000	0.7700	41.3804	(77)						
Southwest	1.2600	36.7938	0.6300	0.7000	0.7700	14.1683	(79)						
Northwest	1.5300	18.0708	0.6300	0.7000	1.0000	10.9736	(82)						
Solar gains	66.5223	117.6732	172.5909	233.2699	279.0106	284.7918	271.3241	236.0069	193.4163	133.1775	80.4726	56.4154	(83)
Total gains	452.8951	516.1133	553.2693	604.0961	631.3807	626.4381	600.3366	564.4103	531.5595	480.3593	447.0862	434.3619	(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	10.9780	11.0391	11.0996	11.3929	11.4495	11.7205	11.7205	11.7722	11.6146	11.4495	11.3355	11.2188	
alpha	1.7319	1.7359	1.7400	1.7595	1.7633	1.7814	1.7814	1.7848	1.7743	1.7633	1.7557	1.7479	
util living area	0.9620	0.9508	0.9360	0.9043	0.8543	0.7692	0.6739	0.7052	0.8274	0.9142	0.9501	0.9646	(86)
MIT	16.1810	16.5184	17.1387	18.0793	19.0246	19.9162	20.4173	20.3406	19.6416	18.4326	17.1921	16.1661	(87)
Th 2	19.0032	19.0113	19.0193	19.0572	19.0644	19.0981	19.0981	19.1044	19.0850	19.0644	19.0499	19.0349	(88)
util rest of house	0.9538	0.9400	0.9206	0.8781	0.8051	0.6675	0.4891	0.5345	0.7477	0.8853	0.9373	0.9570	(89)
MIT 2	14.8632	15.2006	15.8187	16.7619	17.6774	18.5125	18.9090	18.8672	18.2793	17.1231	15.8930	14.8649	(90)

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Living area fraction									fLA = Living area / (4) =		0.5781 (91)	
MIT	15.6251	15.9625	16.5818	17.5235	18.4562	19.3240	19.7810	19.7190	19.0669	17.8801	16.6440	15.6172 (92)
Temperature adjustment												0.0000
adjusted MIT	15.6251	15.9625	16.5818	17.5235	18.4562	19.3240	19.7810	19.7190	19.0669	17.8801	16.6440	15.6172 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9317	0.9144	0.8923	0.8488	0.7843	0.6826	0.5690	0.6023	0.7467	0.8597	0.9128	0.9360	(94)
Useful gains	421.9554	471.9501	493.6931	512.7328	495.2184	427.6288	341.5968	339.9721	396.9263	412.9418	408.1116	406.5496	(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	1833.9716	1781.5413	1614.7640	1345.6367	1049.0501	716.5435	482.4954	501.2188	760.2536	1130.4001	1496.8118	1809.2099	(97)
Space heating kWh	1050.5400	880.0453	834.0768	599.6908	412.0508	0.0000	0.0000	0.0000	0.0000	533.7890	783.8641	1043.5793	(98a)
Space heating requirement - total per year (kWh/year)												6137.6361	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	1050.5400	880.0453	834.0768	599.6908	412.0508	0.0000	0.0000	0.0000	0.0000	533.7890	783.8641	1043.5793	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6137.6361	
Space heating per m2										(98c) / (4) =		95.9006	(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	1425.7969	1122.4359	1147.7179	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.3940	0.4555	0.4302	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	561.7112	511.2783	493.7130	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	665.5103	638.6017	602.2970	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	74.7354	94.7286	80.7865	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fc = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	18.6838	23.6822	20.1966	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												62.5626	(107)
Energy for space heating												95.9006	(99)
Energy for space cooling												0.9775	(108)
Total												96.8781	(109)
Fabric Energy Efficiency (DFEE)												96.9	(109)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling	64.0000 (1b)	x 2.4000 (2b)	= 153.6000 (1b) - (3b)	
Ground floor				
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.0000			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	153.6000 (5)	

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1953 (8)
Pressure test	No	
Pressure Test Method	Blower Door	
Measured/design AP50	15.0000	(17)
Infiltration rate	0.9453	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.8035 (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	1.0245	1.0044	0.9843	0.8839	0.8638	0.7633	0.7633	0.7433	0.8035	0.8638	0.9040	0.9441	(22b)

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Effective ac 1.0245 1.0044 0.9844 0.8906 0.8731 0.7913 0.7913 0.7762 0.8228 0.8731 0.9086 0.9457 (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						
Main dwelling													
Doors			3.6100	1.4000	5.0540			(26a)					
Windows			4.9400	1.3258	6.5492			(27)					
Rooflights			1.5300	1.3258	2.0284			(27a)					
Ground Floor			64.0000	0.2500	16.0000			(28a)					
External Wall	85.5000	8.5500	76.9500	0.3000	23.0850			(29a)					
External Roof	64.0000	1.5300	62.4700	0.2900	18.1163			(30)					
Total net area of external elements Aum(A, m2)			213.5000					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	70.8330			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K													
Thermal bridges (Default value 0.200 * total exposed area)								100.0000 (35)					
Point Thermal bridges						(36a) =		42.7000 (36)					
Total fabric heat loss						(33) + (36) + (36a) =		0.0000					
								113.5330 (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	51.9290	50.9108	49.8988	45.1433	44.2535	40.1116	40.1116	39.3446	41.7070	44.2535	46.0535	47.9352	(38)
Average = Sum(39)m / 12 =	165.4619	164.4437	163.4317	158.6762	157.7865	153.6446	153.6446	152.8776	155.2400	157.7865	159.5864	161.4682	(39)
												158.6707	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	2.5853	2.5694	2.5536	2.4793	2.4654	2.4007	2.4007	2.3887	2.4256	2.4654	2.4935	2.5229	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

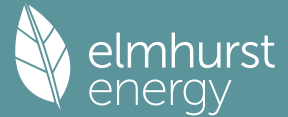
												2.0922 (42)
Assumed occupancy												
Hot water usage for mixer showers												
76.1395	74.9953	73.3279	70.1377	67.7834	65.1579	63.6656	65.3204	67.1343	69.9532	73.2120	75.8478 (42a)	
Hot water usage for baths												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)	
Hot water usage for other uses												
36.0560	34.7449	33.4338	32.1226	30.8115	29.5004	29.5004	30.8115	32.1226	33.4338	34.7449	36.0560 (42c)	
Average daily hot water use (litres/day)												102.9763 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												
112.1955	109.7402	106.7617	102.2604	98.5949	94.6583	93.1660	96.1319	99.2569	103.3870	107.9569	111.9038 (44)	
Energy conte	177.6903	156.2686	164.0887	139.9893	132.7277	116.3935	112.6762	119.0313	122.3937	140.2952	153.8044 (45)	
Energy content (annual)	Total = Sum(45)m =										1710.5733	
Distribution loss (46)m = 0.15 x (45)m												
26.6535	23.4403	24.6133	20.9984	19.9092	17.4590	16.9014	17.8547	18.3591	21.0443	23.0707	26.2822 (46)	
Water storage loss:												
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000 (48)
Temperature factor from Table 2b												0.6000 (49)
Enter (49) or (54) in (55)												0.9000 (55)
Total storage loss												
27.9000	25.2000	27.9000	27.0000	27.9000	27.0000	27.9000	27.9000	27.0000	27.9000	27.0000	27.9000 (56)	
If cylinder contains dedicated solar storage												
27.9000	25.2000	27.9000	27.0000	27.9000	27.0000	27.9000	27.9000	27.0000	27.9000	27.0000	27.9000 (57)	
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)	
Total heat required for water heating calculated for each month												
205.5903	181.4686	191.9887	166.9893	160.6277	143.3935	140.5762	146.9313	149.3937	168.1952	180.8044	203.1143 (62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)	
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)	
Output from w/h												
205.5903	181.4686	191.9887	166.9893	160.6277	143.3935	140.5762	146.9313	149.3937	168.1952	180.8044	203.1143 (64)	
Total per year (kWh/year) = Sum(64)m =												2039.0733 (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												
81.4020	72.1193	76.8795	68.1464	66.4520	60.3008	59.7848	61.8979	62.2959	68.9682	72.7399	80.5788 (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	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.5564	22.6990	18.4601	13.9755	10.4468	8.8196	9.5299	12.3874	16.6263	21.1109	24.6395	26.2667	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	273.0011	275.8340	268.6952	253.4975	234.3132	216.2826	204.2371	201.4042	208.5430	223.7407	242.9250	260.9556	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	(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)	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	(71)
Water heating gains (Table 5)	109.4113	107.3204	103.3327	94.6478	89.3172	83.7511	80.3560	83.1961	86.5221	92.6991	101.0277	108.3048	(72)
Total internal gains	499.4578	497.3423	481.9768	453.6097	425.5661	400.3423	385.6119	388.4766	403.1803	429.0396	460.0812	487.0160	(73)

6. Solar gains

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[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			3.6800	36.7938	0.6300		0.7000		0.7700	41.3804 (77)
Southwest			1.2600	36.7938	0.6300		0.7000		0.7700	14.1683 (79)
Northwest			1.5300	18.0708	0.6300		0.7000		1.0000	10.9736 (82)

Solar gains	66.5223	117.6732	172.5909	233.2699	279.0106	284.7918	271.3241	236.0069	193.4163	133.1775	80.4726	56.4154 (83)
Total gains	565.9801	615.0155	654.5678	686.8797	704.5767	685.1341	656.9360	624.4835	596.5966	562.2171	540.5537	543.4314 (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	10.7443	10.8109	10.8778	11.2038	11.2670	11.5707	11.5707	11.6288	11.4518	11.2670	11.1399	11.0101
alpha	1.7163	1.7207	1.7252	1.7469	1.7511	1.7714	1.7714	1.7753	1.7635	1.7511	1.7427	1.7340
util living area	0.9470	0.9365	0.9189	0.8866	0.8341	0.7473	0.6483	0.6770	0.8031	0.8937	0.9340	0.9502 (86)
MIT	16.3370	16.6448	17.2670	18.1775	19.0990	19.9637	20.4500	20.3814	19.7070	18.5397	17.3251	16.3257 (87)
Th 2	18.9717	18.9807	18.9898	19.0329	19.0411	19.0796	19.0796	19.0868	19.0647	19.0411	19.0246	19.0075 (88)
util rest of house	0.9358	0.9229	0.9000	0.8565	0.7799	0.6406	0.4608	0.5021	0.7164	0.8593	0.9175	0.9398 (89)
MIT 2	14.0421	14.4202	15.1838	16.3024	17.4040	18.3961	18.8651	18.8194	18.1306	16.7586	15.2720	14.0355 (90)
Living area fraction	15.3689	15.7063	16.3881	17.3865	18.3839	19.3024	19.7814	19.7224	FLA = Living area / (4) =			0.5781 (91)
MIT	15.3689	15.7063	16.3881	17.3865	18.3839	19.3024	19.7814	19.7224	19.0420	17.7883	16.4589	15.3595 (92)
Temperature adjustment												0.0000
adjusted MIT	15.3689	15.7063	16.3881	17.3865	18.3839	19.3024	19.7814	19.7224	19.0420	17.7883	16.4589	15.3595 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9040	0.8884	0.8632	0.8206	0.7557	0.6560	0.5424	0.5723	0.7151	0.8274	0.8843	0.9092 (94)
Useful gains	511.6279	546.4048	565.0361	563.6718	532.4190	449.4572	356.2997	357.3673	426.6306	465.1826	478.0172	494.0844 (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	1831.4744	1777.0326	1616.0364	1346.5983	1054.6255	722.4920	488.8023	507.9210	767.1917	1134.2140	1493.5566	1801.9036 (97)
Space heating kWh	981.9658	826.9819	781.9442	563.7071	388.5216	0.0000	0.0000	0.0000	0.0000	497.7593	731.1883	973.0175 (98a)
Space heating requirement - total per year (kWh/year)												5745.0857
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	981.9658	826.9819	781.9442	563.7071	388.5216	0.0000	0.0000	0.0000	0.0000	497.7593	731.1883	973.0175 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5745.0857
Space heating per m2										(98c) / (4) =		89.7670 (99)

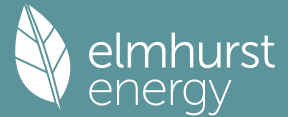
9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.1000 (201)
 Fraction of space heat from main system(s) 0.9000 (202)
 Efficiency of main space heating system 1 (in %) 100.0000 (206)
 Efficiency of main space heating system 2 (in %) 0.0000 (207)
 Efficiency of secondary/supplementary heating system, % 100.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	981.9658	826.9819	781.9442	563.7071	388.5216	0.0000	0.0000	0.0000	0.0000	497.7593	731.1883	973.0175 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	883.7692	744.2837	703.7498	507.3364	349.6695	0.0000	0.0000	0.0000	0.0000	447.9834	658.0695	875.7157 (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)	98.1966	82.6982	78.1944	56.3707	38.8522	0.0000	0.0000	0.0000	0.0000	49.7759	73.1188	97.3017 (215)

Water heating												
Water heating requirement	205.5903	181.4686	191.9887	166.9893	160.6277	143.3935	140.5762	146.9313	149.3937	168.1952	180.8044	203.1143 (64)
Efficiency of water heater (217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (216)
Fuel for water heating, kWh/month	205.5903	181.4686	191.9887	166.9893	160.6277	143.3935	140.5762	146.9313	149.3937	168.1952	180.8044	203.1143 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	22.3694	17.9456	16.1580	11.8380	9.1440	7.4708	8.3415	10.8426	14.0835	18.4783	20.8711	22.9911 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)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 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												5170.5772 (211)

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Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	574.5086	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2039.0733	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	180.5338	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(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	7964.6929	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5170.5772	16.4900	852.6282	(240)
Total CO2 associated with community systems			0.0000	(473)
Space heating - secondary	574.5086	16.4900	94.7365	(242)
Water heating (other fuel)	2039.0733	16.4900	336.2432	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	180.5338	16.4900	29.7700	(250)
Additional standing charges			0.0000	(251)
Total energy cost			1313.3779	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	4.3378 (257)
SAP value	32.0095	
SAP rating (Section 12)	32	(258)
SAP band	F	

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	5170.5772	0.1533	792.5549	(261)
Total CO2 associated with community systems			0.0000	(373)
Space heating - secondary	574.5086	0.1533	88.0617	(263)
Water heating (other fuel)	2039.0733	0.1411	287.7800	(264)
Space and water heating			1168.3965	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	180.5338	0.1443	26.0566	(268)
Total CO2, kg/year			1194.4531	(272)
CO2 emissions per m2			18.6600	(273)
EI value			85.3159	
EI rating			85	(274)
EI band			B	

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

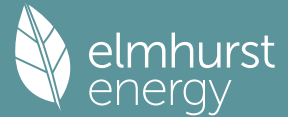
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling	64.0000 (1b)	x 2.4000 (2b)	= 153.6000 (1b) - (3b)	
Ground floor			(4)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.0000			
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	153.6000 (5)	

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1953 (8)

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Pressure test												No
Pressure Test Method												Blower Door
Measured/design AP50												15.0000 (17)
Infiltration rate												0.9453 (18)
Number of sides sheltered												2 (19)
Shelter factor												(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) = 0.8035 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	4.5000	4.3000	4.4000	3.9000	3.9000	3.4000	3.5000	3.4000	3.6000	3.9000	3.8000	4.1000 (22)
Adj infilt rate	1.1250	1.0750	1.1000	0.9750	0.9750	0.8500	0.8750	0.8500	0.9000	0.9750	0.9500	1.0250 (22a)
Effective ac	0.9040	0.8638	0.8839	0.7834	0.7834	0.6830	0.7031	0.6830	0.7232	0.7834	0.7633	0.8236 (22b)
	0.9086	0.8731	0.8906	0.8069	0.8069	0.7332	0.7472	0.7332	0.7615	0.8069	0.7913	0.8392 (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
Main dwelling							
Doors			3.6100	1.4000	5.0540		(26a)
Windows			4.9400	1.3258	6.5492		(27)
Rooflights			1.5300	1.3258	2.0284		(27a)
Ground Floor			64.0000	0.2500	16.0000		(28a)
External Wall	85.5000	8.5500	76.9500	0.3000	23.0850		(29a)
External Roof	64.0000	1.5300	62.4700	0.2900	18.1163		(30)
Total net area of external elements Aum(A, m2)			213.5000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 70.8330		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)
Thermal bridges (Default value 0.200 * total exposed area)							42.7000 (36)
Point Thermal bridges						(36a) = 0.0000	
Total fabric heat loss						(33) + (36) + (36a) = 113.5330	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	46.0535	44.2535	45.1433	40.8991	40.8991	37.1663	37.8719	37.1663	38.5981	40.8991	40.1116	42.5354 (38)
Average = Sum(39)m / 12 =	159.5864	157.7865	158.6762	154.4321	154.4321	150.6992	151.4049	150.6992	152.1310	154.4321	153.6446	156.0684 (39)
												154.4994
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	2.4935	2.4654	2.4793	2.4130	2.4130	2.3547	2.3657	2.3547	2.3770	2.4130	2.4007	2.4386 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

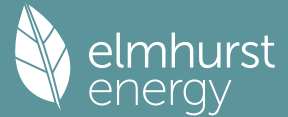
4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0922 (42)
Hot water usage for mixer showers												
Hot water usage for baths	76.1395	74.9953	73.3279	70.1377	67.7834	65.1579	63.6656	65.3204	67.1343	69.9532	73.2120	75.8478 (42a)
Hot water usage for other uses	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)
Average daily hot water use (litres/day)	36.0560	34.7449	33.4338	32.1226	30.8115	29.5004	29.5004	30.8115	32.1226	33.4338	34.7449	36.0560 (42c)
												102.9763 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	112.1955	109.7402	106.7617	102.2604	98.5949	94.6583	93.1660	96.1319	99.2569	103.3870	107.9569	111.9038 (44)
Energy content (annual)	177.6903	156.2686	164.0887	139.9893	132.7277	116.3935	112.6762	119.0313	122.3937	140.2952	153.8044	175.2143 (45)
Distribution loss (46)m = 0.15 x (45)m	26.6535	23.4403	24.6133	20.9984	19.9092	17.4590	16.9014	17.8547	18.3591	21.0443	23.0707	26.2822 (46)
Water storage loss:												
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000 (48)
Temperature factor from Table 2b												0.6000 (49)
Enter (49) or (54) in (55)												0.9000 (55)
Total storage loss	27.9000	25.2000	27.9000	27.0000	27.9000	27.0000	27.9000	27.9000	27.0000	27.9000	27.0000	27.9000 (56)
If cylinder contains dedicated solar storage	27.9000	25.2000	27.9000	27.0000	27.9000	27.0000	27.9000	27.9000	27.0000	27.9000	27.0000	27.9000 (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	205.5903	181.4686	191.9887	166.9893	160.6277	143.3935	140.5762	146.9313	149.3937	168.1952	180.8044	203.1143 (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	205.5903	181.4686	191.9887	166.9893	160.6277	143.3935	140.5762	146.9313	149.3937	168.1952	180.8044	203.1143 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	81.4020	72.1193	76.8795	68.1464	66.4520	60.3008	59.7848	61.8979	62.2959	68.9682	72.7399	80.5788 (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	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.5564	22.6990	18.4601	13.9755	10.4468	8.8196	9.5299	12.3874	16.6263	21.1109	24.6395	26.2667 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	273.0011	275.8340	268.6952	253.4975	234.3132	216.2826	204.2371	201.4042	208.5430	223.7407	242.9250	260.9556 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												

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Pumps, fans	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453 (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)
	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873 (71)
Water heating gains (Table 5)	109.4113	107.3204	103.3327	94.6478	89.3172	83.7511	80.3560	83.1961	86.5221	92.6991	101.0277	108.3048 (72)
Total internal gains	499.4578	497.3423	481.9768	453.6097	425.5661	400.3423	385.6119	388.4766	403.1803	429.0396	460.0812	487.0160 (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				3.6800	40.6744	0.6300	0.7000		0.7700		45.7447 (77)	
Southwest				1.2600	40.6744	0.6300	0.7000		0.7700		15.6626 (79)	
Northwest				1.5300	20.8575	0.6300	0.7000		1.0000		12.6659 (82)	
Solar gains	74.0731	120.2347	175.2888	241.8848	283.7507	309.9116	289.2937	253.8437	209.0567	142.9197	91.8425	62.1877 (83)
Total gains	573.5309	617.5770	657.2656	695.4945	709.3167	710.2538	674.9056	642.3202	612.2370	571.9593	551.9236	549.2037 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil, m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	11.1399	11.2670	11.2038	11.5117	11.5117	11.7969	11.7419	11.7969	11.6858	11.5117	11.5707	11.3910
util living area	1.7427	1.7511	1.7469	1.7674	1.7674	1.7865	1.7828	1.7865	1.7791	1.7674	1.7714	1.7594
	0.9442	0.9345	0.9139	0.8761	0.8159	0.7002	0.5708	0.5951	0.7715	0.8821	0.9286	0.9474 (86)
MIT	16.5137	16.7916	17.4763	18.4095	19.3240	20.1950	20.6453	20.6097	19.9245	18.7553	17.5327	16.5277 (87)
Th 2	19.0246	19.0411	19.0329	19.0722	19.0722	19.1074	19.1007	19.1074	19.0938	19.0722	19.0796	19.0570 (88)
util rest of house	0.9325	0.9206	0.8937	0.8426	0.7540	0.5713	0.3361	0.3660	0.6679	0.8431	0.9108	0.9364 (89)
MIT 2	14.2690	14.6123	15.4501	16.5934	17.6766	18.6405	19.0157	19.0037	18.3775	17.0268	15.5388	14.2931 (90)
Living area fraction	15.5667	15.8722	16.6215	17.6434	18.6290	19.5392	19.9578	19.9322	19.2718	18.0261	16.6915	15.5850 (92)
MIT	15.5667	15.8722	16.6215	17.6434	18.6290	19.5392	19.9578	19.9322	19.2718	18.0261	16.6915	15.5850 (93)
Temperature adjustment	15.5667	15.8722	16.6215	17.6434	18.6290	19.5392	19.9578	19.9322	19.2718	18.0261	16.6915	15.5850 (93)
adjusted MIT	15.5667	15.8722	16.6215	17.6434	18.6290	19.5392	19.9578	19.9322	19.2718	18.0261	16.6915	15.5850 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9003	0.8862	0.8570	0.8081	0.7354	0.6067	0.4583	0.4824	0.6802	0.8130	0.8773	0.9054 (94)
Ext temp.	516.3642	547.2946	563.2549	562.0596	521.6350	430.9388	309.3424	309.8830	416.4539	465.0309	484.1775	497.2240 (95)
Heat loss rate W	4.5000	5.0000	6.9000	9.4000	12.3000	15.3000	17.4000	17.3000	14.7000	11.1000	7.4000	4.5000 (96)
Space heating kWh	1766.0978	1715.4885	1542.5705	1273.0383	977.4046	638.8420	387.2621	396.6635	695.5193	1069.6123	1427.5912	1730.0171 (97)
Space heating requirement - total per year (kWh/year)	929.8018	785.0263	728.6108	511.9046	339.0926	0.0000	0.0000	0.0000	0.0000	449.8086	679.2578	917.1981 (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)	929.8018	785.0263	728.6108	511.9046	339.0926	0.0000	0.0000	0.0000	0.0000	449.8086	679.2578	917.1981 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	929.8018	785.0263	728.6108	511.9046	339.0926	0.0000	0.0000	0.0000	0.0000	449.8086	679.2578	917.1981 (98c)
Space heating per m ²	929.8018	785.0263	728.6108	511.9046	339.0926	0.0000	0.0000	0.0000	0.0000	449.8086	679.2578	917.1981 (98c)
												5340.7006 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.1000 (201)
Fraction of space heat from main system(s)												0.9000 (202)
Efficiency of main space heating system 1 (in %)												100.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	929.8018	785.0263	728.6108	511.9046	339.0926	0.0000	0.0000	0.0000	0.0000	449.8086	679.2578	917.1981 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	836.8217	706.5237	655.7497	460.7142	305.1834	0.0000	0.0000	0.0000	0.0000	404.8277	611.3320	825.4783 (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)	92.9802	78.5026	72.8611	51.1905	33.9093	0.0000	0.0000	0.0000	0.0000	44.9809	67.9258	91.7198 (215)
Water heating requirement	205.5903	181.4686	191.9887	166.9893	160.6277	143.3935	140.5762	146.9313	149.3937	168.1952	180.8044	203.1143 (64)
Efficiency of water heater (217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (216)
Fuel for water heating, kWh/month	205.5903	181.4686	191.9887	166.9893	160.6277	143.3935	140.5762	146.9313	149.3937	168.1952	180.8044	203.1143 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	22.3694	17.9456	16.1580	11.8380	9.1440	7.4708	8.3415	10.8426	14.0835	18.4783	20.8711	22.9911 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)

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(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4806.6306	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												534.0701	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												2039.0733	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												180.5338	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(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												7560.3078	(238)

10a. Fuel costs - using BEDF prices (580)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4806.6306	28.4300	1366.5251	(240)
Total CO2 associated with community systems			0.0000	(473)
Space heating - secondary	534.0701	28.4300	151.8361	(242)
Water heating (other fuel)	2039.0733	28.4300	579.7085	(247)
Energy for instantaneous electric shower(s)	0.0000	28.4300	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	180.5338	28.4300	51.3258	(250)
Additional standing charges			0.0000	(251)
Total energy cost			2149.3955	(255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4806.6306	0.1535	737.8624	(261)
Total CO2 associated with community systems			0.0000	(373)
Space heating - secondary	534.0701	0.1535	81.9847	(263)
Water heating (other fuel)	2039.0733	0.1411	287.7800	(264)
Space and water heating			1107.6271	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	180.5338	0.1443	26.0566	(268)
Total CO2, kg/year			1133.6837	(272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4806.6306	1.5683	7538.3797	(275)
Total CO2 associated with community systems			0.0000	(473)
Space heating - secondary	534.0701	1.5683	837.5977	(277)
Water heating (other fuel)	2039.0733	1.5219	3103.2027	(278)
Space and water heating			11479.1801	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	180.5338	1.5338	276.9088	(282)
Total Primary energy kWh/year			11756.0889	(286)

SAP 10 EPC IMPROVEMENTS

DH3001

Current energy efficiency rating: F 32
Current environmental impact rating: B 85

N Solar water heating			Recommended
U Solar photovoltaic panels			Recommended
V2 Wind turbine			Recommended
Recommended measures:			
N Solar water heating	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 4.3	-£ 192	-87 kg (7.6%)
V2 Wind turbine	+ 9.5	-£ 321	-235 kg (22.4%)
	+ 25.3	-£ 774	-496 kg (61.0%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
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Solar water heating	£192	1.35 kg/m ²	F 36	B 86
Solar photovoltaic panels	£321	3.67 kg/m ²	E 46	B 89
Wind turbine	£774	7.75 kg/m ²	C 71	A 95
Total Savings	£1287	12.77 kg/m ²		

Potential energy efficiency rating: C 71
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 580 TEST (07 Sep 2025)
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	£2149	£1957	£192
Space heating	£1518	£1548	-£30
Water heating	£580	£358	£222
Lighting	£51	£51	£0
Generated (PV)	-£0	-£321	£321
Generated (wind)	-£0	-£774	£774
Total cost of fuels	£2149	£862	£1287
Total cost of uses	£2149	£862	£1287
Delivered energy	118 kWh/m ²	23 kWh/m ²	95 kWh/m ²
Carbon dioxide emissions	1.1 tonnes	0.3 tonnes	0.8 tonnes
CO2 emissions per m ²	18 kg/m ²	5 kg/m ²	13 kg/m ²
Primary energy	184 kWh/m ²	72 kWh/m ²	112 kWh/m ²

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling	64.0000 (1b)	x 2.4000 (2b)	= 153.6000 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	153.6000 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1953 (8)
Pressure test		No	
Pressure Test Method		Blower Door	
Measured/design AP50		15.0000	(17)
Infiltration rate		0.9453	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.8035 (21)

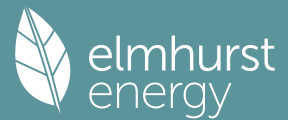
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	1.0245	1.0044	0.9843	0.8839	0.8638	0.7633	0.7633	0.7433	0.8035	0.8638	0.9040	0.9441 (22b)
Effective ac	1.0245	1.0044	0.9844	0.8906	0.8731	0.7913	0.7913	0.7762	0.8228	0.8731	0.9086	0.9457 (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
Main dwelling							
Doors			3.6100	1.4000	5.0540		(26a)
Windows			4.9400	1.3258	6.5492		(27)
Rooflights			1.5300	1.3258	2.0284		(27a)
Ground Floor			64.0000	0.2500	16.0000		(28a)
External Wall	85.5000	8.5500	76.9500	0.3000	23.0850		(29a)
External Roof	64.0000	1.5300	62.4700	0.2900	18.1163		(30)
Total net area of external elements Aum(A, m ²)			213.5000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	70.8330		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Default value 0.200 * total exposed area)							42.7000 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	113.5330 (37)

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

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(38)m	Jan 51.9290	Feb 50.9108	Mar 49.8988	Apr 45.1433	May 44.2535	Jun 40.1116	Jul 40.1116	Aug 39.3446	Sep 41.7070	Oct 44.2535	Nov 46.0535	Dec 47.9352	(38)
Heat transfer coeff	165.4619	164.4437	163.4317	158.6762	157.7865	153.6446	153.6446	152.8776	155.2400	157.7865	159.5864	161.4682	(39)
Average = Sum(39)m / 12 =												158.6707	
HLP	Jan 2.5853	Feb 2.5694	Mar 2.5536	Apr 2.4793	May 2.4654	Jun 2.4007	Jul 2.4007	Aug 2.3887	Sep 2.4256	Oct 2.4654	Nov 2.4935	Dec 2.5229	(40)
HLP (average)												2.4792	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0922	(42)
Hot water usage for mixer showers												75.8478	(42a)
Hot water usage for baths												0.0000	(42b)
Hot water usage for other uses												36.0560	(42c)
Average daily hot water use (litres/day)												102.9763	(43)
Daily hot water use	Jan 112.1955	Feb 109.7402	Mar 106.7617	Apr 102.2604	May 98.5949	Jun 94.6583	Jul 93.1660	Aug 96.1319	Sep 99.2569	Oct 103.3870	Nov 107.9569	Dec 111.9038	(44)
Energy conte	177.6903	156.2686	164.0887	139.9893	132.7277	116.3935	112.6762	119.0313	122.3937	140.2952	153.8044	175.2143	(45)
Energy content (annual)												1710.5733	
Distribution loss (46)m = 0.15 x (45)m												26.6535	(46)
Water storage loss:												210.0000	(47)
Store volume												1.5000	(48)
a) If manufacturer declared loss factor is known (kWh/day):												0.6000	(49)
Temperature factor from Table 2b												0.9000	(55)
Enter (49) or (54) in (55)												0.9000	(55)
Total storage loss	27.9000	25.2000	27.9000	27.0000	27.9000	27.0000	27.9000	27.9000	27.0000	27.9000	27.0000	27.9000	(56)
If cylinder contains dedicated solar storage	17.9357	16.2000	17.9357	17.3571	17.9357	17.3571	17.9357	17.9357	17.3571	17.9357	17.3571	17.9357	(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	195.6260	172.4686	182.0245	157.3465	150.6635	133.7506	130.6119	136.9671	139.7508	158.2309	171.1615	193.1501	(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)
If combined cylinder, total volume of cylinder												210.0000	(H13)
Effective solar volume												115.5000	(H14)
Reference volume												225.0000	(H15)
Storage tank correction coefficient												1.1814	(H16)
Heat delivered to hot water												609.9165	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												609.9165	
Solar input	-0.0000	-20.0212	-59.7024	-78.4455	-98.9613	-90.4673	-89.3574	-80.2761	-58.0582	-32.4794	-2.1477	-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	195.6260	152.4474	122.3220	78.9010	51.7022	43.2833	41.2545	56.6909	81.6927	125.7515	169.0138	193.1501	(64)
Total per year (kWh/year) = Sum(64)m =												1311.8354	(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	73.4306	64.9193	68.9081	60.4322	58.4805	52.5865	51.8134	53.9265	54.5816	60.9967	65.0257	72.6073	(65)

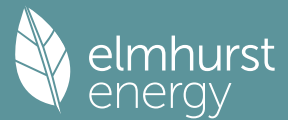
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan 125.5309	Feb 125.5309	Mar 125.5309	Apr 125.5309	May 125.5309	Jun 125.5309	Jul 125.5309	Aug 125.5309	Sep 125.5309	Oct 125.5309	Nov 125.5309	Dec 125.5309	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.5564	22.6990	18.4601	13.9755	10.4468	8.8196	9.5299	12.3874	16.6263	21.1109	24.6395	26.2667	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	273.0011	275.8340	268.6952	253.4975	234.3132	216.2826	204.2371	201.4042	208.5430	223.7407	242.9250	260.9556	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	(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)	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	(71)
Water heating gains (Table 5)	98.6970	96.6061	92.6184	83.9336	78.6029	73.0369	69.6417	72.4818	75.8078	81.9848	90.3134	97.5905	(72)
Total internal gains	488.7435	486.6280	471.2626	442.8954	414.8518	389.6280	374.8976	377.7623	392.4660	418.3253	449.3669	476.3017	(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	3.6800	36.7938	0.6300	0.7000	0.7700	41.3804 (77)
Southwest	1.2600	36.7938	0.6300	0.7000	0.7700	14.1683 (79)
Northwest	1.5300	18.0708	0.6300	0.7000	1.0000	10.9736 (82)

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Solar gains	66.5223	117.6732	172.5909	233.2699	279.0106	284.7918	271.3241	236.0069	193.4163	133.1775	80.4726	56.4154 (83)
Total gains	555.2658	604.3012	643.8535	676.1654	693.8624	674.4198	646.2217	613.7692	585.8823	551.5028	529.8395	532.7171 (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	10.7443	10.8109	10.8778	11.2038	11.2670	11.5707	11.5707	11.6288	11.4518	11.2670	11.1399	11.0101
alpha	1.7163	1.7207	1.7252	1.7469	1.7511	1.7714	1.7714	1.7753	1.7635	1.7511	1.7427	1.7340
util living area	0.9485	0.9381	0.9208	0.8891	0.8373	0.7515	0.6535	0.6823	0.8073	0.8965	0.9360	0.9517 (86)
MIT	16.3175	16.6258	17.2488	18.1606	19.0844	19.9524	20.4421	20.3726	19.6936	18.5223	17.3058	16.3057 (87)
Th 2	18.9717	18.9807	18.9898	19.0329	19.0411	19.0796	19.0796	19.0868	19.0647	19.0411	19.0246	19.0075 (88)
util rest of house	0.9375	0.9248	0.9023	0.8594	0.7837	0.6456	0.4661	0.5077	0.7217	0.8628	0.9199	0.9415 (89)
MIT 2	14.0187	14.3975	15.1623	16.2831	17.3886	18.3866	18.8609	18.8142	18.1181	16.7390	15.2491	14.0113 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	15.3477	15.6857	16.3686	17.3685	18.3690	19.2918	19.7751	19.7151	19.0289	17.7700	16.4381	15.3378 (92)
Temperature adjustment	0.0000											
adjusted MIT	15.3477	15.6857	16.3686	17.3685	18.3690	19.2918	19.7751	19.7151	19.0289	17.7700	16.4381	15.3378 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9062	0.8908	0.8658	0.8236	0.7591	0.6603	0.5472	0.5773	0.7196	0.8309	0.8871	0.9115 (94)
Useful gains	503.2006	538.3016	557.4355	556.8787	526.7350	445.2937	353.5806	354.3010	421.5931	458.2655	470.0066	485.5548 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1827.9700	1773.6435	1612.8357	1343.7500	1052.2736	720.8761	487.8316	506.8079	765.1675	1131.3278	1490.2359	1798.3937 (97)
Space heating kWh	985.6284	830.1498	785.2178	566.5474	391.0008	0.0000	0.0000	0.0000	0.0000	500.7584	734.5651	976.7522 (98a)
Space heating requirement - total per year (kWh/year)	5770.6198											
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	985.6284	830.1498	785.2178	566.5474	391.0008	0.0000	0.0000	0.0000	0.0000	500.7584	734.5651	976.7522 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	5770.6198											
Space heating per m2	(98c) / (4) = 90.1659 (99)											

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.1000 (201)
Fraction of space heat from main system(s)												0.9000 (202)
Efficiency of main space heating system 1 (in %)												100.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	985.6284	830.1498	785.2178	566.5474	391.0008	0.0000	0.0000	0.0000	0.0000	500.7584	734.5651	976.7522 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	887.0656	747.1348	706.6960	509.8926	351.9007	0.0000	0.0000	0.0000	0.0000	450.6825	661.1086	879.0770 (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)	98.5628	83.0150	78.5218	56.6547	39.1001	0.0000	0.0000	0.0000	0.0000	50.0758	73.4565	97.6752 (215)
Water heating												
Water heating requirement	195.6260	152.4474	122.3220	78.9010	51.7022	43.2833	41.2545	56.6909	81.6927	125.7515	169.0138	193.1501 (64)
Efficiency of water heater	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (216)
Fuel for water heating, kWh/month	195.6260	152.4474	122.3220	78.9010	51.7022	43.2833	41.2545	56.6909	81.6927	125.7515	169.0138	193.1501 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	22.3694	17.9456	16.1580	11.8380	9.1440	7.4708	8.3415	10.8426	14.0835	18.4783	20.8711	22.9911 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-41.6161	-64.2859	-99.9460	-118.6233	-127.8257	-82.4837	-81.1761	-78.5428	-71.7783	-74.6010	-47.2580	-35.3489 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	-212.5732	-192.0016	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	-8.4704	-19.2940	-42.4003	-72.1487	-107.8571	-149.2300	-147.4754	-121.2312	-84.6848	-32.2449	-12.1518	-6.5649 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	-91.1028	-82.2864	-91.1028	-88.1640	-91.1028	-88.1640	-91.1028	-91.1028	-88.1640	-91.1028	-88.1640	-91.1028 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1	5193.5578 (211)											
Space heating fuel - main system 2	0.0000 (213)											
Space heating fuel - secondary	577.0620 (215)											
Efficiency of water heater	100.0000											
Water heating fuel used	1311.8354 (219)											
Space cooling fuel	0.0000 (221)											
Electricity for pumps and fans:												
pump for solar water heating	80.0000 (230g)											

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Total electricity for the above, kWh/year	80.0000 (231)
Electricity for lighting (calculated in Appendix L)	180.5338 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1727.2394 (233)
Wind generation	-3575.5408 (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	2040.2089 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5193.5578	16.4900	856.4177 (240)
Total CO2 associated with community systems			0.0000 (473)
Space heating - secondary	577.0620	16.4900	95.1575 (242)
Water heating (other fuel)	1311.8354	16.4900	216.3217 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	16.4900	13.1920 (249)
Energy for lighting	180.5338	16.4900	29.7700 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-923.4858	16.4900	-152.2828
PV Unit electricity exported	-803.7536	5.5900	-44.9298
Total			-197.2126 (252)
Wind Turbine electricity used in dwelling	-2502.8785	16.4900	-412.7247
Wind Turbine electricity exported	-1072.6622	5.5900	-59.9618
Total			-472.6865 (252)
Total energy cost			540.9598 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] = 1.7867 (257)
SAP value	71.0383
SAP rating (Section 12)	71 (258)
SAP band	C

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	5193.5578	0.1533	796.0331 (261)
Total CO2 associated with community systems			0.0000 (373)
Space heating - secondary	577.0620	0.1533	88.4481 (263)
Water heating (other fuel)	1311.8354	0.1473	193.2973 (264)
Space and water heating			1077.7785 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	180.5338	0.1443	26.0566 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-923.4858	0.1361	-125.7029
PV Unit electricity exported	-803.7536	0.1188	-95.4711
Total			-221.1741 (269)
Wind Turbine electricity used in dwelling	-2502.8785	0.1387	-347.1801
Wind Turbine electricity exported	-1072.6622	0.1387	-148.7915
Total			-495.9716 (269)
Total CO2, kg/year			397.7864 (272)
CO2 emissions per m2			6.2200 (273)
EI value			95.1098
EI rating			95 (274)
EI band			A

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

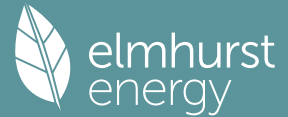
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling	64.0000 (1b)	2.4000 (2b)	153.6000 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.0000		153.6000 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	153.6000 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)

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Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000	Air changes per hour	0.1953 (8)
Pressure test			No	
Pressure Test Method			Blower Door	
Measured/design AP50			15.0000	(17)
Infiltration rate			0.9453	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.8035	(21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	4.5000	4.3000	4.4000	3.9000	3.9000	3.4000	3.5000	3.4000	3.6000	3.9000	3.8000	4.1000	(22)
Adj infilt rate	1.1250	1.0750	1.1000	0.9750	0.9750	0.8500	0.8750	0.8500	0.9000	0.9750	0.9500	1.0250	(22a)
Effective ac	0.9040	0.8638	0.8839	0.7834	0.7834	0.6830	0.7031	0.6830	0.7232	0.7834	0.7633	0.8236	(22b)
	0.9086	0.8731	0.8906	0.8069	0.8069	0.7332	0.7472	0.7332	0.7615	0.8069	0.7913	0.8392	(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	
Main dwelling								
Doors			3.6100	1.4000	5.0540			(26a)
Windows			4.9400	1.3258	6.5492			(27)
Rooflights			1.5300	1.3258	2.0284			(27a)
Ground Floor			64.0000	0.2500	16.0000			(28a)
External Wall	85.5000	8.5500	76.9500	0.3000	23.0850			(29a)
External Roof	64.0000	1.5300	62.4700	0.2900	18.1163			(30)
Total net area of external elements Aum(A, m2)			213.5000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	70.8330			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								100.0000 (35)
Thermal bridges (Default value 0.200 * total exposed area)								42.7000 (36)
Point Thermal bridges						(36a) =		0.0000
Total fabric heat loss						(33) + (36) + (36a) =		113.5330 (37)

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

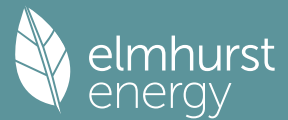
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	46.0535	44.2535	45.1433	40.8991	40.8991	37.1663	37.8719	37.1663	38.5981	40.8991	40.1116	42.5354	(38)
Average = Sum(39)m / 12 =	159.5864	157.7865	158.6762	154.4321	154.4321	150.6992	151.4049	150.6992	152.1310	154.4321	153.6446	156.0684	(39)
												154.4994	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	2.4935	2.4654	2.4793	2.4130	2.4130	2.3547	2.3657	2.3547	2.3770	2.4130	2.4007	2.4386	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.0922 (42)
Hot water usage for mixer showers													
	76.1395	74.9953	73.3279	70.1377	67.7834	65.1579	63.6656	65.3204	67.1343	69.9532	73.2120	75.8478	(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	36.0560	34.7449	33.4338	32.1226	30.8115	29.5004	29.5004	30.8115	32.1226	33.4338	34.7449	36.0560	(42c)
Average daily hot water use (litres/day)													102.9763 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	112.1955	109.7402	106.7617	102.2604	98.5949	94.6583	93.1660	96.1319	99.2569	103.3870	107.9569	111.9038	(44)
Energy content (annual)	177.6903	156.2686	164.0887	139.9893	132.7277	116.3935	112.6762	119.0313	122.3937	140.2952	153.8044	175.2143	(45)
Distribution loss (46)m = 0.15 x (45)m	26.6535	23.4403	24.6133	20.9984	19.9092	17.4590	16.9014	17.8547	18.3591	21.0443	23.0707	26.2822	(46)
Water storage loss:													
Store volume													210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.5000 (48)
Temperature factor from Table 2b													0.6000 (49)
Enter (49) or (54) in (55)													0.9000 (55)
Total storage loss	27.9000	25.2000	27.9000	27.0000	27.9000	27.0000	27.9000	27.9000	27.0000	27.9000	27.0000	27.9000	(56)
If cylinder contains dedicated solar storage	17.9357	16.2000	17.9357	17.3571	17.9357	17.3571	17.9357	17.9357	17.3571	17.9357	17.3571	17.9357	(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	195.6260	172.4686	182.0245	157.3465	150.6635	133.7506	130.6119	136.9671	139.7508	158.2309	171.1615	193.1501	(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)
If combined cylinder, total volume of cylinder													210.0000 (H13)
Effective solar volume													115.5000 (H14)
Reference volume													225.0000 (H15)
Storage tank correction coefficient													1.1814 (H16)

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Heat delivered to hot water												663.3356 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												663.3356
Solar input	-2.5307	-21.7219	-61.9457	-82.4391	-101.0571	-98.3392	-95.4354	-87.5395	-65.2072	-38.3867	-8.7330	-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	193.0953	150.7467	120.0788	74.9074	49.6064	35.4114	35.1765	49.4276	74.5436	119.8442	162.4285	193.1501 (64)
												1258.4163 (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)
Heat gains from water heating, kWh/month	73.4306	64.9193	68.9081	60.4322	58.4805	52.5865	51.8134	53.9265	54.5816	60.9967	65.0257	72.6073 (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	
(66m)	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.5564	22.6990	18.4601	13.9755	10.4468	8.8196	9.5299	12.3874	16.6263	21.1109	24.6395	26.2667	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	273.0011	275.8340	268.6952	253.4975	234.3132	216.2826	204.2371	201.4042	208.5430	223.7407	242.9250	260.9556	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	(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)	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	(71)
Water heating gains (Table 5)	98.6970	96.6061	92.6184	83.9336	78.6029	73.0369	69.6417	72.4818	75.8078	81.9848	90.3134	97.5905	(72)
Total internal gains	488.7435	486.6280	471.2626	442.8954	414.8518	389.6280	374.8976	377.7623	392.4660	418.3253	449.3669	476.3017	(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					3.6800	40.6744	0.6300	0.7000			0.7700			45.7447 (77)		
Southwest					1.2600	40.6744	0.6300	0.7000			0.7700			15.6626 (79)		
Northwest					1.5300	20.8575	0.6300	0.7000			1.0000			12.6659 (82)		
Solar gains					74.0731	120.2347	175.2888	241.8848	283.7507	309.9116	289.2937	253.8437	209.0567	142.9197	91.8425	62.1877 (83)
Total gains					562.8166	606.8627	646.5513	684.7802	698.6025	699.5396	664.1913	631.6060	601.5227	561.2450	541.2093	538.4894 (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	11.1399	11.2670	11.2038	11.5117	11.5117	11.7969	11.7419	11.7969	11.6858	11.5117	11.5707	11.3910
alpha	1.7427	1.7511	1.7469	1.7674	1.7674	1.7865	1.7828	1.7865	1.7791	1.7674	1.7714	1.7594
util living area	0.9458	0.9362	0.9159	0.8786	0.8193	0.7048	0.5761	0.6006	0.7760	0.8852	0.9307	0.9489 (86)
MIT	16.4939	16.7722	17.4580	18.3928	19.3101	20.1854	20.6395	20.6032	19.9123	18.7383	17.5133	16.5075 (87)
Th 2	19.0246	19.0411	19.0329	19.0722	19.0722	19.1074	19.1007	19.1074	19.0938	19.0722	19.0796	19.0570 (88)
util rest of house	0.9344	0.9226	0.8961	0.8457	0.7581	0.5763	0.3405	0.3709	0.6734	0.8468	0.9133	0.9382 (89)
MIT 2	14.2451	14.5891	15.4285	16.5745	17.6623	18.6333	19.0138	19.0014	18.3668	17.0079	15.5157	14.2686 (90)
Living area fraction	fLA = Living area / (4) = 0.5781 (91)											
MIT	15.5452	15.8512	16.6018	17.6257	18.6149	19.5306	19.9537	19.9275	19.2603	18.0083	16.6705	15.5630 (92)
Temperature adjustment	0.0000											
adjusted MIT	15.5452	15.8512	16.6018	17.6257	18.6149	19.5306	19.9537	19.9275	19.2603	18.0083	16.6705	15.5630 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9027	0.8886	0.8596	0.8112	0.7390	0.6111	0.4630	0.4874	0.6848	0.8167	0.8801	0.9077	(94)
Useful gains	508.0268	539.2540	555.7885	555.5044	516.2894	427.4542	307.5039	307.8166	411.9526	458.3843	476.3257	488.7884	(95)
Ext temp.	4.5000	5.0000	6.9000	9.4000	12.3000	15.3000	17.4000	17.3000	14.7000	11.1000	7.4000	4.5000	(96)
Heat loss rate W	1762.6634	1712.1670	1539.4524	1270.3178	975.2275	637.5444	386.6379	395.9564	693.7596	1066.8614	1424.3696	1726.5767	(97)
Space heating kWh	933.4497	788.1976	731.8459	514.6656	341.4500	0.0000	0.0000	0.0000	0.0000	452.7069	682.5916	920.9145	(98a)
Space heating requirement - total per year (kWh/year)												5365.8218	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	933.4497	788.1976	731.8459	514.6656	341.4500	0.0000	0.0000	0.0000	0.0000	452.7069	682.5916	920.9145	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5365.8218	
Space heating per m2										(98c) / (4) =		83.8410	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.1000 (201)
Fraction of space heat from main system(s)												0.9000 (202)
Efficiency of main space heating system 1 (in %)												100.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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Space heating requirement	933.4497	788.1976	731.8459	514.6656	341.4500	0.0000	0.0000	0.0000	0.0000	452.7069	682.5916	920.9145	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	840.1047	709.3778	658.6613	463.1990	307.3050	0.0000	0.0000	0.0000	0.0000	407.4362	614.3324	828.8230	(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)	93.3450	78.8198	73.1846	51.4666	34.1450	0.0000	0.0000	0.0000	0.0000	45.2707	68.2592	92.0914	(215)
Water heating requirement	193.0953	150.7467	120.0788	74.9074	49.6064	35.4114	35.1765	49.4276	74.5436	119.8442	162.4285	193.1501	(64)
Efficiency of water heater	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(216)
Fuel for water heating, kWh/month	193.0953	150.7467	120.0788	74.9074	49.6064	35.4114	35.1765	49.4276	74.5436	119.8442	162.4285	193.1501	(217)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(219)
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	22.3694	17.9456	16.1580	11.8380	9.1440	7.4708	8.3415	10.8426	14.0835	18.4783	20.8711	22.9911	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-46.0776	-65.6487	-100.7406	-119.9767	-125.7726	-84.0195	-82.2896	-80.2952	-74.4873	-78.4698	-53.1577	-38.8305	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	-212.5732	-192.0016	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	-205.7160	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	-10.2390	-20.4862	-44.6137	-78.0583	-113.5336	-167.5276	-160.9974	-134.5335	-95.2495	-37.0654	-15.2927	-7.8304	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	-91.1028	-82.2864	-91.1028	-88.1640	-91.1028	-88.1640	-91.1028	-88.1640	-91.1028	-88.1640	-91.1028	-88.1640	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4829.2396	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												536.5822	(215)
Efficiency of water heater												100.0000	(216)
Water heating fuel used												1258.4163	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												180.5338	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1835.1931	(233)
Wind generation												-3575.5408	(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												1474.0381	(238)

10a. Fuel costs - using BEDF prices (580)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4829.2396	28.4300	1372.9528	(240)
Total CO2 associated with community systems			0.0000	(473)
Space heating - secondary	536.5822	28.4300	152.5503	(242)
Water heating (other fuel)	1258.4163	28.4300	357.7678	(247)
Energy for instantaneous electric shower(s)	0.0000	28.4300	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	28.4300	22.7440	(249)
Energy for lighting	180.5338	28.4300	51.3258	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-949.7658	28.4300	-270.0184	
PV Unit electricity exported	-885.4273	5.8100	-51.4433	
Total			-321.4617	(252)
Wind Turbine electricity used in dwelling	-2502.8785	28.4300	-711.5684	
Wind Turbine electricity exported	-1072.6622	5.8100	-62.3217	
Total			-773.8900	(252)
Total energy cost			861.9889	(255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4829.2396	0.1535	741.2881	(261)
Total CO2 associated with community systems			0.0000	(373)
Space heating - secondary	536.5822	0.1535	82.3653	(263)
Water heating (other fuel)	1258.4163	0.1481	186.3190	(264)
Space and water heating			1009.9724	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	180.5338	0.1443	26.0566	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-949.7658	0.1364	-129.5115	
PV Unit electricity exported	-885.4273	0.1187	-105.0962	
Total			-234.6077	(269)
Wind Turbine electricity used in dwelling	-2502.8785	0.1387	-347.1801	
Wind Turbine electricity exported	-1072.6622	0.1387	-148.7915	
Total			-495.9716	(269)

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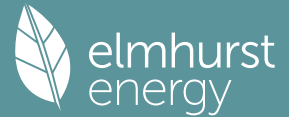
Total CO2, kg/year

316.5468 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	4829.2396	1.5683	7573.6708 (275)
Total CO2 associated with community systems			0.0000 (473)
Space heating - secondary	536.5822	1.5683	841.5190 (277)
Water heating (other fuel)	1258.4163	1.5478	1947.7381 (278)
Space and water heating			10362.9279 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	180.5338	1.5338	276.9088 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-949.7658	1.5041	-1428.5563
PV Unit electricity exported	-885.4273	0.4350	-385.1445
Total			-1813.7008 (283)
Wind Turbine electricity used in dwelling	-2502.8785	1.5128	-3786.3546
Wind Turbine electricity exported	-1072.6622	0.5128	-550.0612
Total			-4336.4158 (283)
Total Primary energy kWh/year			4610.7441 (286)

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Property Reference	DH3001			Issued on Date	25/09/2025
Assessment Reference	DH3002	Prop Type Ref	DH-30		
Property	1 Bed Dwelling, Welwyn Equestrian Centre, Pottersheath Road, Codicote, Welwyn, AL6 9SZ				
SAP Rating	39 E	DER	17.10	TER	
Environmental	87 B	% DER < TER			N/A
CO ₂ Emissions (t/year)	1.02	DFEE	91.41	TFEE	
Compliance Check	N/A	% DFEE < TFEE			
% DPER < TPER		DPER	187.44	TPER	
Assessor Details	Mr. Joe Solti			Assessor ID	5122-0001
Client	Phillips Planning Services Ltd, .				

SAP 10 WORKSHEET FOR Conversion (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)
Main dwelling			
Ground floor	64.0000 (1b)	2.4000 (2b)	153.6000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.0000		153.6000 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	153.6000 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1953 (8)
Pressure test	No
Pressure Test Method	Blower Door
Measured/design AP50	15.0000 (17)
Infiltration rate	0.9453 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.8035 (21)

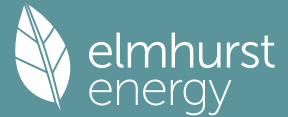
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	1.0245	1.0044	0.9843	0.8839	0.8638	0.7633	0.7633	0.7433	0.8035	0.8638	0.9040	0.9441 (22b)
Effective ac	1.0245	1.0044	0.9844	0.8906	0.8731	0.7913	0.7913	0.7762	0.8228	0.8731	0.9086	0.9457 (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
Main dwelling							
Doors			3.6100	1.4000	5.0540		(26a)
Windows			4.9400	1.3258	6.5492		(27)
Rooflights			1.5300	1.3258	2.0284		(27a)
Ground Floor			64.0000	0.2500	16.0000		(28a)
External Wall	85.5000	8.5500	76.9500	0.3000	23.0850		(29a)
External Roof	64.0000	1.5300	62.4700	0.1500	9.3705		(30)
Total net area of external elements Aum(A, m ²)			213.5000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	62.0872	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Default value 0.200 * total exposed area)							42.7000 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	104.7872 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	51.9290	50.9108	49.8988	45.1433	44.2535	40.1116	40.1116	39.3446	41.7070	44.2535	46.0535	47.9352 (38)
Heat transfer coeff	156.7161	155.6979	154.6859	149.9304	149.0407	144.8988	144.8988	144.1318	146.4942	149.0407	150.8406	152.7224 (39)
Average = Sum(39)m / 12 =												149.9249

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HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	2.4487	2.4328	2.4170	2.3427	2.3288	2.2640	2.2640	2.2521	2.2890	2.3288	2.3569	2.3863	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	2.3426	
												31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.0922 (42)
Hot water usage for mixer showers													
76.1395	74.9953	73.3279	70.1377	67.7834	65.1579	63.6656	65.3204	67.1343	69.9532	73.2120	75.8478	(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													
36.0560	34.7449	33.4338	32.1226	30.8115	29.5004	29.5004	30.8115	32.1226	33.4338	34.7449	36.0560	(42c)	
Average daily hot water use (litres/day)												102.9763 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1955	109.7402	106.7617	102.2604	98.5949	94.6583	93.1660	96.1319	99.2569	103.3870	107.9569	111.9038	(44)
Energy content (annual)	177.6903	156.2686	164.0887	139.9893	132.7277	116.3935	112.6762	119.0313	122.3937	140.2952	153.8044	175.2143	(45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1710.5733	
26.6535	23.4403	24.6133	20.9984	19.9092	17.4590	16.9014	17.8547	18.3591	21.0443	23.0707	26.2822	(46)	
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.9000	(55)
Total storage loss													
27.9000	25.2000	27.9000	27.0000	27.9000	27.0000	27.9000	27.9000	27.9000	27.0000	27.9000	27.0000	27.9000	(56)
If cylinder contains dedicated solar storage													
27.9000	25.2000	27.9000	27.0000	27.9000	27.0000	27.9000	27.9000	27.9000	27.0000	27.9000	27.0000	27.9000	(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													
205.5903	181.4686	191.9887	166.9893	160.6277	143.3935	140.5762	146.9313	149.3937	168.1952	180.8044	203.1143	(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													
205.5903	181.4686	191.9887	166.9893	160.6277	143.3935	140.5762	146.9313	149.3937	168.1952	180.8044	203.1143	(64)	
12Total per year (kWh/year)												2039.0733	(64)
Electric shower(s)												2039	(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)	
												0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													
Heat gains from water heating, kWh/month													
81.4020	72.1193	76.8795	68.1464	66.4520	60.3008	59.7848	61.8979	62.2959	68.9682	72.7399	80.5788	(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	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	105.2215	116.4952	105.2215	108.7289	105.2215	108.7289	105.2215	105.2215	108.7289	105.2215	108.7289	105.2215 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	182.9108	184.8088	180.0258	169.8433	156.9898	144.9093	136.8388	134.9408	139.7238	149.9062	162.7598	174.8402 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609 (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)	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873 (71)
Water heating gains (Table 5)	109.4113	107.3204	103.3327	94.6478	89.3172	83.7511	80.3560	83.1961	86.5221	92.6991	101.0277	108.3048 (72)
Total internal gains	451.9263	463.0071	442.9627	427.6028	405.9112	391.7721	376.7990	377.7411	389.3575	402.2096	426.8990	442.7492 (73)

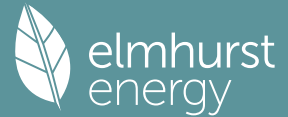
6. Solar gains

[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				3.6800	36.7938		0.6300		0.7000		0.7700		41.3804 (77)
Southwest				1.2600	36.7938		0.6300		0.7000		0.7700		14.1683 (79)
Northwest				1.5300	18.0708		0.6300		0.7000		1.0000		10.9736 (82)
Solar gains	66.5223	117.6732	172.5909	233.2699	279.0106	284.7918	271.3241	236.0069	193.4163	133.1775	80.4726	56.4154	(83)
Total gains	518.4486	580.6803	615.5536	660.8727	684.9218	676.5638	648.1231	613.7480	582.7738	535.3871	507.3716	499.1646	(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	11.3439	11.4181	11.4928	11.8574	11.9281	12.2691	12.2691	12.3344	12.1355	11.9281	11.7858	11.6406
alpha	1.7563	1.7612	1.7662	1.7905	1.7952	1.8179	1.8179	1.8223	1.8090	1.7952	1.7857	1.7760
util living area	0.9528	0.9405	0.9239	0.8891	0.8342	0.7411	0.6398	0.6703	0.8013	0.8977	0.9387	0.9555 (86)
MIT	16.3914	16.7262	17.3350	18.2609	19.1737	20.0283	20.4916	20.4242	19.7678	18.6028	17.3951	16.3898 (87)
Th 2	19.0510	19.0604	19.0698	19.1147	19.1232	19.1631	19.1631	19.1706	19.1476	19.1232	19.1060	19.0882 (88)
util rest of house	0.9429	0.9279	0.9065	0.8604	0.7818	0.6377	0.4607	0.5028	0.7176	0.8653	0.9236	0.9464 (89)

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MIT 2	15.0943	15.4290	16.0350	16.9644	17.8436	18.6390	18.9971	18.9630	18.4198	17.3142	16.1197	15.1124 (90)
Living area fraction									FLA = Living area / (4) =			0.5781 (91)
MIT	15.8442	16.1789	16.7866	17.7139	18.6126	19.4422	19.8611	19.8077	19.1991	18.0592	16.8571	15.8509 (92)
Temperature adjustment												0.0000
adjusted MIT	15.8442	16.1789	16.7866	17.7139	18.6126	19.4422	19.8611	19.8077	19.1991	18.0592	16.8571	15.8509 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9179	0.9000	0.8765	0.8310	0.7633	0.6568	0.5404	0.5721	0.7206	0.8395	0.8969	0.9225	(94)
Useful gains	475.8989	522.5947	539.5307	549.1848	522.8247	444.3687	350.2608	351.1317	419.9293	449.4825	455.0386	460.4581	(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	1809.1571	1756.1077	1591.1885	1321.4781	1030.2555	701.6242	472.5279	491.1612	746.9905	1111.7218	1471.7603	1779.3559	(97)
Space heating requirement kWh	991.9441	828.9207	782.4333	556.0512	377.5285	0.0000	0.0000	0.0000	0.0000	492.7060	732.0397	981.2600	(98a)
Space heating requirement - total per year (kWh/year)												5742.8835	
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	991.9441	828.9207	782.4333	556.0512	377.5285	0.0000	0.0000	0.0000	0.0000	492.7060	732.0397	981.2600	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5742.8835	
Space heating per m2										(98c) / (4) =		89.7326	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.1000 (201)
Fraction of space heat from main system(s)													0.9000 (202)
Efficiency of main space heating system 1 (in %)													100.0000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													100.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	991.9441	828.9207	782.4333	556.0512	377.5285	0.0000	0.0000	0.0000	0.0000	492.7060	732.0397	981.2600	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	892.7497	746.0286	704.1900	500.4461	339.7757	0.0000	0.0000	0.0000	0.0000	443.4354	658.8357	883.1340	(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)	99.1944	82.8921	78.2433	55.6051	37.7529	0.0000	0.0000	0.0000	0.0000	49.2706	73.2040	98.1260	(215)
Water heating requirement	205.5903	181.4686	191.9887	166.9893	160.6277	143.3935	140.5762	146.9313	149.3937	168.1952	180.8044	203.1143	(64)
Efficiency of water heater	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(216)
Fuel for water heating, kWh/month	205.5903	181.4686	191.9887	166.9893	160.6277	143.3935	140.5762	146.9313	149.3937	168.1952	180.8044	203.1143	(217)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(219)
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(223)
Lighting	22.3694	17.9456	16.1580	11.8380	9.1440	7.4708	8.3415	10.8426	14.0835	18.4783	20.8711	22.9911	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												5168.5951	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												574.2883	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												2039.0733	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												180.5338	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(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												7962.4906	(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 (high-rate cost)	0.0000	0.0000	0.0000	(261)
Space heating - main system 1 (low-rate cost)	5168.5951	0.1360	0.0000	(261)

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Total CO2 associated with community systems			0.0000 (373)
Space heating - secondary	574.2883	0.1534	88.0867 (263)
Water heating (high-rate cost)	0.0000	0.0000	0.0000 (264)
Water heating (low-rate cost)	2039.0733	0.1360	277.3140 (264)
Space and water heating			1068.3296 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	180.5338	0.1443	26.0566 (268)
Total CO2, kg/year			1094.3862 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			17.1000 (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 (high-rate cost)	0.0000	0.0000	0.0000 (275)
Space heating - main system 1 (low-rate cost)	5168.5951	1.5010	0.0000 (275)
Total CO2 associated with community systems			0.0000 (473)
Space heating - secondary	574.2883	1.5679	900.4052 (277)
Water heating (high-rate cost)	0.0000	0.0000	0.0000 (278)
Water heating (low-rate cost)	2039.0733	1.5010	3060.6490 (278)
Space and water heating			11719.1155 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	180.5338	1.5338	276.9088 (282)
Total Primary energy kWh/year			11996.0243 (286)
Dwelling Primary energy Rate (DPER)			187.4400 (287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling	64.0000 (1b)	x 2.4000 (2b)	= 153.6000 (1b) - (3b)
Ground floor			(4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.0000		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 153.6000 (5)
Dwelling volume			

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	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) = 0.1302 (8)
Pressure test	No
Pressure Test Method	Blower Door
Measured/design AP50	15.0000 (17)
Infiltration rate	0.8802 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.7482 (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	0.9539	0.9352	0.9165	0.8230	0.8043	0.7108	0.7108	0.6921	0.7482	0.8043	0.8417	0.8791 (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	0.9550	0.9373	0.9200	0.8387	0.8234	0.7526	0.7526	0.7395	0.7799	0.8234	0.8542	0.8864 (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
Main dwelling							
Doors			3.6100	1.4000	5.0540		(26a)
Windows			4.9400	1.3258	6.5492		(27)
Rooflights			1.5300	1.3258	2.0284		(27a)
Ground Floor			64.0000	0.2500	16.0000		(28a)
External Wall	85.5000	8.5500	76.9500	0.3000	23.0850		(29a)
External Roof	64.0000	1.5300	62.4700	0.1500	9.3705		(30)
Total net area of external elements Aum (A, m2)			213.5000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 62.0872		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)
Thermal bridges (Default value 0.200 * total exposed area)							42.7000 (36)
Point Thermal bridges						(36a) = 0.0000	
Total fabric heat loss						(33) + (36) + (36a) = 104.7872	(37)

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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	48.4064	47.5109	46.6330	42.5100	41.7386	38.1476	38.1476	37.4826	39.5308	41.7386	43.2991	44.9306	(38)
Heat transfer coeff	153.1935	152.2980	151.4202	147.2972	146.5258	142.9347	142.9347	142.2697	144.3179	146.5258	148.0863	149.7178	(39)
Average = Sum(39)m / 12 =												147.2935	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.3936	2.3797	2.3659	2.3015	2.2895	2.2334	2.2334	2.2230	2.2550	2.2895	2.3138	2.3393	(40)
HLP (average)												2.3015	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.0922 (42)
Hot water usage for mixer showers													(42a)
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	
Hot water usage for baths													(42b)
25.6236	25.2430	24.7071	23.7191	22.9792	22.1588	21.7157	22.2478	22.8272	23.7051	24.7135	25.5369		
Hot water usage for other uses													(42c)
36.0560	34.7449	33.4338	32.1226	30.8115	29.5004	29.5004	30.8115	32.1226	33.4338	34.7449	36.0560		
Average daily hot water use (litres/day)												56.5353	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	61.6796	59.9879	58.1409	55.8417	53.7907	51.6592	51.2160	53.0593	54.9498	57.1388	59.4584	61.5930	(44)
Energy conte	97.6854	85.4220	89.3604	76.4445	72.4126	63.5210	61.9414	65.6985	67.7587	77.5368	84.7094	96.4397	(45)
Energy content (annual)												938.9304	
Distribution loss (46)m = 0.15 x (45)m													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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													
83.0326	72.6087	75.9563	64.9778	61.5507	53.9928	52.6502	55.8437	57.5949	65.9063	72.0030	81.9738		(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	83.0326	72.6087	75.9563	64.9778	61.5507	53.9928	52.6502	55.8437	57.5949	65.9063	72.0030	81.9738	(64)
12Total per year (kWh/year)												798.0908	(64)
Electric shower(s)	47.4883	42.3125	46.2036	44.0915	44.9189	42.8483	44.2765	44.9189	44.0915	46.2036	45.3348	47.4883	(64a)
												540.1766	(64a)
Heat gains from water heating, kWh/month	32.6302	28.7303	30.5400	27.2673	26.6174	24.2103	24.2317	25.1907	25.4216	28.0275	29.3344	32.3655	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	105.2215	116.4952	105.2215	108.7289	105.2215	108.7289	105.2215	105.2215	108.7289	105.2215	108.7289	105.2215	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	182.9108	184.8088	180.0258	169.8433	156.9898	144.9093	136.8388	134.9408	139.7238	149.9062	162.7598	174.8402	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	(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)	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	(71)
Water heating gains (Table 5)	43.8578	42.7534	41.0484	37.8713	35.7761	33.6254	32.5695	33.8584	35.3078	37.6713	40.7423	43.5020	(72)
Total internal gains	386.3728	398.4401	380.6783	370.8262	352.3701	341.6463	329.0125	328.4034	338.1431	347.1818	366.6136	377.9465	(73)

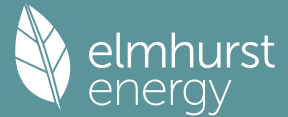
6. Solar gains

[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						3.6800	36.7938	0.6300	0.7000			0.7700	41.3804 (77)				
Southwest						1.2600	36.7938	0.6300	0.7000			0.7700	14.1683 (79)				
Northwest						1.5300	18.0708	0.6300	0.7000			1.0000	10.9736 (82)				
Solar gains						66.5223	117.6732	172.5909	233.2699	279.0106	284.7918	271.3241	236.0069	193.4163	133.1775	80.4726	56.4154 (83)
Total gains						452.8951	516.1133	553.2693	604.0961	631.3807	626.4381	600.3366	564.4103	531.5595	480.3593	447.0862	434.3619 (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	11.6048	11.6730	11.7407	12.0693	12.1329	12.4377	12.4377	12.4958	12.3185	12.1329	12.0050	11.8742	
alpha	1.7737	1.7782	1.7827	1.8046	1.8089	1.8292	1.8292	1.8331	1.8212	1.8089	1.8003	1.7916	
util living area	0.9615	0.9499	0.9345	0.9014	0.8492	0.7601	0.6615	0.6938	0.8209	0.9117	0.9492	0.9642	(86)
MIT	16.3238	16.6625	17.2749	18.2051	19.1275	19.9910	20.4667	20.3936	19.7207	18.5399	17.3225	16.3141	(87)

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Th 2	19.0838	19.0922	19.1005	19.1399	19.1473	19.1823	19.1823	19.1888	19.1688	19.1473	19.1323	19.1167 (88)
util rest of house	0.9534	0.9392	0.9193	0.8754	0.8005	0.6608	0.4847	0.5297	0.7426	0.8832	0.9365	0.9567 (89)
MIT 2	15.0462	15.3850	15.9951	16.9282	17.8201	18.6279	19.0026	18.9632	18.3987	17.2711	16.0645	15.0537 (90)
Living area fraction									fLA = Living area / (4) =			0.5781 (91)
MIT	15.7848	16.1235	16.7350	17.6664	18.5759	19.4160	19.8490	19.7901	19.1629	18.0046	16.7918	15.7824 (92)
Temperature adjustment												0.0000
adjusted MIT	15.7848	16.1235	16.7350	17.6664	18.5759	19.4160	19.8490	19.7901	19.1629	18.0046	16.7918	15.7824 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9315	0.9139	0.8913	0.8467	0.7807	0.6766	0.5615	0.5953	0.7423	0.8580	0.9123	0.9359	(94)
Useful gains	421.8779	471.6798	493.1341	511.4756	492.8950	423.8351	337.0685	335.9703	394.5847	412.1258	407.8880	406.5208	(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	1759.3978	1709.3228	1549.7808	1291.2624	1007.5021	688.3690	464.4021	482.3126	730.6727	1084.9668	1435.2189	1734.0855	(97)
Space heating kWh	995.1148	831.6961	786.1451	561.4465	382.8677	0.0000	0.0000	0.0000	0.0000	500.5937	739.6782	987.7081	(98a)
Space heating requirement - total per year (kWh/year)												5785.2502	
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	995.1148	831.6961	786.1451	561.4465	382.8677	0.0000	0.0000	0.0000	0.0000	500.5937	739.6782	987.7081	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5785.2502	
Space heating per m2										(98c) / (4) =		90.3945	(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	1343.5864	1057.7170	1081.2499	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.4152	0.4787	0.4527	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	557.8477	506.3280	489.5264	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	665.5103	638.6017	602.2970	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	77.5171	98.4116	83.9014	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction													
Intermittency factor (Table 10b)									fC = cooled area /	(4) =		1.0000	(105)
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	19.3793	24.6029	20.9753	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement													64.9575 (107)
Energy for space heating													90.3945 (99)
Energy for space cooling													1.0150 (108)
Total													91.4095 (109)
Fabric Energy Efficiency (DFEE)													91.4 (109)

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

1. Overall dwelling characteristics

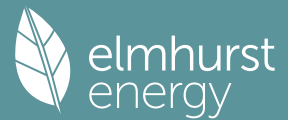
	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling	64.0000 (1b)	x 2.4000 (2b)	= 153.6000 (1b) - (3b)	
Ground floor				
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.0000			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	153.6000 (5)	

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1953 (8)
Pressure test	No	
Pressure Test Method	Blower Door	
Measured/design AP50	15.0000	(17)
Infiltration rate	0.9453	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.8035 (21)

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

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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												
	1.0245	1.0044	0.9843	0.8839	0.8638	0.7633	0.7633	0.7433	0.8035	0.8638	0.9040	0.9441 (22b)
Effective ac	1.0245	1.0044	0.9844	0.8906	0.8731	0.7913	0.7913	0.7762	0.8228	0.8731	0.9086	0.9457 (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	
Main dwelling								
Doors			3.6100	1.4000	5.0540			(26a)
Windows			4.9400	1.3258	6.5492			(27)
Rooflights			1.5300	1.3258	2.0284			(27a)
Ground Floor			64.0000	0.2500	16.0000			(28a)
External Wall	85.5000	8.5500	76.9500	0.3000	23.0850			(29a)
External Roof	64.0000	1.5300	62.4700	0.1500	9.3705			(30)
Total net area of external elements Aum(A, m2)			213.5000					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	62.0872		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								100.0000 (35)
Thermal bridges (Default value 0.200 * total exposed area)								42.7000 (36)
Point Thermal bridges						(36a) =		0.0000
Total fabric heat loss						(33) + (36) + (36a) =		104.7872 (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	51.9290	50.9108	49.8988	45.1433	44.2535	40.1116	40.1116	39.3446	41.7070	44.2535	46.0535	47.9352	(38)
Average = Sum(39)m / 12 =	156.7161	155.6979	154.6859	149.9304	149.0407	144.8988	144.8988	144.1318	146.4942	149.0407	150.8406	152.7224	(39)
													149.9249

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	2.4487	2.4328	2.4170	2.3427	2.3288	2.2640	2.2640	2.2521	2.2890	2.3288	2.3569	2.3863	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

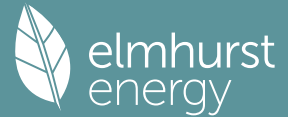
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.0922 (42)
Hot water usage for mixer showers													
	76.1395	74.9953	73.3279	70.1377	67.7834	65.1579	63.6656	65.3204	67.1343	69.9532	73.2120	75.8478	(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													
	36.0560	34.7449	33.4338	32.1226	30.8115	29.5004	29.5004	30.8115	32.1226	33.4338	34.7449	36.0560	(42c)
Average daily hot water use (litres/day)													102.9763 (43)
Daily hot water use													
	112.1955	109.7402	106.7617	102.2604	98.5949	94.6583	93.1660	96.1319	99.2569	103.3870	107.9569	111.9038	(44)
Energy conte	177.6903	156.2686	164.0887	139.9893	132.7277	116.3935	112.6762	119.0313	122.3937	140.2952	153.8044	175.2143	(45)
Energy content (annual)										Total = Sum(45)m =			1710.5733
Distribution loss (46)m = 0.15 x (45)m													
	26.6535	23.4403	24.6133	20.9984	19.9092	17.4590	16.9014	17.8547	18.3591	21.0443	23.0707	26.2822	(46)
Water storage loss:													
Store volume													210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.5000 (48)
Temperature factor from Table 2b													0.6000 (49)
Enter (49) or (54) in (55)													0.9000 (55)
Total storage loss													
	27.9000	25.2000	27.9000	27.0000	27.9000	27.0000	27.9000	27.9000	27.0000	27.9000	27.0000	27.9000	(56)
If cylinder contains dedicated solar storage													
	27.9000	25.2000	27.9000	27.0000	27.9000	27.0000	27.9000	27.9000	27.0000	27.9000	27.0000	27.9000	(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													
	205.5903	181.4686	191.9887	166.9893	160.6277	143.3935	140.5762	146.9313	149.3937	168.1952	180.8044	203.1143	(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													
	205.5903	181.4686	191.9887	166.9893	160.6277	143.3935	140.5762	146.9313	149.3937	168.1952	180.8044	203.1143	(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													
	81.4020	72.1193	76.8795	68.1464	66.4520	60.3008	59.7848	61.8979	62.2959	68.9682	72.7399	80.5788	(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	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.5564	22.6990	18.4601	13.9755	10.4468	8.8196	9.5299	12.3874	16.6263	21.1109	24.6395	26.2667	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	273.0011	275.8340	268.6952	253.4975	234.3132	216.2826	204.2371	201.4042	208.5430	223.7407	242.9250	260.9556	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	(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)													
	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	(71)
Water heating gains (Table 5)													
	109.4113	107.3204	103.3327	94.6478	89.3172	83.7511	80.3560	83.1961	86.5221	92.6991	101.0277	108.3048	(72)
Total internal gains													
	499.4578	497.3423	481.9768	453.6097	425.5661	400.3423	385.6119	388.4766	403.1803	429.0396	460.0812	487.0160	(73)

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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				3.6800	36.7938		0.6300		0.7000	0.7700	41.3804 (77)
Southwest				1.2600	36.7938		0.6300		0.7000	0.7700	14.1683 (79)
Northwest				1.5300	18.0708		0.6300		0.7000	1.0000	10.9736 (82)
Solar gains	66.5223	117.6732	172.5909	233.2699	279.0106	284.7918	271.3241	236.0069	193.4163	133.1775	56.4154 (83)
Total gains	565.9801	615.0155	654.5678	686.8797	704.5767	685.1341	656.9360	624.4835	596.5966	562.2171	543.4314 (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	11.3439	11.4181	11.4928	11.8574	11.9281	12.2691	12.2691	12.3344	12.1355	11.9281	11.7858	11.6406
alpha	1.7563	1.7612	1.7662	1.7905	1.7952	1.8179	1.8179	1.8223	1.8090	1.7952	1.7857	1.7760
util living area												
	0.9460	0.9351	0.9168	0.8830	0.8281	0.7375	0.6354	0.6648	0.7957	0.8904	0.9325	0.9493 (86)
MIT	16.4813	16.7894	17.4037	18.3032	19.2010	20.0372	20.4979	20.4328	19.7853	18.6476	17.4570	16.4757 (87)
Th 2	19.0510	19.0604	19.0698	19.1147	19.1232	19.1631	19.1631	19.1706	19.1476	19.1232	19.1060	19.0882 (88)
util rest of house												
	0.9349	0.9216	0.8980	0.8531	0.7746	0.6336	0.4564	0.4971	0.7107	0.8562	0.9161	0.9390 (89)
MIT 2	15.1817	15.4900	16.1002	17.0032	17.8666	18.6451	18.9998	18.9671	18.4329	17.3548	16.1789	15.1960 (90)
Living area fraction												
									fLA = Living area /	(4) =		0.5781 (91)
MIT	15.9330	16.2412	16.8538	17.7548	18.6380	19.4499	19.8659	19.8145	19.2147	18.1022	16.9178	15.9358 (92)
Temperature adjustment												0.0000
adjusted MIT	15.9330	16.2412	16.8538	17.7548	18.6380	19.4499	19.8659	19.8145	19.2147	18.1022	16.9178	15.9358 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9080	0.8925	0.8671	0.8236	0.7567	0.6533	0.5364	0.5670	0.7146	0.8305	0.8883	0.9132 (94)
Useful gains	513.8836	548.8734	567.5505	565.7436	533.1773	447.5894	352.3746	354.0582	426.3172	466.9142	480.1530	496.2366 (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	1823.0859	1765.8005	1601.5905	1327.5964	1034.0473	702.7428	473.2211	492.1318	749.2769	1118.1351	1480.9239	1792.3174 (97)
Space heating kWh	974.0465	817.7750	769.3257	548.5341	372.6473	0.0000	0.0000	0.0000	0.0000	484.5084	720.5550	964.2841 (98a)
Space heating requirement - total per year (kWh/year)												5651.6761
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	974.0465	817.7750	769.3257	548.5341	372.6473	0.0000	0.0000	0.0000	0.0000	484.5084	720.5550	964.2841 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5651.6761
Space heating per m2										(98c) / (4) =		88.3074 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.1000 (201)
Fraction of space heat from main system(s)												0.9000 (202)
Efficiency of main space heating system 1 (in %)												100.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	974.0465	817.7750	769.3257	548.5341	372.6473	0.0000	0.0000	0.0000	0.0000	484.5084	720.5550	964.2841 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	876.6419	735.9975	692.3931	493.6807	335.3826	0.0000	0.0000	0.0000	0.0000	436.0575	648.4995	867.8557 (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)	97.4047	81.7775	76.9326	54.8534	37.2647	0.0000	0.0000	0.0000	0.0000	48.4508	72.0555	96.4284 (215)
Water heating												
Water heating requirement	205.5903	181.4686	191.9887	166.9893	160.6277	143.3935	140.5762	146.9313	149.3937	168.1952	180.8044	203.1143 (64)
Efficiency of water heater	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (216)
Fuel for water heating, kWh/month	205.5903	181.4686	191.9887	166.9893	160.6277	143.3935	140.5762	146.9313	149.3937	168.1952	180.8044	203.1143 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	22.3694	17.9456	16.1580	11.8380	9.1440	7.4708	8.3415	10.8426	14.0835	18.4783	20.8711	22.9911 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)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 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)

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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												5086.5085	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												565.1676	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												2039.0733	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												180.5338	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(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												7871.2832	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	0.0000	0.0000	0.0000	(240)
Space heating - main system 1 (low-rate cost)	5086.5085	14.1700	0.0000	(240)
Total CO2 associated with community systems			0.0000	(473)
Space heating - secondary	565.1676	14.1700	80.0842	(242)
Water heating (high-rate cost)	0.0000	0.0000	0.0000	(245)
Water heating (low-rate cost)	2039.0733	14.1700	288.9367	(246)
Energy for instantaneous electric shower(s)	0.0000	17.4100	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	180.5338	17.4100	31.4309	(250)
Additional standing charges			26.0000	(251)
Total energy cost			1147.2101	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	3.7890	(257)
SAP value		39.0885	
SAP rating (Section 12)		39	(258)
SAP band		E	

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 (high-rate cost)	0.0000	0.0000	0.0000	(261)
Space heating - main system 1 (low-rate cost)	5086.5085	0.1360	0.0000	(261)
Total CO2 associated with community systems			0.0000	(373)
Space heating - secondary	565.1676	0.1534	86.6825	(263)
Water heating (high-rate cost)	0.0000	0.0000	0.0000	(264)
Water heating (low-rate cost)	2039.0733	0.1360	277.3140	(264)
Space and water heating			1055.7617	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	180.5338	0.1443	26.0566	(268)
Total CO2, kg/year			1081.8183	(272)
CO2 emissions per m2			16.9000	(273)
EI value			86.7006	
EI rating			87	(274)
EI band			B	

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

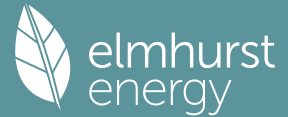
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling				
Ground floor	64.0000 (1b)	x 2.4000 (2b)	= 153.6000 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.0000		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)... (3n) =	153.6000 (5)	

2. Ventilation rate

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

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Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1953 (8)
Pressure test	No	
Pressure Test Method	Blower Door	
Measured/design AP50		15.0000 (17)
Infiltration rate		0.9453 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.8035 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	4.5000	4.3000	4.4000	3.9000	3.9000	3.4000	3.5000	3.4000	3.6000	3.9000	3.8000	4.1000
Adj infilt rate	1.1250	1.0750	1.1000	0.9750	0.9750	0.8500	0.8750	0.8500	0.9000	0.9750	0.9500	1.0250
Effective ac	0.9040	0.8638	0.8839	0.7834	0.7834	0.6830	0.7031	0.6830	0.7232	0.7834	0.7633	0.8236
	0.9086	0.8731	0.8906	0.8069	0.8069	0.7332	0.7472	0.7332	0.7615	0.8069	0.7913	0.8392

3. Heat losses and heat loss parameter

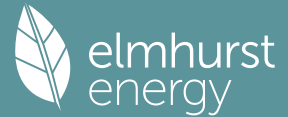
Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Doors			3.6100	1.4000	5.0540			(26a)
Windows			4.9400	1.3258	6.5492			(27)
Rooflights			1.5300	1.3258	2.0284			(27a)
Ground Floor			64.0000	0.2500	16.0000			(28a)
External Wall	85.5000	8.5500	76.9500	0.3000	23.0850			(29a)
External Roof	64.0000	1.5300	62.4700	0.1500	9.3705			(30)
Total net area of external elements Aum(A, m2)			213.5000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		62.0872			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								100.0000 (35)
Thermal bridges (Default value 0.200 * total exposed area)								42.7000 (36)
Point Thermal bridges						(36a) =		0.0000
Total fabric heat loss						(33) + (36) + (36a) =		104.7872 (37)

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.0922 (42)
Hot water usage for mixer showers													
Hot water usage for baths	76.1395	74.9953	73.3279	70.1377	67.7834	65.1579	63.6656	65.3204	67.1343	69.9532	73.2120	75.8478	(42a)
Hot water usage for other uses	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)
Average daily hot water use (litres/day)	36.0560	34.7449	33.4338	32.1226	30.8115	29.5004	29.5004	30.8115	32.1226	33.4338	34.7449	36.0560	(42c)
													102.9763 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	112.1955	109.7402	106.7617	102.2604	98.5949	94.6583	93.1660	96.1319	99.2569	103.3870	107.9569	111.9038	(44)
Energy content (annual)	177.6903	156.2686	164.0887	139.9893	132.7277	116.3935	112.6762	119.0313	122.3937	140.2952	153.8044	175.2143	(45)
Distribution loss (46)m = 0.15 x (45)m	26.6535	23.4403	24.6133	20.9984	19.9092	17.4590	16.9014	17.8547	18.3591	21.0443	23.0707	26.2822	(46)
Water storage loss:													
Store volume													210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.5000 (48)
Temperature factor from Table 2b													0.6000 (49)
Enter (49) or (54) in (55)													0.9000 (55)
Total storage loss	27.9000	25.2000	27.9000	27.0000	27.9000	27.0000	27.9000	27.9000	27.0000	27.9000	27.0000	27.9000	(56)
If cylinder contains dedicated solar storage	27.9000	25.2000	27.9000	27.0000	27.9000	27.0000	27.9000	27.9000	27.0000	27.9000	27.0000	27.9000	(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	205.5903	181.4686	191.9887	166.9893	160.6277	143.3935	140.5762	146.9313	149.3937	168.1952	180.8044	203.1143	(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	205.5903	181.4686	191.9887	166.9893	160.6277	143.3935	140.5762	146.9313	149.3937	168.1952	180.8044	203.1143	(64)
													2039.0733 (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)
Heat gains from water heating, kWh/month	81.4020	72.1193	76.8795	68.1464	66.4520	60.3008	59.7848	61.8979	62.2959	68.9682	72.7399	80.5788	(65)

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

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Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.5564	22.6990	18.4601	13.9755	10.4468	8.8196	9.5299	12.3874	16.6263	21.1109	24.6395	26.2667 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	273.0011	275.8340	268.6952	253.4975	234.3132	216.2826	204.2371	201.4042	208.5430	223.7407	242.9250	260.9556 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453 (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)	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873 (71)
Water heating gains (Table 5)	109.4113	107.3204	103.3327	94.6478	89.3172	83.7511	80.3560	83.1961	86.5221	92.6991	101.0277	108.3048 (72)
Total internal gains	499.4578	497.3423	481.9768	453.6097	425.5661	400.3423	385.6119	388.4766	403.1803	429.0396	460.0812	487.0160 (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				3.6800	40.6744	0.6300	0.7000	0.7700	45.7447 (77)			
Southwest				1.2600	40.6744	0.6300	0.7000	0.7700	15.6626 (79)			
Northwest				1.5300	20.8575	0.6300	0.7000	1.0000	12.6659 (82)			
Solar gains	74.0731	120.2347	175.2888	241.8848	283.7507	309.9116	289.2937	253.8437	209.0567	142.9197	91.8425	62.1877 (83)
Total gains	573.5309	617.5770	657.2656	695.4945	709.3167	710.2538	674.9056	642.3202	612.2370	571.9593	551.9236	549.2037 (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	11.7858	11.9281	11.8574	12.2028	12.2028	12.5237	12.4617	12.5237	12.3986	12.2028	12.2691	12.0672
alpha	1.7857	1.7952	1.7905	1.8135	1.8135	1.8349	1.8308	1.8349	1.8266	1.8135	1.8179	1.8045
util living area	0.9431	0.9329	0.9115	0.8718	0.8090	0.6886	0.5561	0.5807	0.7626	0.8782	0.9268	0.9463 (86)
MIT	16.6665	16.9462	17.6170	18.5364	19.4230	20.2606	20.6816	20.6484	19.9979	18.8629	17.6715	16.6850 (87)
Th 2	19.1060	19.1232	19.1147	19.1555	19.1555	19.1919	19.1850	19.1919	19.1779	19.1555	19.1631	19.1397 (88)
util rest of house	0.9315	0.9192	0.8914	0.8387	0.7480	0.5639	0.3352	0.3645	0.6615	0.8395	0.9092	0.9355 (89)
MIT 2	15.3933	15.6773	16.3334	17.2504	18.0910	18.8409	19.1195	19.1123	18.6336	17.5790	16.4196	15.4300 (90)
Living area fraction	16.1293	16.4109	17.0755	17.9938	18.8610	19.6617	20.0226	20.0003	19.4223	18.3212	17.1433	16.1556 (92)
MIT	16.1293	16.4109	17.0755	17.9938	18.8610	19.6617	20.0226	20.0003	19.4223	18.3212	17.1433	16.1556 (92)
Temperature adjustment	16.1293	16.4109	17.0755	17.9938	18.8610	19.6617	20.0226	20.0003	19.4223	18.3212	17.1433	16.1556 (93)
adjusted MIT	16.1293	16.4109	17.0755	17.9938	18.8610	19.6617	20.0226	20.0003	19.4223	18.3212	17.1433	16.1556 (93)

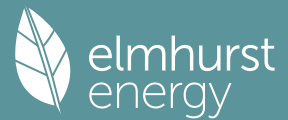
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9043	0.8902	0.8607	0.8107	0.7356	0.6021	0.4510	0.4754	0.6783	0.8157	0.8811	0.9093 (94)
Useful gains	518.6608	549.7592	565.6980	563.8657	521.7936	427.6539	304.3905	305.3274	415.2535	466.5507	486.3168	499.4148 (95)
Ext temp.	4.5000	5.0000	6.9000	9.4000	12.3000	15.3000	17.4000	17.3000	14.7000	11.1000	7.4000	4.5000 (96)
Heat loss rate W	1754.1747	1700.6841	1525.6100	1252.0026	955.8544	619.1544	374.1378	383.3234	677.1108	1052.0331	1411.7949	1717.1256 (97)
Space heating kWh	919.2223	773.4216	714.1745	495.4586	322.9412	0.0000	0.0000	0.0000	0.0000	435.5989	666.3443	905.9769 (98a)
Space heating requirement - total per year (kWh/year)												5233.1383
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	919.2223	773.4216	714.1745	495.4586	322.9412	0.0000	0.0000	0.0000	0.0000	435.5989	666.3443	905.9769 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5233.1383
Space heating per m2										(98c) / (4) =		81.7678 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.1000 (201)
Fraction of space heat from main system(s)												0.9000 (202)
Efficiency of main space heating system 1 (in %)												100.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	919.2223	773.4216	714.1745	495.4586	322.9412	0.0000	0.0000	0.0000	0.0000	435.5989	666.3443	905.9769 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	827.3001	696.0794	642.7571	445.9128	290.6471	0.0000	0.0000	0.0000	0.0000	392.0390	599.7098	815.3792 (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)	91.9222	77.3422	71.4175	49.5459	32.2941	0.0000	0.0000	0.0000	0.0000	43.5599	66.6344	90.5977 (215)
Water heating												
Water heating requirement	205.5903	181.4686	191.9887	166.9893	160.6277	143.3935	140.5762	146.9313	149.3937	168.1952	180.8044	203.1143 (64)
Efficiency of water heater	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												

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	205.5903	181.4686	191.9887	166.9893	160.6277	143.3935	140.5762	146.9313	149.3937	168.1952	180.8044	203.1143	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	22.3694	17.9456	16.1580	11.8380	9.1440	7.4708	8.3415	10.8426	14.0835	18.4783	20.8711	22.9911	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)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	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4709.8245	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												523.3138	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												2039.0733	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												180.5338	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(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												7452.7454	(238)

10a. Fuel costs - using BDEF prices (580)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1 (high-rate cost)	0.0000	0.0000	0.0000 (240)
Space heating - main system 1 (low-rate cost)	4709.8245	20.6900	0.0000 (240)
Total CO2 associated with community systems			0.0000 (473)
Space heating - secondary	523.3138	20.6900	108.2736 (242)
Water heating (high-rate cost)	0.0000	0.0000	0.0000 (245)
Water heating (low-rate cost)	2039.0733	20.6900	421.8843 (246)
Energy for instantaneous electric shower(s)	0.0000	25.7700	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	180.5338	25.7700	46.5236 (250)
Additional standing charges			108.0000 (251)
Total energy cost			1659.1441 (255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1 (high-rate cost)	0.0000	0.0000	0.0000 (261)
Space heating - main system 1 (low-rate cost)	4709.8245	0.1360	0.0000 (261)
Total CO2 associated with community systems			0.0000 (373)
Space heating - secondary	523.3138	0.1536	80.3862 (263)
Water heating (high-rate cost)	0.0000	0.0000	0.0000 (264)
Water heating (low-rate cost)	2039.0733	0.1360	277.3140 (264)
Space and water heating			998.2363 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	180.5338	0.1443	26.0566 (268)
Total CO2, kg/year			1024.2929 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1 (high-rate cost)	0.0000	0.0000	0.0000 (275)
Space heating - main system 1 (low-rate cost)	4709.8245	1.5010	0.0000 (275)
Total CO2 associated with community systems			0.0000 (473)
Space heating - secondary	523.3138	1.5687	820.9238 (277)
Water heating (high-rate cost)	0.0000	0.0000	0.0000 (278)
Water heating (low-rate cost)	2039.0733	1.5010	3060.6490 (278)
Space and water heating			10951.0193 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	180.5338	1.5338	276.9088 (282)
Total Primary energy kWh/year			11227.9281 (286)

SAP 10 EPC IMPROVEMENTS

DH3002

Current energy efficiency rating: E 39
Current environmental impact rating: B 87

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N Solar water heating			Recommended
U Solar photovoltaic panels			Recommended
V2 Wind turbine			Recommended
Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 4.0	-£ 135	-91 kg (8.9%)
U Solar photovoltaic panels	+ 9.5	-£ 248	-237 kg (25.4%)
V2 Wind turbine	+ 22.2	-£ 580	-496 kg (71.2%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£135	1.43 kg/m²	E 43 B 88
Solar photovoltaic panels	£248	3.70 kg/m²	E 53 B 90
Wind turbine	£580	7.75 kg/m²	C 75 A 97
Total Savings	£963	12.87 kg/m²	

Potential energy efficiency rating: C 75
 Potential environmental impact rating: A 97

Fuel prices for cost data on this page from database revision number 580 TEST (07 Sep 2025)
 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	£1659	£1524	£135
Space heating	£1191	£1217	-£26
Water heating	£422	£260	£162
Lighting	£47	£47	£0
Generated (PV)	-£0	-£248	£248
Generated (wind)	-£0	-£580	£580
Total cost of fuels	£1659	£696	£963
Total cost of uses	£1660	£696	£964
Delivered energy	116 kWh/m²	21 kWh/m²	95 kWh/m²
Carbon dioxide emissions	1.0 tonnes	0.2 tonnes	0.8 tonnes
CO2 emissions per m²	16 kg/m²	3 kg/m²	13 kg/m²
Primary energy	175 kWh/m²	67 kWh/m²	108 kWh/m²

SAP 10 WORKSHEET FOR Conversion (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)
Main dwelling	64.0000 (1b)	2.4000 (2b)	153.6000 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.0000		
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 153.6000 (5)

2. Ventilation rate

	m³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

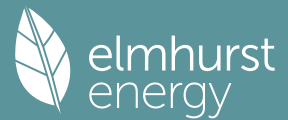
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1953 (8)
Pressure test	No	
Pressure Test Method	Blower Door	
Measured/design AP50	15.0000	(17)
Infiltration rate	0.9453	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.8035 (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	1.0245	1.0044	0.9843	0.8839	0.8638	0.7633	0.7633	0.7433	0.8035	0.8638	0.9040	0.9441 (22b)
Effective ac	1.0245	1.0044	0.9844	0.8906	0.8731	0.7913	0.7913	0.7762	0.8228	0.8731	0.9086	0.9457 (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
Main dwelling							
Doors			3.6100	1.4000	5.0540		(26a)

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Windows				4.9400	1.3258	6.5492	(27)
Rooflights				1.5300	1.3258	2.0284	(27a)
Ground Floor				64.0000	0.2500	16.0000	(28a)
External Wall	85.5000	8.5500		76.9500	0.3000	23.0850	(29a)
External Roof	64.0000	1.5300		62.4700	0.1500	9.3705	(30)
Total net area of external elements Aum(A, m2)				213.5000			(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	62.0872		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)
Thermal bridges (Default value 0.200 * total exposed area)							42.7000 (36)
Point Thermal Bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	104.7872 (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	51.9290	50.9108	49.8988	45.1433	44.2535	40.1116	40.1116	39.3446	41.7070	44.2535	46.0535	47.9352	(38)
Average = Sum(39)m / 12 =	156.7161	155.6979	154.6859	149.9304	149.0407	144.8988	144.8988	144.1318	146.4942	149.0407	150.8406	152.7224	(39)
												149.9249	
HLP (average)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Days in mont	2.4487	2.4328	2.4170	2.3427	2.3288	2.2640	2.2640	2.2521	2.2890	2.3288	2.3569	2.3863	(40)
	31	28	31	30	31	30	31	31	30	31	30	2.3426	
												31	

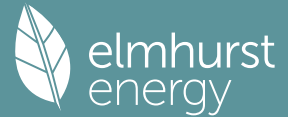
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.0922 (42)
Hot water usage for mixer showers	76.1395	74.9953	73.3279	70.1377	67.7834	65.1579	63.6656	65.3204	67.1343	69.9532	73.2120	75.8478	(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	36.0560	34.7449	33.4338	32.1226	30.8115	29.5004	29.5004	30.8115	32.1226	33.4338	34.7449	36.0560	(42c)
Average daily hot water use (litres/day)												102.9763	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	112.1955	109.7402	106.7617	102.2604	98.5949	94.6583	93.1660	96.1319	99.2569	103.3870	107.9569	111.9038	(44)
Energy content (annual)	177.6903	156.2686	164.0887	139.9893	132.7277	116.3935	112.6762	119.0313	122.3937	140.2952	153.8044	175.2143	(45)
Distribution loss (46)m = 0.15 x (45)m	26.6535	23.4403	24.6133	20.9984	19.9092	17.4590	16.9014	17.8547	18.3591	21.0443	23.0707	26.2822	(46)
Water storage loss:													
Store volume													210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.5000 (48)
Temperature factor from Table 2b													0.6000 (49)
Enter (49) or (54) in (55)													0.9000 (55)
Total storage loss	27.9000	25.2000	27.9000	27.0000	27.9000	27.0000	27.9000	27.9000	27.0000	27.9000	27.0000	27.9000	(56)
If cylinder contains dedicated solar storage	17.9357	16.2000	17.9357	17.3571	17.9357	17.3571	17.9357	17.9357	17.3571	17.9357	17.3571	17.9357	(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	195.6260	172.4686	182.0245	157.3465	150.6635	133.7506	130.6119	136.9671	139.7508	158.2309	171.1615	193.1501	(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)
If combined cylinder, total volume of cylinder													210.0000 (H13)
Effective solar volume													115.5000 (H14)
Reference volume													225.0000 (H15)
Storage tank correction coefficient													1.1814 (H16)
Heat delivered to hot water													609.9165 (H24)
Heat delivered to space heating													0.0000 (H29)
Solar input													609.9165
Solar input	-0.0000	-20.0212	-59.7024	-78.4455	-98.9613	-90.4673	-89.3574	-80.2761	-58.0582	-32.4794	-2.1477	-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	195.6260	152.4474	122.3220	78.9010	51.7022	43.2833	41.2545	56.6909	81.6927	125.7515	169.0138	193.1501	(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	73.4306	64.9193	68.9081	60.4322	58.4805	52.5865	51.8134	53.9265	54.5816	60.9967	65.0257	72.6073	(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	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	25.5564	22.6990	18.4601	13.9755	10.4468	8.8196	9.5299	12.3874	16.6263	21.1109	24.6395	26.2667	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	273.0011	275.8340	268.6952	253.4975	234.3132	216.2826	204.2371	201.4042	208.5430	223.7407	242.9250	260.9556	(68)
Pumps, fans	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	(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)	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	(71)
Total internal gains	98.6970	96.6061	92.6184	83.9336	78.6029	73.0369	69.6417	72.4818	75.8078	81.9848	90.3134	97.5905	(72)
	488.7435	486.6280	471.2626	442.8954	414.8518	389.6280	374.8976	377.7623	392.4660	418.3253	449.3669	476.3017	(73)

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6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast			3.6800	36.7938	0.6300	0.7000	0.7700	41.3804	(77)
Southwest			1.2600	36.7938	0.6300	0.7000	0.7700	14.1683	(79)
Northwest			1.5300	18.0708	0.6300	0.7000	1.0000	10.9736	(82)
Solar gains	66.5223	117.6732	172.5909	233.2699	279.0106	284.7918	271.3241	236.0069	193.4163
Total gains	555.2658	604.3012	643.8535	676.1654	693.8624	674.4198	646.2217	613.7692	585.8823

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	11.3439	11.4181	11.4928	11.8574	11.9281	12.2691	12.2691	12.3344	12.1355	11.9281	11.7858	11.6406
alpha	1.7563	1.7612	1.7662	1.7905	1.7952	1.8179	1.8179	1.8223	1.8090	1.7952	1.7857	1.7760
util living area	0.9475	0.9368	0.9188	0.8856	0.8314	0.7420	0.6408	0.6703	0.8001	0.8933	0.9345	0.9508 (86)
MIT	16.4612	16.7698	17.3850	18.2859	19.1862	20.0260	20.4902	20.4242	19.7718	18.6298	17.4371	16.4550 (87)
Th 2	19.0510	19.0604	19.0698	19.1147	19.1232	19.1631	19.1631	19.1706	19.1476	19.1232	19.1060	19.0882 (88)
util rest of house	0.9367	0.9236	0.9003	0.8561	0.7785	0.6387	0.4617	0.5028	0.7160	0.8599	0.9185	0.9408 (89)
MIT 2	15.1621	15.4710	16.0825	16.9873	17.8541	18.6375	18.9965	18.9630	18.4227	17.3387	16.1599	15.1759 (90)
Living area fraction	15.9132	16.2219	16.8355	17.7380	18.6242	19.4402	19.8600	19.8077	19.2027	18.0852	16.8983	15.9154 (91)
MIT	15.9132	16.2219	16.8355	17.7380	18.6242	19.4402	19.8600	19.8077	19.2027	18.0852	16.8983	15.9154 (92)
Temperature adjustment												0.0000
adjusted MIT	15.9132	16.2219	16.8355	17.7380	18.6242	19.4402	19.8600	19.8077	19.2027	18.0852	16.8983	15.9154 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9102	0.8948	0.8696	0.8267	0.7603	0.6577	0.5413	0.5721	0.7192	0.8341	0.8910	0.9154 (94)
Useful gains	505.4056	540.7276	559.9240	558.9617	527.5586	443.5569	349.7999	351.1375	421.3762	460.0040	472.1048	487.6550 (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	1819.9705	1762.7925	1598.7562	1325.0901	1031.9900	701.3419	472.3766	491.1631	747.5088	1115.5920	1477.9838	1789.2024 (97)
Space heating kWh	978.0363	821.2276	772.8912	551.6125	375.2969	0.0000	0.0000	0.0000	0.0000	487.7575	724.2329	968.3512 (98a)
Space heating requirement - total per year (kWh/year)												5679.4060
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	978.0363	821.2276	772.8912	551.6125	375.2969	0.0000	0.0000	0.0000	0.0000	487.7575	724.2329	968.3512 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5679.4060
Space heating per m2										(98c) / (4) =		88.7407 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.1000 (201)
Fraction of space heat from main system(s)												0.9000 (202)
Efficiency of main space heating system 1 (in %)												100.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	978.0363	821.2276	772.8912	551.6125	375.2969	0.0000	0.0000	0.0000	0.0000	487.7575	724.2329	968.3512 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	880.2327	739.1048	695.6020	496.4512	337.7672	0.0000	0.0000	0.0000	0.0000	438.9817	651.8096	871.5161 (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)	97.8036	82.1228	77.2891	55.1612	37.5297	0.0000	0.0000	0.0000	0.0000	48.7757	72.4233	96.8351 (215)
Water heating												
Water heating requirement	195.6260	152.4474	122.3220	78.9010	51.7022	43.2833	41.2545	56.6909	81.6927	125.7515	169.0138	193.1501 (64)
Efficiency of water heater	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (216)
Fuel for water heating, kWh/month	195.6260	152.4474	122.3220	78.9010	51.7022	43.2833	41.2545	56.6909	81.6927	125.7515	169.0138	193.1501 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	22.3694	17.9456	16.1580	11.8380	9.1440	7.4708	8.3415	10.8426	14.0835	18.4783	20.8711	22.9911 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-31.8517	-44.9642	-64.7790	-72.9325	-78.6321	-73.4066	-72.5094	-68.4729	-61.2520	-51.4874	-35.0395	-27.5247 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	-212.5732	-192.0016	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	-18.2348	-38.6158	-77.5672	-117.8395	-157.0507	-158.3071	-156.1422	-131.3011	-95.2111	-55.3585	-24.3703	-14.3892 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	-91.1028	-82.2864	-91.1028	-88.1640	-91.1028	-88.1640	-91.1028	-88.1640	-91.1028	-88.1640	-91.1028	-91.1028 (234b)

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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												5111.4654	(211)	
Space heating fuel - main system 2												0.0000	(213)	
Space heating fuel - secondary												567.9406	(215)	
Efficiency of water heater												100.0000		
Water heating fuel used												1311.8354	(219)	
Space cooling fuel												0.0000	(221)	
Electricity for pumps and fans:														
pump for solar water heating												80.0000	(230g)	
Total electricity for the above, kWh/year												80.0000	(231)	
Electricity for lighting (calculated in Appendix L)												180.5338	(232)	
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation												-1727.2394	(233)	
Wind generation												-3575.5408	(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												1948.9951	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	0.0000	0.0000	0.0000	(240)
Space heating - main system 1 (low-rate cost)	5111.4654	14.1700	0.0000	(240)
Total CO2 associated with community systems			0.0000	(473)
Space heating - secondary	567.9406	14.1700	80.4772	(242)
Water heating (high-rate cost)	0.0000	0.0000	0.0000	(245)
Water heating (low-rate cost)	1311.8354	14.1700	185.8871	(246)
Energy for instantaneous electric shower(s)	0.0000	17.4100	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	17.4100	13.9280	(249)
Energy for lighting	180.5338	17.4100	31.4309	(250)
Additional standing charges			26.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-682.8519	17.4100	-118.8845	
PV Unit electricity exported	-1044.3875	5.5900	-58.3813	
Total			-177.2658	(252)
Wind Turbine electricity used in dwelling	-2502.8785	14.1700	-354.6579	
Wind Turbine electricity exported	-1072.6622	5.5900	-59.9618	
Total			-414.6197	(252)
Total energy cost			470.1324	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.5527 (257)
SAP value		74.8302
SAP rating (Section 12)		75 (258)
SAP band		C

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 (high-rate cost)	0.0000	0.0000	0.0000	(261)
Space heating - main system 1 (low-rate cost)	5111.4654	0.1360	0.0000	(261)
Total CO2 associated with community systems			0.0000	(373)
Space heating - secondary	567.9406	0.1534	87.1024	(263)
Water heating (high-rate cost)	0.0000	0.0000	0.0000	(264)
Water heating (low-rate cost)	1311.8354	0.1360	178.4096	(264)
Space and water heating			960.6713	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	180.5338	0.1443	26.0566	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-682.8519	0.1346	-91.8849	
PV Unit electricity exported	-1044.3875	0.1256	-131.1969	
Total			-223.0817	(269)
Wind Turbine electricity used in dwelling	-2502.8785	0.1387	-347.1801	
Wind Turbine electricity exported	-1072.6622	0.1387	-148.7915	
Total			-495.9716	(269)
Total CO2, kg/year			278.7716	(272)
CO2 emissions per m2			4.3600	(273)
EI value			96.5729	
EI rating			97	(274)
EI band			A	

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1. Overall dwelling characteristics

Main dwelling	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	64.0000 (1b)	x 2.4000 (2b)	= 153.6000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 153.6000 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour 30.0000 / (5) = 0.1953 (8)
Pressure test	No
Pressure Test Method	Blower Door
Measured/design AP50	15.0000 (17)
Infiltration rate	0.9453 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.8035 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.5000	4.3000	4.4000	3.9000	3.9000	3.4000	3.5000	3.4000	3.6000	3.9000	3.8000	4.1000 (22)
Wind factor	1.1250	1.0750	1.1000	0.9750	0.9750	0.8500	0.8750	0.8500	0.9000	0.9750	0.9500	1.0250 (22a)
Adj infilt rate	0.9040	0.8638	0.8839	0.7834	0.7834	0.6830	0.7031	0.6830	0.7232	0.7834	0.7633	0.8236 (22b)
Effective ac	0.9086	0.8731	0.8906	0.8069	0.8069	0.7332	0.7472	0.7332	0.7615	0.8069	0.7913	0.8392 (25)

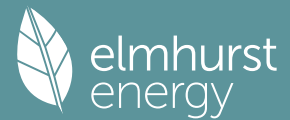
3. Heat losses and heat loss parameter

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					
Main dwelling												
Doors			3.6100	1.4000	5.0540		(26a)					
Windows			4.9400	1.3258	6.5492		(27)					
Rooflights			1.5300	1.3258	2.0284		(27a)					
Ground Floor			64.0000	0.2500	16.0000		(28a)					
External Wall	85.5000	8.5500	76.9500	0.3000	23.0850		(29a)					
External Roof	64.0000	1.5300	62.4700	0.1500	9.3705		(30)					
Total net area of external elements Aum(A, m2)			213.5000				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	62.0872		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)					
Thermal bridges (Default value 0.200 * total exposed area)							42.7000 (36)					
Point Thermal bridges						(36a) =	0.0000					
Total fabric heat loss						(33) + (36) + (36a) =	104.7872 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 46.0535	Feb 44.2535	Mar 45.1433	Apr 40.8991	May 40.8991	Jun 37.1663	Jul 37.8719	Aug 37.1663	Sep 38.5981	Oct 40.8991	Nov 40.1116	Dec 42.5354 (38)
Heat transfer coeff	150.8406	149.0407	149.9304	145.6863	145.6863	141.9534	142.6591	141.9534	143.3852	145.6863	144.8988	147.3226 (39)
Average = Sum(39)m / 12 =												145.7536
HLP	Jan 2.3569	Feb 2.3288	Mar 2.3427	Apr 2.2763	May 2.2763	Jun 2.2180	Jul 2.2290	Aug 2.2180	Sep 2.2404	Oct 2.2763	Nov 2.2640	Dec 2.3019 (40)
HLP (average)												2.2774
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

												2.0922 (42)
Assumed occupancy												
Hot water usage for mixer showers												
	76.1395	74.9953	73.3279	70.1377	67.7834	65.1579	63.6656	65.3204	67.1343	69.9532	73.2120	75.8478 (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												
	36.0560	34.7449	33.4338	32.1226	30.8115	29.5004	29.5004	30.8115	32.1226	33.4338	34.7449	36.0560 (42c)
Average daily hot water use (litres/day)												102.9763 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
	112.1955	109.7402	106.7617	102.2604	98.5949	94.6583	93.1660	96.1319	99.2569	103.3870	107.9569	111.9038 (44)
Energy conte	177.6903	156.2686	164.0887	139.9893	132.7277	116.3935	112.6762	119.0313	122.3937	140.2952	153.8044	175.2143 (45)
Energy content (annual)	Total = Sum(45)m =											1710.5733
Distribution loss (46)m = 0.15 x (45)m												
	26.6535	23.4403	24.6133	20.9984	19.9092	17.4590	16.9014	17.8547	18.3591	21.0443	23.0707	26.2822 (46)
Water storage loss:												
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000 (48)
Temperature factor from Table 2b												0.6000 (49)
Enter (49) or (54) in (55)												0.9000 (55)
Total storage loss												
	27.9000	25.2000	27.9000	27.0000	27.9000	27.0000	27.9000	27.9000	27.0000	27.9000	27.0000	27.9000 (56)
If cylinder contains dedicated solar storage												
	17.9357	16.2000	17.9357	17.3571	17.9357	17.3571	17.9357	17.9357	17.3571	17.9357	17.3571	17.9357 (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)

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Total heat required for water heating calculated for each month												
	195.6260	172.4686	182.0245	157.3465	150.6635	133.7506	130.6119	136.9671	139.7508	158.2309	171.1615	193.1501 (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)
If combined cylinder, total volume of cylinder												210.0000 (H13)
Effective solar volume												115.5000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.1814 (H16)
Heat delivered to hot water												663.3356 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												663.3356
Solar input	-2.5307	-21.7219	-61.9457	-82.4391	-101.0571	-98.3392	-95.4354	-87.5395	-65.2072	-38.3867	-8.7330	-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	193.0953	150.7467	120.0788	74.9074	49.6064	35.4114	35.1765	49.4276	74.5436	119.8442	162.4285	193.1501 (64)
								Total per year (kWh/year) = Sum(64)m =				1258.4163 (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	73.4306	64.9193	68.9081	60.4322	58.4805	52.5865	51.8134	53.9265	54.5816	60.9967	65.0257	72.6073 (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	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.5564	22.6990	18.4601	13.9755	10.4468	8.8196	9.5299	12.3874	16.6263	21.1109	24.6395	26.2667 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	273.0011	275.8340	268.6952	253.4975	234.3132	216.2826	204.2371	201.4042	208.5430	223.7407	242.9250	260.9556 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453 (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)	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873 (71)
Water heating gains (Table 5)	98.6970	96.6061	92.6184	83.9336	78.6029	73.0369	69.6417	72.4818	75.8078	81.9848	90.3134	97.5905 (72)
Total internal gains	488.7435	486.6280	471.2626	442.8954	414.8518	389.6280	374.8976	377.7623	392.4660	418.3253	449.3669	476.3017 (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				3.6800	40.6744		0.6300		0.7000		0.7700	45.7447 (77)
Southwest				1.2600	40.6744		0.6300		0.7000		0.7700	15.6626 (79)
Northwest				1.5300	20.8575		0.6300		0.7000		1.0000	12.6659 (82)
Solar gains	74.0731	120.2347	175.2888	241.8848	283.7507	309.9116	289.2937	253.8437	209.0567	142.9197	91.8425	62.1877 (83)
Total gains	562.8166	606.8627	646.5513	684.7802	698.6025	699.5396	664.1913	631.6060	601.5227	561.2450	541.2093	538.4894 (84)

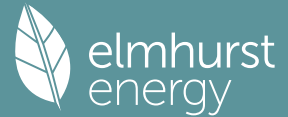
7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												21.0000 (85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	11.7858	11.9281	11.8574	12.2028	12.2028	12.5237	12.4617	12.5237	12.3986	12.2028	12.2691	12.0672
alpha	1.7857	1.7952	1.7905	1.8135	1.8135	1.8349	1.8308	1.8349	1.8266	1.8135	1.8179	1.8045
util living area	0.9447	0.9347	0.9136	0.8745	0.8126	0.6933	0.5615	0.5864	0.7673	0.8814	0.9289	0.9479 (86)
MIT	16.6460	16.9261	17.5982	18.5193	19.4089	20.2511	20.6761	20.6422	19.9857	18.8455	17.6515	16.6641 (87)
Th 2	19.1060	19.1232	19.1147	19.1555	19.1555	19.1919	19.1850	19.1919	19.1779	19.1555	19.1631	19.1397 (88)
util rest of house	0.9334	0.9212	0.8939	0.8419	0.7522	0.5690	0.3396	0.3694	0.6671	0.8434	0.9117	0.9374 (89)
MIT 2	15.3735	15.6581	16.3156	17.2349	18.0794	18.8352	19.1180	19.1105	18.6250	17.5635	16.4005	15.4097 (90)
Living area fraction									FLA = Living area / (4) =			
MIT	16.1092	16.3912	17.0571	17.9775	18.8480	19.6538	20.0188	19.9960	19.4117	18.3046	17.1237	16.1349 (92)
Temperature adjustment												0.0000
adjusted MIT	16.1092	16.3912	17.0571	17.9775	18.8480	19.6538	20.0188	19.9960	19.4117	18.3046	17.1237	16.1349 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9066	0.8926	0.8634	0.8139	0.7394	0.6066	0.4557	0.4804	0.6831	0.8195	0.8840	0.9117 (94)
Useful gains	510.2760	541.6800	558.2133	557.3366	516.5332	424.3205	302.6811	303.3966	410.8734	459.9265	478.4350	490.9303 (95)
Ext temp.	4.5000	5.0000	6.9000	9.4000	12.3000	15.3000	17.4000	17.3000	14.7000	11.1000	7.4000	4.5000 (96)
Heat loss rate W	1751.1316	1697.7474	1522.8579	1249.6187	953.9585	618.0365	373.5947	382.7076	675.5814	1049.6176	1408.9544	1714.0821 (97)
Space heating kWh	923.1966	776.8773	717.6956	498.4431	325.4444	0.0000	0.0000	0.0000	0.0000	438.7302	669.9739	910.0249 (98a)
Space heating requirement - total per year (kWh/year)												5260.3860
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)

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Solar heating contribution - total per year (kWh/year)	0.0000										
Space heating kWh	923.1966	776.8773	717.6956	498.4431	325.4444	0.0000	0.0000	0.0000	0.0000	438.7302	669.9739
Space heating requirement after solar contribution - total per year (kWh/year)											910.0249 (98c)
Space heating per m2											5260.3860
											(98c) / (4) = 82.1935 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.1000 (201)
Fraction of space heat from main system(s)												0.9000 (202)
Efficiency of main space heating system 1 (in %)												100.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	923.1966	776.8773	717.6956	498.4431	325.4444	0.0000	0.0000	0.0000	0.0000	438.7302	669.9739	910.0249 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	830.8769	699.1896	645.9260	448.5988	292.9000	0.0000	0.0000	0.0000	0.0000	394.8572	602.9765	819.0224 (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)	92.3197	77.6877	71.7696	49.8443	32.5444	0.0000	0.0000	0.0000	0.0000	43.8730	66.9974	91.0025 (215)
Water heating												
Water heating requirement	193.0953	150.7467	120.0788	74.9074	49.6064	35.4114	35.1765	49.4276	74.5436	119.8442	162.4285	193.1501 (64)
Efficiency of water heater	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (216)
Fuel for water heating, kWh/month	193.0953	150.7467	120.0788	74.9074	49.6064	35.4114	35.1765	49.4276	74.5436	119.8442	162.4285	193.1501 (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	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	22.3694	17.9456	16.1580	11.8380	9.1440	7.4708	8.3415	10.8426	14.0835	18.4783	20.8711	22.9911 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-34.8266	-45.8954	-65.5908	-74.3188	-79.1580	-75.8588	-74.3485	-70.7103	-63.8528	-54.0422	-38.8028	-29.9244 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	-212.5732	-192.0016	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732 (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	-21.4900	-40.2395	-79.7635	-123.7163	-160.1482	-175.6883	-168.9385	-144.1183	-105.8840	-61.4930	-29.6476	-16.7366 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	-91.1028	-82.2864	-91.1028	-88.1640	-91.1028	-88.1640	-91.1028	-91.1028	-88.1640	-91.1028	-88.1640	-91.1028 (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												4734.3474 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												526.0386 (215)
Efficiency of water heater												100.0000
Water heating fuel used												1258.4163 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
pump for solar water heating												80.0000 (230g)
Total electricity for the above, kWh/year												80.0000 (231)
Electricity for lighting (calculated in Appendix L)												180.5338 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1835.1931 (233)
Wind generation												-3575.5408 (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												1368.6023 (238)

10a. Fuel costs - using BEDF prices (580)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1 (high-rate cost)	0.0000	0.0000	0.0000 (240)
Space heating - main system 1 (low-rate cost)	4734.3474	20.6900	0.0000 (240)
Total CO2 associated with community systems			0.0000 (473)
Space heating - secondary	526.0386	20.6900	108.8374 (242)
Water heating (high-rate cost)	0.0000	0.0000	0.0000 (245)
Water heating (low-rate cost)	1258.4163	20.6900	260.3663 (246)
Energy for instantaneous electric shower(s)	0.0000	25.7700	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	25.7700	20.6160 (249)
Energy for lighting	180.5338	25.7700	46.5236 (250)
Additional standing charges			108.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-707.3293	25.7700	-182.2788
PV Unit electricity exported	-1127.8638	5.8100	-65.5289
Total			-247.8076 (252)
Wind Turbine electricity used in dwelling	-2502.8785	20.6900	-517.8456
Wind Turbine electricity exported	-1072.6622	5.8100	-62.3217
Total			-580.1672 (252)
Total energy cost			695.9049 (255)

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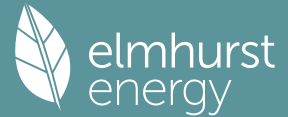
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1 (high-rate cost)	0.0000	0.0000	0.0000 (261)
Space heating - main system 1 (low-rate cost)	4734.3474	0.1360	0.0000 (261)
Total CO2 associated with community systems			0.0000 (373)
Space heating - secondary	526.0386	0.1536	80.7992 (263)
Water heating (high-rate cost)	0.0000	0.0000	0.0000 (264)
Water heating (low-rate cost)	1258.4163	0.1360	171.1446 (264)
Space and water heating			895.8151 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	180.5338	0.1443	26.0566 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-707.3293	0.1347	-95.2838
PV Unit electricity exported	-1127.8638	0.1254	-141.4130
Total			-236.6968 (269)
Wind Turbine electricity used in dwelling	-2502.8785	0.1387	-347.1801
Wind Turbine electricity exported	-1072.6622	0.1387	-148.7915
Total			-495.9716 (269)
Total CO2, kg/year			200.3003 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1 (high-rate cost)	0.0000	0.0000	0.0000 (275)
Space heating - main system 1 (low-rate cost)	4734.3474	1.5010	0.0000 (275)
Total CO2 associated with community systems			0.0000 (473)
Space heating - secondary	526.0386	1.5687	825.1776 (277)
Water heating (high-rate cost)	0.0000	0.0000	0.0000 (278)
Water heating (low-rate cost)	1258.4163	1.5010	1888.8829 (278)
Space and water heating			9820.3160 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	180.5338	1.5338	276.9088 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-707.3293	1.4979	-1059.4788
PV Unit electricity exported	-1127.8638	0.4602	-518.9902
Total			-1578.4689 (283)
Wind Turbine electricity used in dwelling	-2502.8785	1.5128	-3786.3546
Wind Turbine electricity exported	-1072.6622	0.5128	-550.0612
Total			-4336.4158 (283)
Total Primary energy kWh/year			4303.3640 (286)

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Property Reference	DH3001			Issued on Date	25/09/2025
Assessment Reference	DH3003	Prop Type Ref	DH-30		
Property	1 Bed Dwelling, Welwyn Equestrian Centre, Pottersheath Road, Codicote, Welwyn, AL6 9SZ				
SAP Rating	55 D	DER	16.98	TER	
Environmental	87 B	% DER < TER			N/A
CO ₂ Emissions (t/year)	1.01	DFEE	91.41	TFEE	
Compliance Check	N/A	% DFEE < TFEE			
% DPER < TPER		DPER	187.24	TPER	
Assessor Details	Mr. Joe Solti			Assessor ID	5122-0001
Client	Phillips Planning Services Ltd, .				

SAP 10 WORKSHEET FOR Conversion (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)
Main dwelling	64.0000 (1b)	2.4000 (2b)	153.6000 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.0000		153.6000 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	153.6000 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1953 (8)
Pressure test	No
Pressure Test Method	Blower Door
Measured/design AP50	15.0000 (17)
Infiltration rate	0.9453 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.8035 (21)

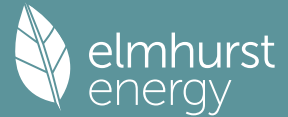
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	1.0245	1.0044	0.9843	0.8839	0.8638	0.7633	0.7633	0.7433	0.8035	0.8638	0.9040	0.9441 (22b)
Effective ac	1.0245	1.0044	0.9844	0.8906	0.8731	0.7913	0.7913	0.7762	0.8228	0.8731	0.9086	0.9457 (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
Main dwelling							
Doors			3.6100	1.4000	5.0540		(26a)
Windows			4.9400	1.3258	6.5492		(27)
Rooflights			1.5300	1.3258	2.0284		(27a)
Ground Floor			64.0000	0.2500	16.0000		(28a)
External Wall	85.5000	8.5500	76.9500	0.3000	23.0850		(29a)
External Roof	64.0000	1.5300	62.4700	0.1500	9.3705		(30)
Total net area of external elements Aum(A, m ²)			213.5000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	62.0872		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Default value 0.200 * total exposed area)							42.7000 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	104.7872 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	51.9290	50.9108	49.8988	45.1433	44.2535	40.1116	40.1116	39.3446	41.7070	44.2535	46.0535	47.9352 (38)
Heat transfer coeff	156.7161	155.6979	154.6859	149.9304	149.0407	144.8988	144.8988	144.1318	146.4942	149.0407	150.8406	152.7224 (39)
Average = Sum(39)m / 12 =												149.9249

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HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	2.4487	2.4328	2.4170	2.3427	2.3288	2.2640	2.2640	2.2521	2.2890	2.3288	2.3569	2.3863	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.0922 (42)
Hot water usage for mixer showers	66.6221	65.6209	64.1619	61.3705	59.3105	57.0132	55.7074	57.1553	58.7425	61.2091	64.0605	66.3668	(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	36.0560	34.7449	33.4338	32.1226	30.8115	29.5004	29.5004	30.8115	32.1226	33.4338	34.7449	36.0560	(42c)
Average daily hot water use (litres/day)												94.2015	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	102.6781	100.3658	97.5957	93.4931	90.1220	86.5136	85.2078	87.9668	90.8651	94.6429	98.8054	102.4228	(44)
Energy content (annual)	162.6170	142.9195	150.0010	127.9874	121.3216	106.3785	103.0515	108.9213	112.0458	128.4295	140.7664	160.3694	(45)
Distribution loss (46)m = 0.15 x (45)m	24.3926	21.4379	22.5001	19.1981	18.1982	15.9568	15.4577	16.3382	16.8069	19.2644	21.1150	24.0554	(46)
Water storage loss:													
Store volume													210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.5000 (48)
Temperature factor from Table 2b													0.6000 (49)
Enter (49) or (54) in (55)													0.9000 (55)
Total storage loss	27.9000	25.2000	27.9000	27.0000	27.9000	27.0000	27.9000	27.9000	27.0000	27.9000	27.0000	27.9000	(56)
If cylinder contains dedicated solar storage	27.9000	25.2000	27.9000	27.0000	27.9000	27.0000	27.9000	27.9000	27.0000	27.9000	27.0000	27.9000	(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	190.5170	168.1195	177.9010	154.9874	149.2216	133.3785	130.9515	136.8213	139.0458	156.3295	167.7664	188.2694	(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	190.5170	168.1195	177.9010	154.9874	149.2216	133.3785	130.9515	136.8213	139.0458	156.3295	167.7664	188.2694	(64)
12Total per year (kWh/year)													1893.3089 (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	76.3902	67.6807	72.1953	64.1558	62.6594	56.9709	56.5846	58.5363	58.8552	65.0228	68.4048	75.6428	(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	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	105.2215	116.4952	105.2215	108.7289	105.2215	108.7289	105.2215	105.2215	108.7289	105.2215	108.7289	105.2215	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	182.9108	184.8088	180.0258	169.8433	156.9898	144.9093	136.8388	134.9408	139.7238	149.9062	162.7598	174.8402	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	(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)	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	(71)
Water heating gains (Table 5)	102.6749	100.7154	97.0367	89.1053	84.2196	79.1262	76.0546	78.6779	81.7434	87.3962	95.0067	101.6705	(72)
Total internal gains	445.1899	456.4021	436.6667	422.0602	400.8137	387.1471	372.4976	373.2229	384.5787	396.9067	420.8780	436.1149	(73)

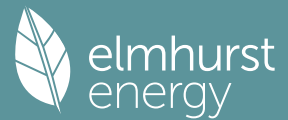
6. Solar gains

[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				3.6800	36.7938		0.6300		0.7000		0.7700		41.3804 (77)
Southwest				1.2600	36.7938		0.6300		0.7000		0.7700		14.1683 (79)
Northwest				1.5300	18.0708		0.6300		0.7000		1.0000		10.9736 (82)
Solar gains	66.5223	117.6732	172.5909	233.2699	279.0106	284.7918	271.3241	236.0069	193.4163	133.1775	80.4726		56.4154 (83)
Total gains	511.7122	574.0753	609.2576	655.3302	679.8243	671.9389	643.8217	609.2297	577.9951	530.0842	501.3506		492.5303 (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	11.3439	11.4181	11.4928	11.8574	11.9281	12.2691	12.2691	12.3344	12.1355	11.9281	11.7858	11.6406	
alpha	1.7563	1.7612	1.7662	1.7905	1.7952	1.8179	1.8179	1.8223	1.8090	1.7952	1.7857	1.7760	
util living area	0.9537	0.9415	0.9251	0.8904	0.8358	0.7430	0.6420	0.6726	0.8033	0.8991	0.9398	0.9565	(86)
MIT	17.1667	17.4354	17.9236	18.6675	19.3997	20.0865	20.4586	20.4044	19.8766	18.9415	17.9728	17.1666	(87)
Th 2	19.0510	19.0604	19.0698	19.1147	19.1232	19.1631	19.1631	19.1706	19.1476	19.1232	19.1060	19.0882	(88)
util rest of house	0.9440	0.9291	0.9078	0.8619	0.7837	0.6399	0.4629	0.5053	0.7200	0.8671	0.9249	0.9475	(89)

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MIT 2	14.9283	15.2611	15.8650	16.7907	17.6711	18.4693	18.8299	18.7955	18.2484	17.1399	15.9452	14.9404 (90)
Living area fraction									FLA = Living area / (4) =			0.5781 (91)
MIT	16.2224	16.5181	17.0551	17.8757	18.6704	19.4042	19.7715	19.7257	19.1897	18.1814	17.1174	16.2275 (92)
Temperature adjustment												0.0000
adjusted MIT	16.2224	16.5181	17.0551	17.8757	18.6704	19.4042	19.7715	19.7257	19.1897	18.1814	17.1174	16.2275 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9232	0.9056	0.8824	0.8366	0.7675	0.6565	0.5333	0.5664	0.7224	0.8449	0.9023	0.9275	(94)
Useful gains	472.3903	519.8824	537.6070	548.2536	521.7766	441.1153	343.3646	345.0789	417.5636	447.8554	452.3695	456.8036	(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	1868.4302	1808.9136	1632.7322	1345.7337	1038.8775	696.1273	459.5425	479.3334	745.6152	1129.9394	1511.0350	1836.8621	(97)
Space heating kWh	1038.6537	866.2289	814.7731	574.1857	384.7231	0.0000	0.0000	0.0000	0.0000	507.4705	762.2391	1026.7635	(98a)
Space heating requirement - total per year (kWh/year)												5975.0377	
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	1038.6537	866.2289	814.7731	574.1857	384.7231	0.0000	0.0000	0.0000	0.0000	507.4705	762.2391	1026.7635	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5975.0377	
Space heating per m2										(98c) / (4) =		93.3600	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.1000 (201)
Fraction of space heat from main system(s)													0.9000 (202)
Efficiency of main space heating system 1 (in %)													100.0000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													100.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1038.6537	866.2289	814.7731	574.1857	384.7231	0.0000	0.0000	0.0000	0.0000	507.4705	762.2391	1026.7635	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	934.7883	779.6060	733.2958	516.7671	346.2508	0.0000	0.0000	0.0000	0.0000	456.7234	686.0152	924.0872	(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)	103.8654	86.6229	81.4773	57.4186	38.4723	0.0000	0.0000	0.0000	0.0000	50.7470	76.2239	102.6764	(215)
Water heating requirement	190.5170	168.1195	177.9010	154.9874	149.2216	133.3785	130.9515	136.8213	139.0458	156.3295	167.7664	188.2694	(64)
Efficiency of water heater (217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(216)
Fuel for water heating, kWh/month	190.5170	168.1195	177.9010	154.9874	149.2216	133.3785	130.9515	136.8213	139.0458	156.3295	167.7664	188.2694	(217)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(219)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Lighting	22.3694	17.9456	16.1580	11.8380	9.1440	7.4708	8.3415	10.8426	14.0835	18.4783	20.8711	22.9911	(221)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
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	(231)
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	(231)
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	(231)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
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	(231)
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	(231)
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	(231)
Annual totals kWh/year													
Space heating fuel - main system 1													5377.5339 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													597.5038 (215)
Efficiency of water heater													100.0000
Water heating fuel used													1893.3089 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year													0.0000 (231)
Electricity for lighting (calculated in Appendix L)													180.5338 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													0.0000 (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													8048.8804 (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 (high-rate cost)	0.0000	0.0000	0.0000 (261)	
Space heating - main system 1 (low-rate cost)	5377.5339	0.1352	726.9873 (261)	

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Total CO2 associated with community systems			0.0000 (373)
Space heating - secondary	597.5038	0.1610	96.2113 (263)
Water heating - high rate cost	56.4630	0.1480	8.3592 (264)
Water heating - low rate cost	1836.8459	0.1243	228.2323 (264)
Space and water heating			1059.7900 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	180.5338	0.1490	26.9031 (268)
Total CO2, kg/year			1086.6932 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			16.9800 (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 (high-rate cost)	0.0000	0.0000	0.0000 (275)
Space heating - main system 1 (low-rate cost)	5377.5339	1.4886	8005.1083 (275)
Total CO2 associated with community systems			0.0000 (473)
Space heating - secondary	597.5038	1.6006	956.3713 (277)
Water heating - high rate cost	56.4630	1.5534	87.7088 (278)
Water heating - low rate cost	1836.8459	1.4447	2653.6918 (278)
Space and water heating			11702.8803 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	180.5338	1.5547	280.6840 (282)
Total Primary energy kWh/year			11983.5643 (286)
Dwelling Primary energy Rate (DPER)			187.2400 (287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling	64.0000 (1b)	x 2.4000 (2b)	= 153.6000 (1b) - (3b)
Ground floor			(4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.0000		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 153.6000 (5)
Dwelling volume			

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	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) = 0.1302 (8)
Pressure test	No
Pressure Test Method	Blower Door
Measured/design AP50	15.0000 (17)
Infiltration rate	0.8802 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.7482 (21)
Wind speed	Jan 5.1000 Feb 5.0000 Mar 4.9000 Apr 4.4000 May 4.3000 Jun 3.8000 Jul 3.8000 Aug 3.7000 Sep 4.0000 Oct 4.3000 Nov 4.5000 Dec 4.7000 (22)
Wind factor	1.2750 1.2500 1.2250 1.1000 1.0750 0.9500 0.9500 0.9250 1.0000 1.0750 1.1250 1.1750 (22a)
Adj infilt rate	0.9539 0.9352 0.9165 0.8230 0.8043 0.7108 0.7108 0.6921 0.7482 0.8043 0.8417 0.8791 (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	0.9550 0.9373 0.9200 0.8387 0.8234 0.7526 0.7526 0.7395 0.7799 0.8234 0.8542 0.8864 (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
Main dwelling							
Doors			3.6100	1.4000	5.0540		(26a)
Windows			4.9400	1.3258	6.5492		(27)
Rooflights			1.5300	1.3258	2.0284		(27a)
Ground Floor			64.0000	0.2500	16.0000		(28a)
External Wall	85.5000	8.5500	76.9500	0.3000	23.0850		(29a)
External Roof	64.0000	1.5300	62.4700	0.1500	9.3705		(30)
Total net area of external elements Aum (A, m2)			213.5000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		62.0872		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)
Thermal bridges (Default value 0.200 * total exposed area)							42.7000 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	104.7872 (37)

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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	48.4064	47.5109	46.6330	42.5100	41.7386	38.1476	38.1476	37.4826	39.5308	41.7386	43.2991	44.9306	(38)
Heat transfer coeff	153.1935	152.2980	151.4202	147.2972	146.5258	142.9347	142.9347	142.2697	144.3179	146.5258	148.0863	149.7178	(39)
Average = Sum(39)m / 12 =												147.2935	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.3936	2.3797	2.3659	2.3015	2.2895	2.2334	2.2334	2.2230	2.2550	2.2895	2.3138	2.3393	(40)
HLP (average)												2.3015	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.0922	(42)
Hot water usage for mixer showers														(42a)
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		
Hot water usage for baths														(42b)
25.6236	25.2430	24.7071	23.7191	22.9792	22.1588	21.7157	22.2478	22.8272	23.7051	24.7135	25.5369			
Hot water usage for other uses														(42c)
36.0560	34.7449	33.4338	32.1226	30.8115	29.5004	29.5004	30.8115	32.1226	33.4338	34.7449	36.0560			
Average daily hot water use (litres/day)													56.5353	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	61.6796	59.9879	58.1409	55.8417	53.7907	51.6592	51.2160	53.0593	54.9498	57.1388	59.4584	61.5930	(44)	
Energy conte	97.6854	85.4220	89.3604	76.4445	72.4126	63.5210	61.9414	65.6985	67.7587	77.5368	84.7094	96.4397	(45)	
Energy content (annual)													938.9304	
Distribution loss (46)m = 0.15 x (45)m														
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)	
Water storage loss:														
Total storage loss														
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)	
If cylinder contains dedicated solar storage														
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)	
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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														
83.0326	72.6087	75.9563	64.9778	61.5507	53.9928	52.6502	55.8437	57.5949	65.9063	72.0030	81.9738	(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	83.0326	72.6087	75.9563	64.9778	61.5507	53.9928	52.6502	55.8437	57.5949	65.9063	72.0030	81.9738	(64)	
12Total per year (kWh/year)													798.0908	(64)
Electric shower(s)	47.4883	42.3125	46.2036	44.0915	44.9189	42.8483	44.2765	44.9189	44.0915	46.2036	45.3348	47.4883	(64a)	
													540.1766	(64a)
Heat gains from water heating, kWh/month														
32.6302	28.7303	30.5400	27.2673	26.6174	24.2103	24.2317	25.1907	25.4216	28.0275	29.3344	32.3655	(65)		

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

Metabolic gains (Table 5), Watts														
(66)m	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	(66)	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5														
105.2215	116.4952	105.2215	108.7289	105.2215	108.7289	105.2215	108.7289	105.2215	108.7289	105.2215	108.7289	105.2215	(67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5														
182.9108	184.8088	180.0258	169.8433	156.9898	144.9093	136.8388	134.9408	139.7238	149.9062	162.7598	174.8402	(68)		
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5														
33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	(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)														
-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	(71)	
Water heating gains (Table 5)														
43.8578	42.7534	41.0484	37.8713	35.7761	33.6254	32.5695	33.8584	35.3078	37.6713	40.7423	43.5020	(72)		
Total internal gains	386.3728	398.4401	380.6783	370.8262	352.3701	341.6463	329.0125	328.4034	338.1431	347.1818	366.6136	377.9465	(73)	

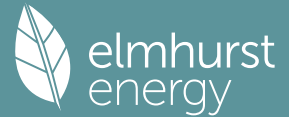
6. Solar gains

[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						3.6800	36.7938	0.6300	0.7000			0.7700	41.3804 (77)				
Southwest						1.2600	36.7938	0.6300	0.7000			0.7700	14.1683 (79)				
Northwest						1.5300	18.0708	0.6300	0.7000			1.0000	10.9736 (82)				
Solar gains						66.5223	117.6732	172.5909	233.2699	279.0106	284.7918	271.3241	236.0069	193.4163	133.1775	80.4726	56.4154 (83)
Total gains						452.8951	516.1133	553.2693	604.0961	631.3807	626.4381	600.3366	564.4103	531.5595	480.3593	447.0862	434.3619 (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	11.6048	11.6730	11.7407	12.0693	12.1329	12.4377	12.4377	12.4958	12.3185	12.1329	12.0050	11.8742		
alpha	1.7737	1.7782	1.7827	1.8046	1.8089	1.8292	1.8292	1.8331	1.8212	1.8089	1.8003	1.7916		
util living area	0.9615	0.9499	0.9345	0.9014	0.8492	0.7601	0.6615	0.6938	0.8209	0.9117	0.9492	0.9642	(86)	
MIT	16.3238	16.6625	17.2749	18.2051	19.1275	19.9910	20.4667	20.3936	19.7207	18.5399	17.3225	16.3141	(87)	

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Th 2	19.0838	19.0922	19.1005	19.1399	19.1473	19.1823	19.1823	19.1888	19.1688	19.1473	19.1323	19.1167 (88)
util rest of house	0.9534	0.9392	0.9193	0.8754	0.8005	0.6608	0.4847	0.5297	0.7426	0.8832	0.9365	0.9567 (89)
MIT 2	15.0462	15.3850	15.9951	16.9282	17.8201	18.6279	19.0026	18.9632	18.3987	17.2711	16.0645	15.0537 (90)
Living area fraction									fLA = Living area / (4) =			0.5781 (91)
MIT	15.7848	16.1235	16.7350	17.6664	18.5759	19.4160	19.8490	19.7901	19.1629	18.0046	16.7918	15.7824 (92)
Temperature adjustment												0.0000
adjusted MIT	15.7848	16.1235	16.7350	17.6664	18.5759	19.4160	19.8490	19.7901	19.1629	18.0046	16.7918	15.7824 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9315	0.9139	0.8913	0.8467	0.7807	0.6766	0.5615	0.5953	0.7423	0.8580	0.9123	0.9359	(94)
Useful gains	421.8779	471.6798	493.1341	511.4756	492.8950	423.8351	337.0685	335.9703	394.5847	412.1258	407.8880	406.5208	(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	1759.3978	1709.3228	1549.7808	1291.2624	1007.5021	688.3690	464.4021	482.3126	730.6727	1084.9668	1435.2189	1734.0855	(97)
Space heating kWh	995.1148	831.6961	786.1451	561.4465	382.8677	0.0000	0.0000	0.0000	0.0000	500.5937	739.6782	987.7081	(98a)
Space heating requirement - total per year (kWh/year)												5785.2502	
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	995.1148	831.6961	786.1451	561.4465	382.8677	0.0000	0.0000	0.0000	0.0000	500.5937	739.6782	987.7081	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5785.2502	
Space heating per m2										(98c) / (4) =		90.3945	(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	1343.5864	1057.7170	1081.2499	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.4152	0.4787	0.4527	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	557.8477	506.3280	489.5264	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	665.5103	638.6017	602.2970	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	77.5171	98.4116	83.9014	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction													
Intermittency factor (Table 10b)									fC = cooled area / (4) =			1.0000	(105)
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	19.3793	24.6029	20.9753	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement													64.9575 (107)
Energy for space heating													90.3945 (99)
Energy for space cooling													1.0150 (108)
Total													91.4095 (109)
Fabric Energy Efficiency (DFEE)													91.4 (109)

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

1. Overall dwelling characteristics

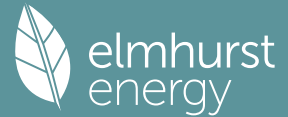
	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling	64.0000 (1b)	x 2.4000 (2b)	= 153.6000 (1b) - (3b)	
Ground floor				
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.0000			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	153.6000 (5)	

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1953 (8)
Pressure test	No	
Pressure Test Method	Blower Door	
Measured/design AP50	15.0000	(17)
Infiltration rate	0.9453	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.8035 (21)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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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												
	1.0245	1.0044	0.9843	0.8839	0.8638	0.7633	0.7633	0.7433	0.8035	0.8638	0.9040	0.9441 (22b)
Effective ac	1.0245	1.0044	0.9844	0.8906	0.8731	0.7913	0.7913	0.7762	0.8228	0.8731	0.9086	0.9457 (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	
Main dwelling								
Doors			3.6100	1.4000	5.0540			(26a)
Windows			4.9400	1.3258	6.5492			(27)
Rooflights			1.5300	1.3258	2.0284			(27a)
Ground Floor			64.0000	0.2500	16.0000			(28a)
External Wall	85.5000	8.5500	76.9500	0.3000	23.0850			(29a)
External Roof	64.0000	1.5300	62.4700	0.1500	9.3705			(30)
Total net area of external elements Aum(A, m2)			213.5000					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	62.0872		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								100.0000 (35)
Thermal bridges (Default value 0.200 * total exposed area)								42.7000 (36)
Point Thermal bridges						(36a) =		0.0000
Total fabric heat loss						(33) + (36) + (36a) =		104.7872 (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	51.9290	50.9108	49.8988	45.1433	44.2535	40.1116	40.1116	39.3446	41.7070	44.2535	46.0535	47.9352	(38)
Heat transfer coeff	156.7161	155.6979	154.6859	149.9304	149.0407	144.8988	144.8988	144.1318	146.4942	149.0407	150.8406	152.7224	(39)
Average = Sum(39)m / 12 =													149.9249

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.4487	2.4328	2.4170	2.3427	2.3288	2.2640	2.2640	2.2521	2.2890	2.3288	2.3569	2.3863	(40)
HLP (average)													2.3426
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

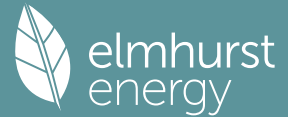
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.0922 (42)
Hot water usage for mixer showers	66.6221	65.6209	64.1619	61.3705	59.3105	57.0132	55.7074	57.1553	58.7425	61.2091	64.0605	66.3668	(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	36.0560	34.7449	33.4338	32.1226	30.8115	29.5004	29.5004	30.8115	32.1226	33.4338	34.7449	36.0560	(42c)
Average daily hot water use (litres/day)													94.2015 (43)
Daily hot water use	102.6781	100.3658	97.5957	93.4931	90.1220	86.5136	85.2078	87.9668	90.8651	94.6429	98.8054	102.4228	(44)
Energy content	162.6170	142.9195	150.0010	127.9874	121.3216	106.3785	103.0515	108.9213	112.0458	128.4295	140.7664	160.3694	(45)
Energy content (annual)										Total = Sum(45)m =			1564.8089
Distribution loss (46)m = 0.15 x (45)m	24.3926	21.4379	22.5001	19.1981	18.1982	15.9568	15.4577	16.3382	16.8069	19.2644	21.1150	24.0554	(46)
Water storage loss:													
Store volume													210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.5000 (48)
Temperature factor from Table 2b													0.6000 (49)
Enter (49) or (54) in (55)													0.9000 (55)
Total storage loss	27.9000	25.2000	27.9000	27.0000	27.9000	27.0000	27.9000	27.9000	27.0000	27.9000	27.0000	27.9000	(56)
If cylinder contains dedicated solar storage	27.9000	25.2000	27.9000	27.0000	27.9000	27.0000	27.9000	27.9000	27.0000	27.9000	27.0000	27.9000	(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	190.5170	168.1195	177.9010	154.9874	149.2216	133.3785	130.9515	136.8213	139.0458	156.3295	167.7664	188.2694	(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	190.5170	168.1195	177.9010	154.9874	149.2216	133.3785	130.9515	136.8213	139.0458	156.3295	167.7664	188.2694	(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	76.3902	67.6807	72.1953	64.1558	62.6594	56.9709	56.5846	58.5363	58.8552	65.0228	68.4048	75.6428	(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	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.5564	22.6990	18.4601	13.9755	10.4468	8.8196	9.5299	12.3874	16.6263	21.1109	24.6395	26.2667	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	273.0011	275.8340	268.6952	253.4975	234.3132	216.2826	204.2371	201.4042	208.5430	223.7407	242.9250	260.9556	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	(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)	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	(71)
Water heating gains (Table 5)	102.6749	100.7154	97.0367	89.1053	84.2196	79.1262	76.0546	78.6779	81.7434	87.3962	95.0067	101.6705	(72)
Total internal gains	492.7214	490.7373	475.6809	448.0672	420.4685	395.7174	381.3105	383.9583	398.4016	423.7367	454.0602	480.3817	(73)

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6. Solar gains

[Jan]	Area				Solar flux	g		FF	Access		Gains	
	m2				Table 6a	Specific data		Specific data	factor		W	
					W/m2	or Table 6b		or Table 6c	Table 6d			
Southeast	3.6800				36.7938	0.6300		0.7000	0.7700		41.3804 (77)	
Southwest	1.2600				36.7938	0.6300		0.7000	0.7700		14.1683 (79)	
Northwest	1.5300				18.0708	0.6300		0.7000	1.0000		10.9736 (82)	
Solar gains	66.5223	117.6732	172.5909	233.2699	279.0106	284.7918	271.3241	236.0069	193.4163	133.1775	80.4726	56.4154 (83)
Total gains	559.2437	608.4105	648.2718	681.3371	699.4791	680.5091	652.6346	619.9652	591.8179	556.9142	534.5327	536.7971 (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	11.3439	11.4181	11.4928	11.8574	11.9281	12.2691	12.2691	12.3344	12.1355	11.9281	11.7858	11.6406
alpha	1.7563	1.7612	1.7662	1.7905	1.7952	1.8179	1.8179	1.8223	1.8090	1.7952	1.7857	1.7760
util living area												
	0.9469	0.9362	0.9180	0.8843	0.8297	0.7394	0.6376	0.6671	0.7976	0.8918	0.9336	0.9502 (86)
MIT	17.2389	17.4861	17.9787	18.7015	19.4215	20.0937	20.4636	20.4114	19.8907	18.9774	18.0225	17.2355 (87)
Th 2	19.0510	19.0604	19.0698	19.1147	19.1232	19.1631	19.1631	19.1706	19.1476	19.1232	19.1060	19.0882 (88)
util rest of house												
	0.9360	0.9228	0.8994	0.8546	0.7765	0.6358	0.4585	0.4995	0.7131	0.8580	0.9175	0.9401 (89)
MIT 2	15.0156	15.3220	15.9303	16.8296	17.6943	18.4754	18.8327	18.7997	18.2617	17.1807	16.0046	15.0241 (90)
Living area fraction	fLA = Living area / (4) =											0.5781 (91)
MIT	16.3009	16.5731	17.1146	17.9118	18.6928	19.4110	19.7756	19.7315	19.2034	18.2194	17.1712	16.3025 (92)
Temperature adjustment												0.0000
adjusted MIT	16.3009	16.5731	17.1146	17.9118	18.6928	19.4110	19.7756	19.7315	19.2034	18.2194	17.1712	16.3025 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9134	0.8982	0.8731	0.8292	0.7608	0.6529	0.5292	0.5611	0.7163	0.8358	0.8938	0.9184 (94)
Useful gains	510.8388	546.4930	565.9778	564.9804	532.1663	444.2884	345.3779	347.8904	423.9196	465.4557	477.7876	493.0050 (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	1880.7409	1817.4808	1641.9247	1351.1393	1042.2176	697.1043	460.1361	480.1689	747.6214	1135.6063	1519.1422	1848.3283 (97)
Space heating kWh	1019.2071	854.1038	800.5045	566.0344	379.4782	0.0000	0.0000	0.0000	0.0000	498.5921	749.7753	1008.3606 (98a)
Space heating requirement - total per year (kWh/year)												5876.0560
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	1019.2071	854.1038	800.5045	566.0344	379.4782	0.0000	0.0000	0.0000	0.0000	498.5921	749.7753	1008.3606 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5876.0560
Space heating per m2	(98c) / (4) =											91.8134 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.1000 (201)
Fraction of space heat from main system(s)												0.9000 (202)
Efficiency of main space heating system 1 (in %)												100.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1019.2071	854.1038	800.5045	566.0344	379.4782	0.0000	0.0000	0.0000	0.0000	498.5921	749.7753	1008.3606 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	917.2864	768.6934	720.4540	509.4310	341.5304	0.0000	0.0000	0.0000	0.0000	448.7329	674.7978	907.5245 (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)	101.9207	85.4104	80.0504	56.6034	37.9478	0.0000	0.0000	0.0000	0.0000	49.8592	74.9775	100.8361 (215)
Water heating												
Water heating requirement	190.5170	168.1195	177.9010	154.9874	149.2216	133.3785	130.9515	136.8213	139.0458	156.3295	167.7664	188.2694 (64)
Efficiency of water heater	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (216)
Fuel for water heating, kWh/month	190.5170	168.1195	177.9010	154.9874	149.2216	133.3785	130.9515	136.8213	139.0458	156.3295	167.7664	188.2694 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	22.3694	17.9456	16.1580	11.8380	9.1440	7.4708	8.3415	10.8426	14.0835	18.4783	20.8711	22.9911 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)

elmhurst
energy

Electricity for pumps and fans:	0.0000	(231)
Total electricity for the above, kWh/year		
Electricity for lighting (calculated in Appendix L)	180.5338	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(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	7949.8987	(238)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1 (high-rate cost)	0.0000	9.4000	0.0000 (240)
Space heating - main system 1 (low-rate cost)	5288.4504	0.0940	497.1143 (240)
Total CO2 associated with community systems			0.0000 (473)
Space heating - secondary (1.00*19.60 + 0.00*9.40)	587.6056	19.6000	115.1707 (242)
Water heating (electric off-peak tariff)			
High-rate fraction			0.0298 (243)
Low-rate fraction			0.9702 (244)
High-rate cost	56.4630	19.6000	11.0667 (245)
Low-rate cost	1836.8459	9.4000	172.6635 (246)
Energy for instantaneous electric shower(s)	0.0000	18.5800	0.0000 (247a)
Pumps, fans and electric keep-hot (0.90*19.60 + 0.10*9.40)	0.0000	0.0000	0.0000 (249)
Energy for lighting (0.90*19.60 + 0.10*9.40)	180.5338	18.5800	33.5432 (250)
Additional standing charges			7.0000 (251)
Total energy cost			836.5585 (255)

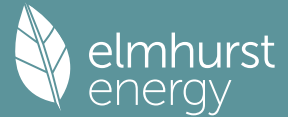
Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	2.7629 (257)
SAP value		55.2127
SAP rating (Section 12)		55 (258)
SAP band		D

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1 (high-rate cost)	0.0000	0.0000	0.0000 (261)
Space heating - main system 1 (low-rate cost)	5288.4504	0.1352	714.9044 (261)
Total CO2 associated with community systems			0.0000 (373)
Space heating - secondary	587.6056	0.1610	94.6121 (263)
Water heating - high rate cost	56.4630	0.1480	8.3592 (264)
Water heating - low rate cost	1836.8459	0.1243	228.2323 (264)
Space and water heating			1046.1080 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	180.5338	0.1490	26.9031 (268)
Total CO2, kg/year			1073.0111 (272)
CO2 emissions per m2			16.7700 (273)
EI value			86.8089
EI rating			87 (274)
EI band			B

Main dwelling	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	64.0000 (1b)	x 2.4000 (2b)	= 153.6000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n)	64.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)... (3n) =	153.6000 (5)

		m3 per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)

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

0 * 20 = 0.0000 (6b)
0 * 10 = 0.0000 (6c)
0 * 20 = 0.0000 (6d)
0 * 35 = 0.0000 (6e)
0 * 20 = 0.0000 (6f)
3 * 10 = 30.0000 (7a)
0 * 10 = 0.0000 (7b)
0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 30.0000
Air changes per hour
Pressure test
Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered
Blower Door
15.0000 (17)
0.9453 (18)
2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.8035 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	4.5000	4.3000	4.4000	3.9000	3.9000	3.4000	3.5000	3.4000	3.6000	3.9000	3.8000	4.1000	(22)
Adj infilt rate	1.1250	1.0750	1.1000	0.9750	0.9750	0.8500	0.8750	0.8500	0.9000	0.9750	0.9500	1.0250	(22a)
Effective ac	0.9040	0.8638	0.8839	0.7834	0.7834	0.6830	0.7031	0.6830	0.7232	0.7834	0.7633	0.8236	(22b)
	0.9086	0.8731	0.8906	0.8069	0.8069	0.7332	0.7472	0.7332	0.7615	0.8069	0.7913	0.8392	(25)

3. Heat losses and heat loss parameter

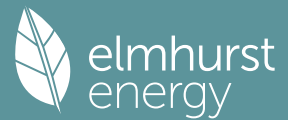
Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Doors			3.6100	1.4000	5.0540			(26a)
Windows			4.9400	1.3258	6.5492			(27)
Rooflights			1.5300	1.3258	2.0284			(27a)
Ground Floor			64.0000	0.2500	16.0000			(28a)
External Wall	85.5000	8.5500	76.9500	0.3000	23.0850			(29a)
External Roof	64.0000	1.5300	62.4700	0.1500	9.3705			(30)
Total net area of external elements Aum(A, m2)			213.5000					(31)
Fabric heat loss, W/K = Sum (A x U)					62.0872			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								100.0000 (35)
Thermal bridges (Default value 0.200 * total exposed area)								42.7000 (36)
Point Thermal bridges								0.0000 (36a)
Total fabric heat loss								(33) + (36) + (36a) = 104.7872 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	46.0535	44.2535	45.1433	40.8991	40.8991	37.1663	37.8719	37.1663	38.5981	40.8991	40.1116	42.5354	(38)
Average = Sum(39)m / 12 =	150.8406	149.0407	149.9304	145.6863	145.6863	141.9534	142.6591	141.9534	143.3852	145.6863	144.8988	147.3226	(39)
												145.7536	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	2.3569	2.3288	2.3427	2.2763	2.2763	2.2180	2.2290	2.2180	2.2404	2.2763	2.2640	2.3019	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.0922 (42)
Hot water usage for mixer showers													
Hot water usage for baths	66.6221	65.6209	64.1619	61.3705	59.3105	57.0132	55.7074	57.1553	58.7425	61.2091	64.0605	66.3668	(42a)
Hot water usage for other uses	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)
Average daily hot water use (litres/day)	36.0560	34.7449	33.4338	32.1226	30.8115	29.5004	29.5004	30.8115	32.1226	33.4338	34.7449	36.0560	(42c)
												94.2015	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	102.6781	100.3658	97.5957	93.4931	90.1220	86.5136	85.2078	87.9668	90.8651	94.6429	98.8054	102.4228	(44)
Energy content (annual)	162.6170	142.9195	150.0010	127.9874	121.3216	106.3785	103.0515	108.9213	112.0458	128.4295	140.7664	160.3694	(45)
Distribution loss (46)m = 0.15 x (45)m	24.3926	21.4379	22.5001	19.1981	18.1982	15.9568	15.4577	16.3382	16.8069	19.2644	21.1150	24.0554	(46)
Water storage loss:													
Store volume													210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.5000 (48)
Temperature factor from Table 2b													0.6000 (49)
Enter (49) or (54) in (55)													0.9000 (55)
Total storage loss	27.9000	25.2000	27.9000	27.0000	27.9000	27.0000	27.9000	27.9000	27.0000	27.9000	27.0000	27.9000	(56)
If cylinder contains dedicated solar storage	27.9000	25.2000	27.9000	27.0000	27.9000	27.0000	27.9000	27.9000	27.0000	27.9000	27.0000	27.9000	(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	190.5170	168.1195	177.9010	154.9874	149.2216	133.3785	130.9515	136.8213	139.0458	156.3295	167.7664	188.2694	(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	190.5170	168.1195	177.9010	154.9874	149.2216	133.3785	130.9515	136.8213	139.0458	156.3295	167.7664	188.2694	(64)
												1893.3089	(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	76.3902	67.6807	72.1953	64.1558	62.6594	56.9709	56.5846	58.5363	58.8552	65.0228	68.4048	75.6428	(65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.5564	22.6990	18.4601	13.9755	10.4468	8.8196	9.5299	12.3874	16.6263	21.1109	24.6395	26.2667 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	273.0011	275.8340	268.6952	253.4975	234.3132	216.2826	204.2371	201.4042	208.5430	223.7407	242.9250	260.9556 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453	49.6453 (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)	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873 (71)
Water heating gains (Table 5)	102.6749	100.7154	97.0367	89.1053	84.2196	79.1262	76.0546	78.6779	81.7434	87.3962	95.0067	101.6705 (72)
Total internal gains	492.7214	490.7373	475.6809	448.0672	420.4685	395.7174	381.3105	383.9583	398.4016	423.7367	454.0602	480.3817 (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				3.6800	40.6744	0.6300	0.7000	0.7700	45.7447 (77)			
Southwest				1.2600	40.6744	0.6300	0.7000	0.7700	15.6626 (79)			
Northwest				1.5300	20.8575	0.6300	0.7000	1.0000	12.6659 (82)			
Solar gains	74.0731	120.2347	175.2888	241.8848	283.7507	309.9116	289.2937	253.8437	209.0567	142.9197	91.8425	62.1877 (83)
Total gains	566.7945	610.9720	650.9697	689.9520	704.2192	705.6289	670.6042	637.8020	607.4582	566.6564	545.9026	542.5693 (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	11.7858	11.9281	11.8574	12.2028	12.2028	12.5237	12.4617	12.5237	12.3986	12.2028	12.2691	12.0672
alpha	1.7857	1.7952	1.7905	1.8135	1.8135	1.8349	1.8308	1.8349	1.8266	1.8135	1.8179	1.8045
util living area	0.9441	0.9340	0.9127	0.8732	0.8107	0.6906	0.5583	0.5831	0.7647	0.8798	0.9280	0.9473 (86)
MIT	17.3887	17.6134	18.1508	18.8896	19.6006	20.2740	20.6121	20.5855	20.0623	19.1509	18.1960	17.4046 (87)
Th 2	19.1060	19.1232	19.1147	19.1555	19.1555	19.1919	19.1850	19.1919	19.1779	19.1555	19.1631	19.1397 (88)
util rest of house	0.9327	0.9205	0.8929	0.8403	0.7500	0.5661	0.3370	0.3665	0.6640	0.8415	0.9106	0.9366 (89)
MIT 2	15.2182	15.5000	16.1582	17.0742	17.9183	18.6729	18.9540	18.9468	18.4634	17.4035	16.2388	15.2495 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	16.4730	16.7218	17.3102	18.1237	18.8909	19.5986	19.9126	19.8942	19.3878	18.4137	17.3703	16.4954 (92)
Temperature adjustment												
adjusted MIT	16.4730	16.7218	17.3102	18.1237	18.8909	19.5986	19.9126	19.8942	19.3878	18.4137	17.3703	16.4954 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9098	0.8959	0.8666	0.8160	0.7390	0.5994	0.4393	0.4645	0.6784	0.8207	0.8866	0.9146 (94)
Useful gains	515.6656	547.3404	564.1208	563.0288	520.3902	422.9776	294.6051	296.2756	412.1061	465.0531	484.0230	496.2341 (95)
Ext temp.	4.5000	5.0000	6.9000	9.4000	12.3000	15.3000	17.4000	17.3000	14.7000	11.1000	7.4000	4.5000 (96)
Heat loss rate W	1806.0156	1747.0320	1560.8020	1270.9221	960.1994	610.1951	358.4444	368.2492	672.1577	1065.5126	1444.6809	1767.1952 (97)
Space heating kWh	960.0204	806.1928	741.5308	509.6832	327.2180	0.0000	0.0000	0.0000	0.0000	446.7419	691.6737	945.5951 (98a)
Space heating requirement - total per year (kWh/year)	5428.6558											
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	960.0204	806.1928	741.5308	509.6832	327.2180	0.0000	0.0000	0.0000	0.0000	446.7419	691.6737	945.5951 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	5428.6558											
Space heating per m ²	84.8227 (99)											

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.1000 (201)
Fraction of space heat from main system(s)												0.9000 (202)
Efficiency of main space heating system 1 (in %)												100.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	960.0204	806.1928	741.5308	509.6832	327.2180	0.0000	0.0000	0.0000	0.0000	446.7419	691.6737	945.5951 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	864.0183	725.5735	667.3778	458.7149	294.4962	0.0000	0.0000	0.0000	0.0000	402.0677	622.5063	851.0356 (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)	96.0020	80.6193	74.1531	50.9683	32.7218	0.0000	0.0000	0.0000	0.0000	44.6742	69.1674	94.5595 (215)
Water heating												
Water heating requirement	190.5170	168.1195	177.9010	154.9874	149.2216	133.3785	130.9515	136.8213	139.0458	156.3295	167.7664	188.2694 (64)

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Efficiency of water heater													100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month														
	190.5170	168.1195	177.9010	154.9874	149.2216	133.3785	130.9515	136.8213	139.0458	156.3295	167.7664	188.2694	(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	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	22.3694	17.9456	16.1580	11.8380	9.1440	7.4708	8.3415	10.8426	14.0835	18.4783	20.8711	22.9911	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)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	(233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)	
Electricity generated by PVs (Appendix M) (negative quantity)														
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)	
Annual totals kWh/year														
Space heating fuel - main system 1													4885.7902	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													542.8656	(215)
Efficiency of water heater													100.0000	
Water heating fuel used													1893.3089	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
Total electricity for the above, kWh/year													0.0000	(231)
Electricity for lighting (calculated in Appendix L)													180.5338	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													0.0000	(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													7502.4985	(238)

10a. Fuel costs - using BEDF prices (580)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	0.0000	15.8000	0.0000	(240)
Space heating - main system 1 (low-rate cost)	4885.7902	0.1580	771.9549	(240)
Total CO2 associated with community systems			0.0000	(473)
Space heating - secondary (1.00*34.60 + 0.00*15.80)	542.8656	34.6000	187.8315	(242)
Water heating (electric off-peak tariff)				
High-rate fraction			0.0298	(243)
Low-rate fraction			0.9702	(244)
High-rate cost	56.4630	34.6000	19.5362	(245)
Low-rate cost	1836.8459	15.8000	290.2216	(246)
Energy for instantaneous electric shower(s)	0.0000	32.7200	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*34.60 + 0.10*15.80)	0.0000	0.0000	0.0000	(249)
Energy for lighting (0.90*34.60 + 0.10*15.80)	180.5338	32.7200	59.0707	(250)
Additional standing charges			8.0000	(251)
Total energy cost			1336.6149	(255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	0.0000	0.0000	0.0000	(261)
Space heating - main system 1 (low-rate cost)	4885.7902	0.1354	661.5067	(261)
Total CO2 associated with community systems			0.0000	(373)
Space heating - secondary	542.8656	0.1613	87.5464	(263)
Water heating - high rate cost	56.4630	0.1480	8.3592	(264)
Water heating - low rate cost	1836.8459	0.1243	228.2323	(264)
Space and water heating			985.6446	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	180.5338	0.1490	26.9031	(268)
Total CO2, kg/year			1012.5477	(272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1 (high-rate cost)	0.0000	0.0000	0.0000	(275)
Space heating - main system 1 (low-rate cost)	4885.7902	1.4894	7277.0821	(275)
Total CO2 associated with community systems			0.0000	(473)
Space heating - secondary	542.8656	1.6015	869.3935	(277)
Water heating - high rate cost	56.4630	1.5534	87.7088	(278)
Water heating - low rate cost	1836.8459	1.4447	2653.6918	(278)
Space and water heating			10887.8763	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	180.5338	1.5547	280.6840	(282)
Total Primary energy kWh/year			11168.5602	(286)

SAP 10 EPC IMPROVEMENTS

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DH3003

Current energy efficiency rating:
Current environmental impact rating:

D 55
B 87

N Solar water heating			Recommended
U Solar photovoltaic panels			Recommended
V2 Wind turbine			Recommended
Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 2.2	-£ 74	-70 kg (6.9%)
U Solar photovoltaic panels	+ 10.3	-£ 310	-239 kg (25.4%)
V2 Wind turbine	+ 28.1	-£ 881	-507 kg (72.1%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£74	1.09 kg/m ²	D 57 B 88
Solar photovoltaic panels	£310	3.74 kg/m ²	D 68 B 90
Wind turbine	£881	7.93 kg/m ²	A 96 A 97
Total Savings	£1266	12.76 kg/m²	

Potential energy efficiency rating: A 96
Potential environmental impact rating: A 97

Fuel prices for cost data on this page from database revision number 580 TEST (07 Sep 2025)
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	£1337	£1262	£74
Space heating	£968	£999	-£31
Water heating	£310	£204	£106
Lighting	£59	£59	£0
Generated (PV)	-£0	-£310	£310
Generated (wind)	-£0	-£881	£881
Total cost of fuels	£1337	£71	£1265
Total cost of uses	£1337	£71	£1266
Delivered energy	117 kWh/m ²	22 kWh/m ²	95 kWh/m ²
Carbon dioxide emissions	1.0 tonnes	0.2 tonnes	0.8 tonnes
CO2 emissions per m ²	16 kg/m ²	3 kg/m ²	13 kg/m ²
Primary energy	175 kWh/m ²	66 kWh/m ²	108 kWh/m ²

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling	64.0000 (1b)	x 2.4000 (2b)	= 153.6000 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 153.6000 (5)

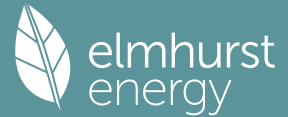
2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1953 (8)
Pressure test		No
Pressure Test Method		Blower Door
Measured/design AP50		15.0000 (17)
Infiltration rate		0.9453 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.8035 (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	1.0245	1.0044	0.9843	0.8839	0.8638	0.7633	0.7633	0.7433	0.8035	0.8638	0.9040	0.9441 (22b)
Effective ac	1.0245	1.0044	0.9844	0.8906	0.8731	0.7913	0.7913	0.7762	0.8228	0.8731	0.9086	0.9457 (25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Doors			3.6100	1.4000	5.0540			(26a)
Windows			4.9400	1.3258	6.5492			(27)
Rooflights			1.5300	1.3258	2.0284			(27a)
Ground Floor			64.0000	0.2500	16.0000			(28a)
External Wall	85.5000	8.5500	76.9500	0.3000	23.0850			(29a)
External Roof	64.0000	1.5300	62.4700	0.1500	9.3705			(30)
Total net area of external elements Aum(A, m2)			213.5000					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	62.0872		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000	(35)
Thermal bridges (Default value 0.200 * total exposed area)							42.7000	(36)
Point Thermal bridges						(36a) =	0.0000	
Total fabric heat loss					(33) + (36) + (36a) =		104.7872	(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	51.9290	50.9108	49.8988	45.1433	44.2535	40.1116	40.1116	39.3446	41.7070	44.2535	46.0535	47.9352	(38)
Average = Sum(39)m / 12 =	156.7161	155.6979	154.6859	149.9304	149.0407	144.8988	144.8988	144.1318	146.4942	149.0407	150.8406	152.7224	(39)
												149.9249	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	2.4487	2.4328	2.4170	2.3427	2.3288	2.2640	2.2640	2.2521	2.2890	2.3288	2.3569	2.3863	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

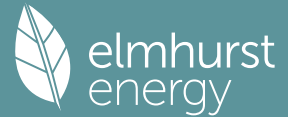
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.0922	(42)
Hot water usage for mixer showers	66.6221	65.6209	64.1619	61.3705	59.3105	57.0132	55.7074	57.1553	58.7425	61.2091	64.0605	66.3668	(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	36.0560	34.7449	33.4338	32.1226	30.8115	29.5004	29.5004	30.8115	32.1226	33.4338	34.7449	36.0560	(42c)	
Average daily hot water use (litres/day)												94.2015	(43)	
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Energy conte	102.6781	100.3658	97.5957	93.4931	90.1220	86.5136	85.2078	87.9668	90.8651	94.6429	98.8054	102.4228	(44)	
Energy content (annual)	162.6170	142.9195	150.0010	127.9874	121.3216	106.3785	103.0515	108.9213	112.0458	128.4295	140.7664	160.3694	(45)	
Distribution loss (46)m = 0.15 x (45)m	24.3926	21.4379	22.5001	19.1981	18.1982	15.9568	15.4577	16.3382	16.8069	19.2644	21.1150	24.0554	(46)	
Water storage loss:														
Store volume													210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													1.5000	(48)
Temperature factor from Table 2b													0.6000	(49)
Enter (49) or (54) in (55)													0.9000	(55)
Total storage loss	27.9000	25.2000	27.9000	27.0000	27.9000	27.0000	27.9000	27.9000	27.0000	27.9000	27.0000	27.9000	(56)	
If cylinder contains dedicated solar storage	17.9357	16.2000	17.9357	17.3571	17.9357	17.3571	17.9357	17.9357	17.3571	17.9357	17.3571	17.9357	(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	180.5527	159.1195	167.9367	145.3446	139.2573	123.7357	120.9872	126.8570	129.4029	146.3652	158.1235	178.3051	(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)
If combined cylinder, total volume of cylinder													210.0000	(H13)
Effective solar volume													115.5000	(H14)
Reference volume													225.0000	(H15)
Storage tank correction coefficient													1.1814	(H16)
Heat delivered to hot water													594.8273	(H24)
Heat delivered to space heating													0.0000	(H29)
Solar input													594.8273	
Solar input	-0.0000	-19.9696	-58.8176	-76.6485	-95.8965	-87.5003	-86.3575	-78.0573	-56.9504	-32.2448	-2.3847	-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	180.5527	139.1499	109.1190	68.6960	43.3608	36.2354	34.6297	48.7997	72.4526	114.1204	155.7388	178.3051	(64)	
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)	
Heat gains from water heating, kWh/month	68.4187	60.4807	64.2239	56.4415	54.6880	49.2566	48.6132	50.5649	51.1409	57.0514	60.6905	67.6714	(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	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	125.5309	(66)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	25.5564	22.6990	18.4601	13.9755	10.4468	8.8196	9.5299	12.3874	16.6263	21.1109	24.6395	26.2667	(67)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	273.0011	275.8340	268.6952	253.4975	234.3132	216.2826	204.2371	201.4042	208.5430	223.7407	242.9250	260.9556	(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)														

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	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873 (71)
Water heating gains (Table 5)	91.9607	90.0011	86.3224	78.3910	73.5054	68.4119	65.3403	67.9636	71.0291	76.6819	84.2924	90.9562 (72)
Total internal gains	482.0071	480.0230	464.9666	437.3529	409.7543	385.0031	370.5962	373.2440	387.6873	413.0224	443.3459	469.6674 (73)

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				3.6800	36.7938		0.6300		0.7000		0.7700		41.3804 (77)
Southwest				1.2600	36.7938		0.6300		0.7000		0.7700		14.1683 (79)
Northwest				1.5300	18.0708		0.6300		0.7000		1.0000		10.9736 (82)
Solar gains	66.5223	117.6732	172.5909	233.2699	279.0106	284.7918	271.3241	236.0069	193.4163	133.1775	80.4726		56.4154 (83)
Total gains	548.5294	597.6962	637.5575	670.6228	688.7649	669.7948	641.9203	609.2509	581.1036	546.1999	523.8184		526.0828 (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	11.3439	11.4181	11.4928	11.8574	11.9281	12.2691	12.2691	12.3344	12.1355	11.9281	11.7858	11.6406
alpha	1.7563	1.7612	1.7662	1.7905	1.7952	1.8179	1.8179	1.8223	1.8090	1.7952	1.7857	1.7760
util living area	0.9485	0.9378	0.9199	0.8869	0.8330	0.7439	0.6429	0.6726	0.8020	0.8947	0.9356	0.9517 (86)
MIT	17.2227	17.4704	17.9637	18.6876	19.4097	20.0847	20.4574	20.4044	19.8798	18.9632	18.0065	17.2189 (87)
Th 2	19.0510	19.0604	19.0698	19.1147	19.1232	19.1631	19.1631	19.1706	19.1476	19.1232	19.1060	19.0882 (88)
util rest of house	0.9378	0.9248	0.9017	0.8576	0.7804	0.6410	0.4639	0.5053	0.7184	0.8617	0.9199	0.9419 (89)
MIT 2	14.9961	15.3031	15.9125	16.8137	17.6817	18.4677	18.8293	18.7955	18.2514	17.1645	15.9856	15.0040 (90)
Living area fraction	16.2834	16.5560	17.0984	17.8970	18.6807	19.4025	19.7706	19.7257	19.1928	18.2044	17.1539	16.2845 (92)
MIT	16.2834	16.5560	17.0984	17.8970	18.6807	19.4025	19.7706	19.7257	19.1928	18.2044	17.1539	16.2845 (93)
Temperature adjustment												0.0000
adjusted MIT	16.2834	16.5560	17.0984	17.8970	18.6807	19.4025	19.7706	19.7257	19.1928	18.2044	17.1539	16.2845 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9156	0.9005	0.8756	0.8323	0.7645	0.6574	0.5342	0.5664	0.7210	0.8394	0.8966	0.9206 (94)
Useful gains	502.2561	538.2439	558.2560	558.1304	526.5282	440.3152	342.9254	345.0845	419.0037	458.4796	469.6418	484.3206 (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	1877.9875	1814.8222	1639.4202	1348.9251	1040.4055	695.8807	459.4129	479.3350	746.0700	1133.3594	1516.5411	1845.5727 (97)
Space heating kWh	1023.5442	857.8606	804.3862	569.3722	382.3247	0.0000	0.0000	0.0000	0.0000	502.1106	753.7675	1012.7716 (98a)
Space heating requirement - total per year (kWh/year)												5906.1376
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	1023.5442	857.8606	804.3862	569.3722	382.3247	0.0000	0.0000	0.0000	0.0000	502.1106	753.7675	1012.7716 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5906.1376
Space heating per m2										(98c) / (4) =		92.2834 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.1000 (201)
Fraction of space heat from main system(s)												0.9000 (202)
Efficiency of main space heating system 1 (in %)												100.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1023.5442	857.8606	804.3862	569.3722	382.3247	0.0000	0.0000	0.0000	0.0000	502.1106	753.7675	1012.7716 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	921.1898	772.0745	723.9476	512.4350	344.0922	0.0000	0.0000	0.0000	0.0000	451.8995	678.3908	911.4944 (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)	102.3544	85.7861	80.4386	56.9372	38.2325	0.0000	0.0000	0.0000	0.0000	50.2111	75.3768	101.2772 (215)
Water heating												
Water heating requirement	180.5527	139.1499	109.1190	68.6960	43.3608	36.2354	34.6297	48.7997	72.4526	114.1204	155.7388	178.3051 (64)
Efficiency of water heater (217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (216)
Fuel for water heating, kWh/month	180.5527	139.1499	109.1190	68.6960	43.3608	36.2354	34.6297	48.7997	72.4526	114.1204	155.7388	178.3051 (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	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	22.3694	17.9456	16.1580	11.8380	9.1440	7.4708	8.3415	10.8426	14.0835	18.4783	20.8711	22.9911 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-34.6592	-50.1106	-73.1871	-82.2908	-87.0608	-74.4041	-73.4615	-69.6460	-62.5850	-56.5194	-38.2730	-29.8121 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	-212.5732	-192.0016	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732 (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)

Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1727.2394	(233)
Wind generation	-3575.5408	(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	2045.0514	(238)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1 (high-rate cost)	0.0000	9.4000	0.0000 (240)
Space heating - main system 1 (low-rate cost)	5315.5238	0.0940	499.6592 (240)
Total CO2 associated with community systems			0.0000 (473)
Space heating - secondary (1.00*19.60 + 0.00*9.40)	590.6138	19.6000	115.7603 (242)
Water heating (electric off-peak tariff)			
High-rate fraction			0.1200 (243)
Low-rate fraction			0.8800 (244)
High-rate cost	141.7176	19.6000	27.7766 (245)
Low-rate cost	1039.4426	9.4000	97.7076 (246)
Energy for instantaneous electric shower(s)	0.0000	18.5800	0.0000 (247a)
Pumps, fans and electric keep-hot (0.90*19.60 + 0.10*9.40)	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	18.5800	14.8640 (249)
Energy for lighting (0.90*19.60 + 0.10*9.40)	180.5338	18.5800	33.5432 (250)
Additional standing charges			7.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-732.0095	18.5800	-136.0074
PV Unit electricity exported	-995.2299	5.5900	-55.6333
Total			-191.6407 (252)
Wind Turbine electricity used in dwelling	-2502.8785	0.0000	-465.0348
Wind Turbine electricity exported	-1072.6622	5.5900	-59.9618
Total			-524.9966 (252)
Total energy cost			79.6736 (255)

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.2631 (257)
SAP value		95.7345
SAP rating (Section 12)		96 (258)
SAP band		A

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1 (high-rate cost)	0.0000	0.0000	0.0000 (261)
Space heating - main system 1 (low-rate cost)	5315.5238	0.1352	718.5162 (261)
Total CO2 associated with community systems			0.0000 (373)
Space heating - secondary	590.6138	0.1610	95.0900 (263)
Water heating - high rate cost	141.7176	0.1550	21.9731 (264)
Water heating - low rate cost	1039.4426	0.1301	135.2777 (264)
Space and water heating			970.8571 (265)
Pumps, fans and electric keep-hot	80.0000	0.1432	11.4562 (267)
Energy for lighting	180.5338	0.1490	26.9031 (268)
Energy saving/generation technologies			
FV Unit electricity used in dwelling	-732.0095	0.1396	-102.1684
FV Unit electricity exported	-995.2299	0.1241	-123.5377
Total			-225.7060 (269)
Wind Turbine electricity used in dwelling	-2502.8785	0.1455	-358.4191
Wind Turbine electricity exported	-1072.6622	0.1387	-148.7915
Total			-507.2105 (269)
Total CO2, kg/year			276.2999 (272)
CO2 emissions per m2			4.3200 (273)
EI value			96.6033
EI rating			97 (274)
EI band			A

Full SAP Calculation Printout



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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling	64.0000 (1b)	x 2.4000 (2b)	= 153.6000 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 153.6000 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1953 (8)
Pressure test	No
Pressure Test Method	Blower Door
Measured/design AP50	15.0000 (17)
Infiltration rate	0.9453 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.8035 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.5000	4.3000	4.4000	3.9000	3.9000	3.4000	3.5000	3.4000	3.6000	3.9000	3.8000	4.1000 (22)
Wind factor	1.1250	1.0750	1.1000	0.9750	0.9750	0.8500	0.8750	0.8500	0.9000	0.9750	0.9500	1.0250 (22a)
Adj infilt rate	0.9040	0.8638	0.8839	0.7834	0.7834	0.6830	0.7031	0.6830	0.7232	0.7834	0.7633	0.8236 (22b)
Effective ac	0.9086	0.8731	0.8906	0.8069	0.8069	0.7332	0.7472	0.7332	0.7615	0.8069	0.7913	0.8392 (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
Main dwelling							
Doors			3.6100	1.4000	5.0540		(26a)
Windows			4.9400	1.3258	6.5492		(27)
Rooflights			1.5300	1.3258	2.0284		(27a)
Ground Floor			64.0000	0.2500	16.0000		(28a)
External Wall	85.5000	8.5500	76.9500	0.3000	23.0850		(29a)
External Roof	64.0000	1.5300	62.4700	0.1500	9.3705		(30)
Total net area of external elements Aum(A, m ²)			213.5000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	62.0872		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Default value 0.200 * total exposed area)							42.7000 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	104.7872 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	46.0535	44.2535	45.1433	40.8991	40.8991	37.1663	37.8719	37.1663	38.5981	40.8991	40.1116	42.5354 (38)
Heat transfer coeff	150.8406	149.0407	149.9304	145.6863	145.6863	141.9534	142.6591	141.9534	143.3852	145.6863	144.8988	147.3226 (39)
Average = Sum(39)m / 12 =												145.7536
HLP	2.3569	2.3288	2.3427	2.2763	2.2763	2.2180	2.2290	2.2180	2.2404	2.2763	2.2640	2.3019 (40)
HLP (average)												2.2774
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

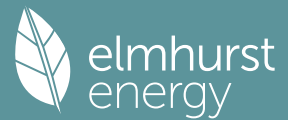
4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.0922 (42)
Hot water usage for mixer showers	66.6221	65.6209	64.1619	61.3705	59.3105	57.0132	55.7074	57.1553	58.7425	61.2091	64.0605	66.3668 (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	36.0560	34.7449	33.4338	32.1226	30.8115	29.5004	29.5004	30.8115	32.1226	33.4338	34.7449	36.0560 (42c)
Average daily hot water use (litres/day)												94.2015 (43)
Daily hot water use	102.6781	100.3658	97.5957	93.4931	90.1220	86.5136	85.2078	87.9668	90.8651	94.6429	98.8054	102.4228 (44)
Energy conte	162.6170	142.9195	150.0010	127.9874	121.3216	106.3785	103.0515	108.9213	112.0458	128.4295	140.7664	160.3694 (45)
Energy content (annual)												Total = Sum(45)m = 1564.8089
Distribution loss (46)m = 0.15 x (45)m	24.3926	21.4379	22.5001	19.1981	18.1982	15.9568	15.4577	16.3382	16.8069	19.2644	21.1150	24.0554 (46)
Water storage loss:												
Store volume												210.0000 (47)

elmhurst
energy

8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9121	0.8982	0.8693	0.8192	0.7428	0.6040	0.4441	0.4696	0.6833	0.8245	0.8895	0.9169 (94)

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Useful gains	507.1780	539.1609	556.5453	556.4415	515.1269	419.7285	293.0287	294.4801	407.7766	458.3740	476.0481	487.6486	(95)
Ext temp.	4.5000	5.0000	6.9000	9.4000	12.3000	15.3000	17.4000	17.3000	14.7000	11.1000	7.4000	4.5000	(96)
Heat loss rate W	1803.3225	1744.4323	1558.3675	1268.8144	958.5300	609.2233	357.9868	367.7280	670.8190	1063.3776	1442.1643	1764.4993	(97)
Space heating kWh	964.3315	809.9424	745.3558	512.9085	329.8919	0.0000	0.0000	0.0000	0.0000	450.1227	695.6037	949.9770	(98a)
Space heating requirement - total per year (kWh/year)												5458.1336	
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	964.3315	809.9424	745.3558	512.9085	329.8919	0.0000	0.0000	0.0000	0.0000	450.1227	695.6037	949.9770	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5458.1336	
Space heating per m2												85.2833	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.1000	(201)
Fraction of space heat from main system(s)													0.9000	(202)
Efficiency of main space heating system 1 (in %)													100.0000	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													100.0000	(208)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Space heating requirement	964.3315	809.9424	745.3558	512.9085	329.8919	0.0000	0.0000	0.0000	0.0000	450.1227	695.6037	949.9770	(98)	
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)	
Space heating fuel (main heating system)	867.8984	728.9482	670.8202	461.6177	296.9027	0.0000	0.0000	0.0000	0.0000	405.1104	626.0434	854.9793	(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)	96.4332	80.9942	74.5356	51.2909	32.9892	0.0000	0.0000	0.0000	0.0000	45.0123	69.5604	94.9977	(215)	
Water heating														
Water heating requirement	177.8396	137.4759	106.9382	64.8792	41.3818	28.9167	28.9839	41.9520	65.5997	108.3615	149.2374	178.3051	(64)	
Efficiency of water heater	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(216)	
Fuel for water heating, kWh/month	177.8396	137.4759	106.9382	64.8792	41.3818	28.9167	28.9839	41.9520	65.5997	108.3615	149.2374	178.3051	(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	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)	
Lighting	22.3694	17.9456	16.1580	11.8380	9.1440	7.4708	8.3415	10.8426	14.0835	18.4783	20.8711	22.9911	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)m	-37.9657	-51.0248	-73.7245	-83.2449	-86.7173	-76.7187	-75.1935	-71.7938	-65.1678	-59.1081	-42.4449	-32.4527	(233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234a)m	-212.5732	-192.0016	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	(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	-18.3510	-35.1101	-71.6298	-114.7901	-152.5888	-174.8283	-168.0935	-143.0349	-104.5690	-56.4271	-26.0055	-14.2083	(233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234b)m	-91.1028	-82.2864	-91.1028	-88.1640	-91.1028	-88.1640	-91.1028	-91.1028	-88.1640	-91.1028	-88.1640	-91.1028	(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												4912.3202	(211)	
Space heating fuel - main system 2												0.0000	(213)	
Space heating fuel - secondary												545.8134	(215)	
Efficiency of water heater												100.0000		
Water heating fuel used												1129.8712	(219)	
Space cooling fuel												0.0000	(221)	
Electricity for pumps and fans:														
pump for solar water heating												80.0000	(230g)	
Total electricity for the above, kWh/year												80.0000	(231)	
Electricity for lighting (calculated in Appendix L)												180.5338	(232)	
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation												-1835.1931	(233)	
Wind generation												-3575.5408	(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												1437.8048	(238)	

10a. Fuel costs - using BEDF prices (580)

	Fuel	Fuel price	Fuel cost	
	kWh/year	p/kWh	£/year	
Space heating - main system 1 (high-rate cost)	0.0000	15.8000	0.0000	(240)
Space heating - main system 1 (low-rate cost)	4912.3202	0.1580	776.1466	(240)
Total CO2 associated with community systems			0.0000	(473)
Space heating - secondary (1.00*34.60 + 0.00*15.80)	545.8134	34.6000	188.8514	(242)
Water heating (electric off-peak tariff)				
High-rate fraction			0.1200	(243)
Low-rate fraction			0.8800	(244)
High-rate cost	135.5638	34.6000	46.9051	(245)
Low-rate cost	994.3074	15.8000	157.1006	(246)
Energy for instantaneous electric shower(s)	0.0000	32.7200	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*34.60 + 0.10*15.80)	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	32.7200	26.1760	(249)
Energy for lighting (0.90*34.60 + 0.10*15.80)	180.5338	32.7200	59.0707	(250)
Additional standing charges			8.0000	(251)

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Energy saving/generation technologies			
PV Unit electricity used in dwelling	-755.5565	32.7200	-247.2181
PV Unit electricity exported	-1079.6366	5.8100	-62.7269
Total			-309.9450 (252)
Wind Turbine electricity used in dwelling	-2502.8785	0.0000	-818.9419
Wind Turbine electricity exported	-1072.6622	5.8100	-62.3217
Total			-881.2635 (252)
Total energy cost			71.0418 (255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1 (high-rate cost)	0.0000	0.0000	0.0000 (261)
Space heating - main system 1 (low-rate cost)	4912.3202	0.1354	665.0505 (261)
Total CO2 associated with community systems			0.0000 (373)
Space heating - secondary	545.8134	0.1613	88.0154 (263)
Water heating - high rate cost	135.5638	0.1558	21.1269 (264)
Water heating - low rate cost	994.3074	0.1308	130.0701 (264)
Space and water heating			904.2629 (265)
Pumps, fans and electric keep-hot	80.0000	0.1432	11.4562 (267)
Energy for lighting	180.5338	0.1490	26.9031 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-755.5565	0.1397	-105.5709
PV Unit electricity exported	-1079.6366	0.1240	-133.8319
Total			-239.4028 (269)
Wind Turbine electricity used in dwelling	-2502.8785	0.1455	-358.4191
Wind Turbine electricity exported	-1072.6622	0.1387	-148.7915
Total			-507.2105 (269)
Total CO2, kg/year			196.0089 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1 (high-rate cost)	0.0000	0.0000	0.0000 (275)
Space heating - main system 1 (low-rate cost)	4912.3202	1.4894	7316.4041 (275)
Total CO2 associated with community systems			0.0000 (473)
Space heating - secondary	545.8134	1.6014	874.0913 (277)
Water heating - high rate cost	135.5638	1.5816	214.4136 (278)
Water heating - low rate cost	994.3074	1.4710	1462.6480 (278)
Space and water heating			9867.5569 (279)
Pumps, fans and electric keep-hot	80.0000	1.5335	122.6788 (281)
Energy for lighting	180.5338	1.5547	280.6840 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-755.5565	1.5208	-1149.0657
PV Unit electricity exported	-1079.6366	0.4548	-491.0567
Total			-1640.1224 (283)
Wind Turbine electricity used in dwelling	-2502.8785	1.3899	-3838.1272
Wind Turbine electricity exported	-1072.6622	0.5128	-550.0612
Total			-4388.1884 (283)
Total Primary energy kWh/year			4242.6090 (286)

Part G Compliance Report

PROJECT DETAILS

Project Reference: DH3001G
Client: Peter & Kay Ivory
Property: 1 Bed Dwelling
Welwyn Equestrian Centre
Codicote AL6 9SZ

Local Authority: North Herts Council
Agent: Phillips Planning Services Ltd

Assessor: Joe Solti
Address: Therm Energy Ltd
Contact: 01903 884357
Software: G-Calc 2015 version 3.0.2
Prepared on: 25-Sep-25

RESULT SUMMARY

By following the Government's national calculation methodology for assessing water efficiency in new dwellings this 1 bed dwelling, as designed, achieves a water consumption of 109.3 litres per person per day.

Compliance with Building Regulation 36(1) has been demonstrated.

Table 1: The Water Calculator for New Dwellings

Installation Type	Unit of measure	Value	Use factor	Fixed use	litres/person/day
WC(single flush)	Flush volume (litres)		4.42	0.00	0
WC(dual flush)	Full flush vol.	6	1.46	0.00	8.76
	Part flush vol.	4	2.96	0.00	11.84
WC(multiple fittings)	Average effective Flush vol. (litres)		4.42	0.00	0
Taps(excl. Kitchen)	Flow rate (litres/min)	6	1.58	1.58	11.06
Bath (shower also present)	Capacity to overflow (litres)	0	0.11	0.00	0
Shower (bath also present)	Flow rate (litres/min)	0	4.37	0.00	0
Bath only	Capacity to overflow (litres)	0	0.50	0.00	0
Shower only	Flow rate (litres/minute)	8	5.6	0.00	44.8
Kitchen sink taps	Flow rate (litres/minute)	14	0.44	10.36	16.52
Washing Machine	litres/kg dry load	8.17	2.1	0.0	17.16
Dishwasher	litres/place setting	1.25	3.6	0.0	4.5
Waste disposal	litres/use	0	3.08	0.0	0
Water softener	litres/person/day	0	1.0	0.0	0
Total calculated use (litres/person/day)					114.64
Contribution from greywater (litres/person/day)					-
Contribution from rainwater (litres/person/day)					-
Normalisation factor					0.91
Total Water Consumption. Code for Sustainable Homes (litres/person/day)					104.3
External water use					5.0
Total Water Consumption. (36(1)) (litres/person/day)					109.3

Summary of fitting types "As Designed"			
Type	Description	Flow rates, volumes etc.	Qty
Taps	Taps	6 litres/min	1
Baths	Baths	litres to overflow	1
Dishwashers	Dishwasher	1.25 litres/place	1
Washing Machines	Washing Machine	8.17 litres/kg	1
Showers	Showers	8 litres/min	1
WC's	Toilets	6 / 4 litres flush vols.	1
Kitchen/Utility taps	Taps	14 litres/min	1

The lower section of this table is to be filled in by the builder prior to completion. The descriptions, values and quantities should represent the 'as built' specification. Please note the values above represent design values and should not be exceeded without prior consultation with the agent/designer (Phillips Planning Services Ltd).
The completed table should be returned to the assessor: Joe Solti (Contact: 01903 884357).

Declaration of fitting types "As Built"			
Type	Make and Model	Flow rates, volumes etc.	Qty
Taps			
Baths			
Dishwashers			
Washing Machines			
Showers			
WC's			
Kitchen/Utility taps			

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The above declaration of fittings, values and quantities is a true reflection of those installed on this project.

Name: Signature: Date:

-----End of Report-----