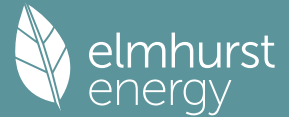


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Property Reference	CROSS-7143-23	Issued on Date	06/12/2023
Assessment Reference	SEC1 - ASHP ROI TF 0.15 improv	Prop Type Ref	DS
Property	Proposed dwelling, The Shed, Ox Lane, St Mawgan, Cornwall, TR8 4BX		
SAP Rating	98 A	DER	-0.47
TER	8.62		
Environmental	101 A	% DER < TER	105.45
CO ₂ Emissions (t/year)	-0.15	DFEE	37.37
TFEE	46.06		
Compliance Check	See BREL	% DFEE < TFEE	18.88
% DPER < TPER	85.86	DPER	6.60
TPER	46.68		
Assessor Details	Mr. Stuart Thomas	Assessor ID	V220-0003
Client			

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	85.6700 (1b)	x 2.5900 (2b)	= 221.8853 (1b) - (3b)
First floor	38.2500 (1c)	x 3.3400 (2c)	= 127.7550 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	349.6403 (5)

2. Ventilation rate

	m ³ per hour											
Number of open chimneys	0 * 80 =	0.0000 (6a)										
Number of open flues	0 * 20 =	0.0000 (6b)										
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)										
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)										
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)										
Number of blocked chimneys	0 * 20 =	0.0000 (6f)										
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)										
Number of passive vents	0 * 10 =	0.0000 (7b)										
Number of flueless gas fires	0 * 40 =	0.0000 (7c)										
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)										
Pressure test	Yes											
Pressure Test Method	Blower Door											
Measured/design AP50	2.0000	(17)										
Infiltration rate	0.1000	(18)										
Number of sides sheltered	1	(19)										
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)										
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.0925 (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	0.1179	0.1156	0.1133	0.1018	0.0994	0.0879	0.0879	0.0856	0.0925	0.0994	0.1041	0.1087 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2129	0.2106	0.2083	0.1967	0.1944	0.1829	0.1829	0.1806	0.1875	0.1944	0.1991	0.2037 (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
Window (Uw = 1.20)			17.9700	1.1450	20.5763		(27)
Door			1.8900	1.0000	1.8900		(26a)
8			1.0900	1.2357	1.3470		(27a)
13-15			2.7600	1.2357	3.4106		(27a)
Floor 1 P/a 0.48			85.6700	0.1200	10.2804	110.0000	9423.7000 (28a)
External Wall 1 Clad	135.5100	11.1300	124.3800	0.1500	18.6570	9.0000	1119.4200 (29a)
External Wall 2 Garage	12.8400		12.8400	0.1400	1.7976	9.0000	115.5600 (29a)
External Wall 4 Dormer	11.8000	8.7300	3.0700	0.1800	0.5526	18.0000	55.2600 (29a)
External Wall 3 "Attic"	28.0900		28.0900	0.0900	2.5281	9.0000	252.8100 (29a)
External Roof 1 Sloping	53.4200	3.8500	49.5700	0.1300	6.4441	9.0000	446.1300 (30)
External Roof 2 Horz	28.8900		28.8900	0.0900	2.6001	9.0000	260.0100 (30)
Roof 3 "attic"	11.4800		11.4800	0.0900	1.0332	9.0000	103.3200 (30)
Total net area of external elements Aum(A, m ²)			367.7000				
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	71.1170		(33)	

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Internal Wall 1 GF	135.8400	9.0000	1222.5600 (32c)
Internal Wall 2 FF	77.1000	9.0000	693.9000 (32c)
Internal Floor 1	38.2500	18.0000	688.5000 (32d)
Internal Ceiling 1	38.2500	9.0000	344.2500 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14725.4200 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 118.8301 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	21.2800	0.0300	0.6384
E6 Corner (normal)	41.1000	0.0210	0.8631
E5 Ground floor (normal)	16.7000	0.0390	0.6513
E11 Eaves (insulation at rafter level)	2.4000	-0.0150	-0.0360
E17 Corner (inverted - internal area greater than external area)	17.8100	0.0240	0.4274
E13 Gable (insulation at rafter level)	10.8000	0.1200	1.2960
R4 Ridge (vaulted ceiling)	4.0000	0.1200	0.4800
R7 Flat ceiling (inverted)	19.7500	0.0800	1.5800
E6 Intermediate floor within a dwelling	10.8000	0.0440	0.4752
E10 Eaves (insulation at ceiling level)	5.3500	0.0510	0.2728
E12 Gable (insulation at ceiling level)	5.3500	0.1500	0.8025
E24 Eaves (insulation at ceiling level - inverted)			

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.4508 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 78.5678 (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	24.5690	24.3022	24.0354	22.7013	22.4345	21.1004	21.1004	20.8335	21.6340	22.4345	22.9681	23.5017 (38)
Average = Sum(39)m / 12 =	103.1368	102.8700	102.6032	101.2691	101.0023	99.6682	99.6682	99.4014	100.2018	101.0023	101.5359	102.0696 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.8323	0.8301	0.8280	0.8172	0.8151	0.8043	0.8043	0.8021	0.8086	0.8151	0.8194	0.8237 (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 2.8773 (42)

Hot water usage for mixer showers 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42a)

Hot water usage for baths 83.5871 82.3457 80.5976 77.3743 74.9608 72.2846 70.8390 72.5749 74.4650 77.3287 80.6183 83.3045 (42b)

Hot water usage for other uses 44.0961 42.4926 40.8891 39.2856 37.6821 36.0787 36.0787 37.6821 39.2856 40.8891 42.4926 44.0961 (42c)

Average daily hot water use (litres/day) 117.5858 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	127.6832	124.8383	121.4867	116.6600	112.6430	108.3632	106.9177	110.2571	113.7507	118.2178	123.1109	127.4006 (44)
Energy content (annual)	202.2190	177.7681	186.7206	159.7017	151.6391	133.2453	129.3077	136.5213	140.2659	160.4204	175.3941	199.4786 (45)
Distribution loss (46)m = 0.15 x (45)m	30.3329	26.6652	28.0081	23.9553	22.7459	19.9868	19.3962	20.4782	21.0399	24.0631	26.3091	29.9218 (46)
Water storage loss:												250.0000 (47)
Store volume												1.6000 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.8640 (55)
Enter (49) or (54) in (55)												
Total storage loss	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840 (56)
If cylinder contains dedicated solar storage	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	252.2654	222.9713	236.7670	208.1337	201.6855	181.6773	179.3541	186.5677	188.6979	210.4668	223.8261	249.5250 (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	252.2654	222.9713	236.7670	208.1337	201.6855	181.6773	179.3541	186.5677	188.6979	210.4668	223.8261	249.5250 (64)
12Total per year (kWh/year)												2541.9378 (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	107.2749	95.2705	102.1217	91.8464	90.4571	83.0496	83.0319	85.4305	85.3840	93.3769	97.0641	106.3638 (65)

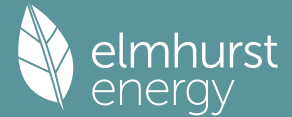
5. Internal gains (see Table 5 and 5a)

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	149.1993	165.1849	149.1993	154.1726	149.1993	154.1726	149.1993	149.1993	154.1726	149.1993	154.1726	149.1993 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	290.2324	293.2441	285.6547	269.4978	249.1025	229.9339	217.1281	214.1164	221.7058	237.8627	258.2579	277.4266 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3864	37.3864	37.3864	37.3864	37.3864	37.3864	37.3864	37.3864	37.3864	37.3864	37.3864	37.3864 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908 (71)
Water heating gains (Table 5)	144.1868	141.7715	137.2604	127.5645	121.5821	115.3467	111.6020	114.8259	118.5889	125.5066	134.8113	142.9620 (72)
Total internal gains	649.7775	666.3596	638.2734	617.3939	586.0430	565.6123	544.0885	544.3006	560.6264	578.7277	613.4009	635.7470 (73)

6. Solar gains

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[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				
East				8.7300	19.6403	0.7600	0.7000			0.7700	63.2130 (76)	
South				3.3000	46.7521	0.7600	0.7000			0.7700	56.8800 (78)	
West				5.9400	19.6403	0.7600	0.7000			0.7700	43.0109 (80)	
East				2.7600	26.0000	0.7600	0.7000			1.0000	34.3587 (82)	
West				1.0900	26.0000	0.7600	0.7000			1.0000	13.5692 (82)	
Solar gains	211.0318	400.4938	637.8384	909.7163	1105.3440	1129.3140	1075.9223	929.0807	733.9517	468.7073	260.7025	175.2139 (83)
Total gains	860.8093	1066.8534	1276.1118	1527.1102	1691.3870	1694.9263	1620.0108	1473.3813	1294.5781	1047.4350	874.1034	810.9609 (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	39.6599	39.7627	39.8661	40.3913	40.4980	41.0401	41.0401	41.1503	40.8216	40.4980	40.2852	40.0746
alpha	3.6440	3.6508	3.6577	3.6928	3.6999	3.7360	3.7360	3.7434	3.7214	3.6999	3.6857	3.6716
util living area	0.9584	0.9180	0.8411	0.6932	0.5254	0.3702	0.2692	0.3076	0.5086	0.7883	0.9272	0.9652 (86)
Living	19.8114	20.0822	20.4051	20.7103	20.8541	20.9045	20.9144	20.9127	20.8763	20.6386	20.1738	19.7660
Non living	18.8182	19.1571	19.5529	19.9175	20.0753	20.1339	20.1420	20.1428	20.1062	19.8473	19.2835	18.7669
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.3919	20.0822	20.4051	20.7103	20.8541	20.9045	20.9144	20.9127	20.8763	20.6386	20.1738	19.9386 (87)
Th 2	20.2254	20.2273	20.2291	20.2384	20.2403	20.2496	20.2496	20.2515	20.2459	20.2403	20.2366	20.2329 (88)
util rest of house	0.9524	0.9072	0.8223	0.6637	0.4884	0.3286	0.2239	0.2586	0.4595	0.7576	0.9158	0.9602 (89)
MIT 2	19.6644	19.1571	19.5529	19.9175	20.0753	20.1339	20.1420	20.1428	20.1062	19.8473	19.2835	19.0311 (90)
Living area fraction										fLA = Living area / (4) =		0.1210 (91)
MIT	19.7525	19.2691	19.6561	20.0135	20.1696	20.2272	20.2355	20.2360	20.1994	19.9430	19.3912	19.1409 (92)
Temperature adjustment												0.0000
adjusted MIT	19.7525	19.2691	19.6561	20.0135	20.1696	20.2272	20.2355	20.2360	20.1994	19.9430	19.3912	19.1409 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9483	0.8916	0.8068	0.6545	0.4848	0.3273	0.2230	0.2576	0.4564	0.7444	0.9006	0.9514 (94)
Useful gains	816.3095	951.2039	1029.5591	999.4547	820.0662	554.7917	361.2971	379.5103	590.8300	779.6953	787.2430	771.5368 (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	1593.7217	1478.1463	1349.8561	1125.4492	855.4485	560.8482	362.3434	381.3068	611.1721	943.6685	1248.0024	1525.0141 (97)
Space heating kWh	578.3947	354.1053	238.3009	90.7160	26.3244	0.0000	0.0000	0.0000	0.0000	121.9960	331.7468	560.5871 (98a)
Space heating requirement - total per year (kWh/year)												2302.1714
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	578.3947	354.1053	238.3009	90.7160	26.3244	0.0000	0.0000	0.0000	0.0000	121.9960	331.7468	560.5871 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2302.1714
Space heating per m2												(98c) / (4) = 18.5779 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 373.9506 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	578.3947	354.1053	238.3009	90.7160	26.3244	0.0000	0.0000	0.0000	0.0000	121.9960	331.7468	560.5871 (98)
Space heating efficiency (main heating system 1)	373.9506	373.9506	373.9506	373.9506	373.9506	0.0000	0.0000	0.0000	0.0000	373.9506	373.9506	373.9506 (210)
Space heating fuel (main heating system)	154.6714	94.6931	63.7253	24.2588	7.0395	0.0000	0.0000	0.0000	0.0000	32.6236	88.7141	149.9094 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	252.2654	222.9713	236.7670	208.1337	201.6855	181.6773	179.3541	186.5677	188.6979	210.4668	223.8261	249.5250 (64)
Efficiency of water heater												200.3638 (216)
(217)m	200.3638	200.3638	200.3638	200.3638	200.3638	200.3638	200.3638	200.3638	200.3638	200.3638	200.3638	200.3638 (217)
Fuel for water heating, kWh/month	125.9037	111.2832	118.1685	103.8779	100.6596	90.6737	89.5142	93.1145	94.1776	105.0423	111.7098	124.5360 (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	20.7227	18.7173	20.7227	20.0542	20.7227	20.0542	20.7227	20.0542	20.7227	20.0542	20.7227	20.7227 (231)
Lighting	28.8463	23.1416	20.8364	15.2657	11.7916	9.6339	10.7567	13.9820	18.1612	23.8285	26.9142	29.6480 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-62.3799	-88.9625	-128.5995	-143.2904	-153.9506	-143.1385	-141.3160	-133.2038	-117.8307	-99.9729	-68.3357	-53.6259 (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	-27.7758	-61.4815	-127.6238	-200.0993	-270.2784	-273.9462	-270.2568	-226.3893	-163.8029	-92.3497	-38.6020	-21.8190 (233b)

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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) =
 Pressure test
 Pressure Test Method
 Measured/design AP50
 Infiltration rate
 Number of sides sheltered
 Shelter factor
 Infiltration rate adjusted to include shelter factor

Air changes per hour
 40.0000 / (5) = 0.1144 (8)
 Yes
 Blower Door
 5.0000 (17)
 0.3644 (18)
 1 (19)
 (20) = 1 - [0.075 x (19)] = 0.9250 (20)
 (21) = (18) x (20) = 0.3371 (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	0.4298	0.4213	0.4129	0.3708	0.3624	0.3202	0.3202	0.3118	0.3371	0.3624	0.3792	0.3961 (22b)
Effective ac	0.5924	0.5888	0.5852	0.5687	0.5657	0.5513	0.5513	0.5486	0.5568	0.5657	0.5719	0.5784 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Semi-glazed door			1.8900	1.0000	1.8900		(26a)
TER Opening Type (Uw = 1.20)			17.9700	1.1450	20.5763		(27)
8			1.0900	1.5918	1.7350		(27a)
13-15			2.7600	1.5918	4.3933		(27a)
Floor 1 P/a 0.48			85.6700	0.1300	11.1371		(28a)
External Wall 1 Clad	135.5100	11.1300	124.3800	0.1800	22.3884		(29a)
External Wall 2 Garage	12.8400		12.8400	0.1800	2.3112		(29a)
External Wall 4 Dormer	11.8000	8.7300	3.0700	0.1800	0.5526		(29a)
External Wall 3 "Attic"	28.0900		28.0900	0.1800	5.0562		(29a)
External Roof 1 Sloping	53.4200	3.8500	49.5700	0.1100	5.4527		(30)
External Roof 2 Horz	28.8900		28.8900	0.1100	3.1779		(30)
Roof 3 "attic"	11.4800		11.4800	0.1100	1.2628		(30)
Total net area of external elements Aum(A, m2)			367.7000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 79.9335		(33)

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

118.8301 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	21.2800	0.0900	1.9152
E5 Ground floor (normal)	41.1000	0.1600	6.5760
E11 Eaves (insulation at rafter level)	16.7000	0.0400	0.6680
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160
E13 Gable (insulation at rafter level)	17.8100	0.0800	1.4248
R4 Ridge (vaulted ceiling)	10.8000	0.0800	0.8640
R7 Flat ceiling (inverted)	4.0000	0.0400	0.1600
E6 Intermediate floor within a dwelling	19.7500	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	10.8000	0.0600	0.6480
E12 Gable (insulation at ceiling level)	5.3500	0.0600	0.3210
E24 Eaves (insulation at ceiling level - inverted)	5.3500	0.2400	1.2840

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

13.6450 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 93.5785 (37)

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

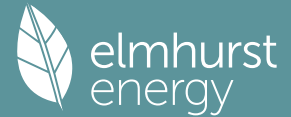
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	68.3461	67.9324	67.5268	65.6218	65.2654	63.6063	63.6063	63.2990	64.2454	65.2654	65.9865	66.7402 (38)
Average = Sum(39)m / 12 =	161.9247	161.5109	161.1053	159.2004	158.8439	157.1848	157.1848	156.8775	157.8239	158.8439	159.5650	160.3188 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.3067	1.3033	1.3001	1.2847	1.2818	1.2684	1.2684	1.2660	1.2736	1.2818	1.2876	1.2937 (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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
Hot water usage for baths	83.5871	82.3457	80.5976	77.3743	74.9608	72.2846	70.8390	72.5749	74.4650	77.3287	80.6183	83.3045 (42b)
Hot water usage for other uses	44.0961	42.4926	40.8891	39.2856	37.6821	36.0787	36.0787	37.6821	39.2856	40.8891	42.4926	44.0961 (42c)
Average daily hot water use (litres/day)												117.5858 (43)
Daily hot water use	127.6832	124.8383	121.4867	116.6600	112.6430	108.3632	106.9177	110.2571	113.7507	118.2178	123.1109	127.4006 (44)
Energy conte	202.2190	177.7681	186.7206	159.7017	151.6391	133.2453	129.3077	136.5213	140.2659	160.4204	175.3941	199.4786 (45)
Energy content (annual)												Total = Sum(45)m = 1952.6818
Distribution loss (46)m = 0.15 x (45)m	30.3329	26.6652	28.0081	23.9553	22.7459	19.9868	19.3962	20.4782	21.0399	24.0631	26.3091	29.9218 (46)
Water storage loss:												250.0000 (47)
Store volume												1.8903 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												1.0208 (55)
Enter (49) or (54) in (55)												
Total storage loss	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444 (56)
If cylinder contains dedicated solar storage												
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	257.1258	227.3614	241.6273	212.8373	206.5459	186.3809	184.2145	191.4281	193.4016	215.3272	228.5297	254.3854 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)

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FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	257.1258	227.3614	241.6273	212.8373	206.5459	186.3809	184.2145	191.4281	193.4016	215.3272	228.5297	254.3854	2599.1650 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											2599.1650 (64)	
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	111.1633	98.7825	106.0100	95.6093	94.3454	86.8125	86.9202	89.3188	89.1469	97.2652	100.8270	110.2521	110.2521 (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	
	143.8635	143.8635	143.8635	143.8635	143.8635	143.8635	143.8635	143.8635	143.8635	143.8635	143.8635	143.8635	143.8635 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	149.1993	165.1849	149.1993	154.1726	149.1993	154.1726	149.1993	149.1993	154.1726	149.1993	154.1726	149.1993	149.1993 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	290.2324	293.2441	285.6547	269.4978	249.1025	229.9339	217.1281	214.1164	221.7058	237.8627	258.2579	277.4266	277.4266 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3864	37.3864	37.3864	37.3864	37.3864	37.3864	37.3864	37.3864	37.3864	37.3864	37.3864	37.3864	37.3864 (69)
Pumps, fans													
	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908 (71)
Water heating gains (Table 5)													
	149.4130	146.9978	142.4866	132.7907	126.8084	120.5730	116.8283	120.0521	123.8152	130.7328	140.0375	148.1883	148.1883 (72)
Total internal gains													
	658.0037	674.5858	646.4996	625.6201	594.2693	570.8385	549.3147	549.5268	565.8526	586.9539	621.6271	643.9732	643.9732 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W							
East	8.7300	19.6403	0.6300	0.7000	0.7700	52.4003 (76)							
South	3.3000	46.7521	0.6300	0.7000	0.7700	47.1505 (78)							
West	5.9400	19.6403	0.6300	0.7000	0.7700	35.6538 (80)							
East	2.7600	26.0000	0.6300	0.7000	1.0000	28.4815 (82)							
West	1.0900	26.0000	0.6300	0.7000	1.0000	11.2481 (82)							
Solar gains	174.9343	331.9883	528.7345	754.1069	916.2720	936.1418	891.8829	770.1590	608.4073	388.5337	216.1086	145.2431	83)
Total gains	832.9380	1006.5741	1175.2341	1379.7270	1510.5412	1506.9804	1441.1977	1319.6858	1174.2599	975.4876	837.7357	789.2163	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	25.2611	25.3258	25.3896	25.6934	25.7510	26.0228	26.0228	26.0738	25.9175	25.7510	25.6347	25.5141	
alpha	2.6841	2.6884	2.6926	2.7129	2.7167	2.7349	2.7349	2.7383	2.7278	2.7167	2.7090	2.7009	
util living area													
	0.9703	0.9507	0.9151	0.8385	0.7228	0.5732	0.4441	0.4938	0.7036	0.8860	0.9542	0.9740	0.9740 (86)
MIT													
	18.3278	18.6815	19.2199	19.9084	20.4526	20.7973	20.9264	20.9002	20.6260	19.8816	18.9893	18.2769	18.2769 (87)
Th 2													
	19.8356	19.8382	19.8408	19.8528	19.8551	19.8656	19.8656	19.8676	19.8616	19.8551	19.8505	19.8457	19.8457 (88)
util rest of house													
	0.9650	0.9421	0.9000	0.8096	0.6726	0.4954	0.3423	0.3900	0.6328	0.8589	0.9448	0.9694	0.9694 (89)
MIT 2													
	16.7396	17.1872	17.8628	18.7119	19.3461	19.7173	19.8289	19.8139	19.5580	18.7030	17.5896	16.6808	16.6808 (90)
Living area fraction													
	FLA = Living area / (4) =												
MIT	16.9319	17.3681	18.0271	18.8567	19.4801	19.8480	19.9618	19.9454	19.6873	18.8457	17.7590	16.8740	16.8740 (92)
Temperature adjustment													
	0.0000												
adjusted MIT	16.9319	17.3681	18.0271	18.8567	19.4801	19.8480	19.9618	19.9454	19.6873	18.8457	17.7590	16.8740	16.8740 (93)

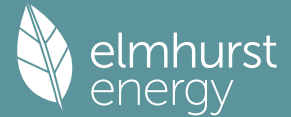
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9448	0.9160	0.8686	0.7792	0.6541	0.4941	0.3514	0.3976	0.6205	0.8278	0.9197	0.9510	0.9510 (94)
Useful gains	786.9733	921.9789	1020.8613	1075.0177	988.0325	744.6002	506.3782	524.7504	728.5890	807.4917	770.4436	750.5186	750.5186 (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	4.2000 (96)
Heat loss rate W													
	2045.4132	2013.7299	1857.0768	1585.1160	1235.8179	824.9063	528.4224	556.1978	881.8040	1309.7781	1700.8069	2031.8851	2031.8851 (97)
Space heating kWh													
	936.2793	733.6566	622.1444	367.2708	184.3523	0.0000	0.0000	0.0000	0.0000	373.7011	669.8615	953.3366	953.3366 (98a)
Space heating requirement - total per year (kWh/year)													
	4840.6026												
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	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)													
	0.0000												
Space heating kWh													
	936.2793	733.6566	622.1444	367.2708	184.3523	0.0000	0.0000	0.0000	0.0000	373.7011	669.8615	953.3366	953.3366 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)													
	4840.6026											39.0623 (99)	
Space heating per m2													
	(98c) / (4) =												

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement												

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Space heating efficiency (main heating system 1)	936.2793	733.6566	622.1444	367.2708	184.3523	0.0000	0.0000	0.0000	0.0000	373.7011	669.8615	953.3366	(98)	
Space heating fuel (main heating system)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)	
Space heating efficiency (main heating system 2)	1014.3871	794.8609	674.0459	397.9099	199.7316	0.0000	0.0000	0.0000	0.0000	404.8766	725.7438	1032.8674	(211)	
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	(212)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating requirement	257.1258	227.3614	241.6273	212.8373	206.5459	186.3809	184.2145	191.4281	193.4016	215.3272	228.5297	254.3854	(64)	
Efficiency of water heater (217)m	86.6934	86.4922	86.0841	85.2716	83.8058	79.8000	79.8000	79.8000	79.8000	85.2838	86.3235	79.8000	(216)	
Fuel for water heating, kWh/month	296.5922	262.8693	280.6875	249.5994	246.4577	233.5600	230.8452	239.8848	242.3578	252.4831	264.7365	293.2753	(219)	
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)	
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	(231)	
Lighting	31.0007	24.8699	22.3926	16.4058	12.6723	10.3534	11.5601	15.0262	19.5176	25.6081	28.9243	31.8623	(232)	
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-85.1325	-110.4088	-146.1070	-150.7822	-151.9943	-138.1389	-136.2481	-133.4552	-127.5410	-119.1701	-90.0141	-74.7684	(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	-82.3277	-167.6298	-323.5409	-472.7664	-613.0660	-611.8232	-604.7424	-517.5137	-386.7334	-235.2255	-108.3442	-65.5499	(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												5244.4231	(211)	
Space heating fuel - main system 2												0.0000	(213)	
Space heating fuel - secondary												0.0000	(215)	
Efficiency of water heater												79.8000	(216)	
Water heating fuel used												3093.3487	(219)	
Space cooling fuel												0.0000	(221)	
Electricity for pumps and fans:														
Total electricity for the above, kWh/year													86.0000	(231)
Electricity for lighting (calculated in Appendix L)													250.1931	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-5653.0238	(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													3020.9412	(238)

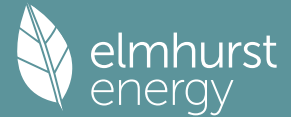
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5244.4231	0.2100	1101.3289
Total CO2 associated with community systems			0.0000
Water heating (other fuel)	3093.3487	0.2100	649.6032
Space and water heating			1750.9321
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293
Energy for lighting	250.1931	0.1443	36.1106
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1463.7607	0.1364	-199.7152
PV Unit electricity exported	-4189.2631	0.1267	-530.8679
Total			-730.5831
Total CO2, kg/year			1068.3888
EPC Target Carbon Dioxide Emission Rate (TER)			8.6200

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	5244.4231	1.1300	5926.1982
Total CO2 associated with community systems			0.0000
Water heating (other fuel)	3093.3487	1.1300	3495.4840
Space and water heating			9421.6822
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008
Energy for lighting	250.1931	1.5338	383.7546
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1463.7607	1.5044	-2202.0211
PV Unit electricity exported	-4189.2631	0.4652	-1948.8000
Total			-4150.8212
Total Primary energy kWh/year			5784.7164
Target Primary Energy Rate (TPER)			46.6800

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1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	85.6700 (1b)	x 2.5900 (2b)	= 221.8853 (1b) - (3b)
First floor	38.2500 (1c)	x 3.3400 (2c)	= 127.7550 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 349.6403 (5)

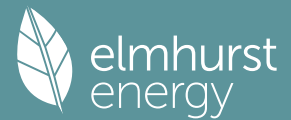
2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1144 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50		2.0000 (17)
Infiltration rate		0.2144 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1983 (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	Jan 1.2750, Feb 1.2500, Mar 1.2250, Apr 1.1000, May 1.0750, Jun 0.9500, Jul 0.9500, Aug 0.9250, Sep 1.0000, Oct 1.0750, Nov 1.1250, Dec 1.1750	(22a)
Adj infiltr rate	0.2529, 0.2479, 0.2429, 0.2182, 0.2132, 0.1884, 0.1884, 0.1834, 0.1983, 0.2132, 0.2231, 0.2330	(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	0.5320, 0.5307, 0.5295, 0.5238, 0.5227, 0.5177, 0.5177, 0.5168, 0.5197, 0.5227, 0.5249, 0.5272	(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						
Window (Uw = 1.20)			17.9700	1.1450	20.5763		(27)						
Door			1.8900	1.0000	1.8900		(26a)						
8			1.0900	1.2357	1.3470		(27a)						
13-15			2.7600	1.2357	3.4106		(27a)						
Floor 1 P/a 0.48			85.6700	0.1200	10.2804	110.0000	9423.7000 (28a)						
External Wall 1 Clad	135.5100	11.1300	124.3800	0.1500	18.6570	9.0000	1119.4200 (29a)						
External Wall 2 Garage	12.8400		12.8400	0.1400	1.7976	9.0000	115.5600 (29a)						
External Wall 4 Dormer	11.8000	8.7300	3.0700	0.1800	0.5526	18.0000	55.2600 (29a)						
External Wall 3 "Attic"	28.0900		28.0900	0.0900	2.5281	9.0000	252.8100 (29a)						
External Roof 1 Sloping	53.4200	3.8500	49.5700	0.1300	6.4441	9.0000	446.1300 (30)						
External Roof 2 Horz	28.8900		28.8900	0.0900	2.6001	9.0000	260.0100 (30)						
Roof 3 "attic"	11.4800		11.4800	0.0900	1.0332	9.0000	103.3200 (30)						
Total net area of external elements Aum(A, m ²)			367.7000				(31)						
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	71.1170		(33)						
Internal Wall 1 GF			135.8400			9.0000	1222.5600 (32c)						
Internal Wall 2 FF			77.1000			9.0000	693.9000 (32c)						
Internal Floor 1			38.2500			18.0000	688.5000 (32d)						
Internal Ceiling 1			38.2500			9.0000	344.2500 (32e)						
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14725.4200 (34)						
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							118.8301 (35)						
List of Thermal Bridges													
K1 Element				Length	Psi-value	Total							
E16 Corner (normal)				21.2800	0.0300	0.6384							
E5 Ground floor (normal)				41.1000	0.0210	0.8631							
E11 Eaves (insulation at rafter level)				16.7000	0.0390	0.6513							
E17 Corner (inverted - internal area greater than external area)				2.4000	-0.0150	-0.0360							
E13 Gable (insulation at rafter level)				17.8100	0.0240	0.4274							
R4 Ridge (vaulted ceiling)				10.8000	0.1200	1.2960							
R7 Flat ceiling (inverted)				4.0000	0.1200	0.4800							
E6 Intermediate floor within a dwelling				19.7500	0.0800	1.5800							
E10 Eaves (insulation at ceiling level)				10.8000	0.0440	0.4752							
E12 Gable (insulation at ceiling level)				5.3500	0.0510	0.2728							
E24 Eaves (insulation at ceiling level - inverted)				5.3500	0.1500	0.8025							
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.4508 (36)						
Point Thermal bridges						(36a) =	0.0000						
Total fabric heat loss						(33) + (36) + (36a) =	78.5678 (37)						
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 61.3793	Feb 61.2361	Mar 61.0957	Apr 60.4362	May 60.3129	Jun 59.7385	Jul 59.7385	Aug 59.6321	Sep 59.9597	Oct 60.3129	Nov 60.5625	Dec 60.8234	(38)
Heat transfer coeff	139.9472	139.8039	139.6635	139.0041	138.8807	138.3063	138.3063	138.2000	138.5276	138.8807	139.1303	139.3912	(39)
Average = Sum(39)m / 12 =												139.0035	
HLP	Jan 1.1293	Feb 1.1282	Mar 1.1270	Apr 1.1217	May 1.1207	Jun 1.1161	Jul 1.1161	Aug 1.1152	Sep 1.1179	Oct 1.1207	Nov 1.1227	Dec 1.1248	(40)
HLP (average)												1.1217	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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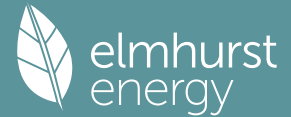
4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.8773 (42)
Hot water usage for mixer showers												0.0000 (42a)
Hot water usage for baths	31.2843	30.8197	30.1654	28.9591	28.0558	27.0541	26.5131	27.1628	27.8702	28.9420	30.1732	31.1786 (42b)
Hot water usage for other uses	44.0961	42.4926	40.8891	39.2856	37.6821	36.0787	36.0787	37.6821	39.2856	40.8891	42.4926	44.0961 (42c)
Average daily hot water use (litres/day)												69.0929 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	75.3805	73.3124	71.0546	68.2447	65.7379	63.1328	62.5917	64.8449	67.1558	69.8311	72.6658	75.2747 (44)
Distribution loss (46)m = 0.15 x (45)m	119.3842	104.3958	109.2083	93.4236	88.4959	77.6291	75.6993	80.2916	82.8099	94.7602	103.5258	117.8620 (45)
Water storage loss:												Total = Sum(45)m = 1147.4856
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 (46)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
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 (57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month	101.4766	88.7364	92.8270	79.4101	75.2215	65.9847	64.3444	68.2478	70.3884	80.5461	87.9969	100.1827 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	101.4766	88.7364	92.8270	79.4101	75.2215	65.9847	64.3444	68.2478	70.3884	80.5461	87.9969	100.1827 (64)
12Total per year (kWh/year)												975.3628 (64)
Electric shower(s)	58.0301	51.7053	56.4602	53.8793	54.8904	52.3601	54.1054	54.8904	53.8793	56.4602	55.3986	58.0301 (64a)
Heat gains from water heating, kWh/month	39.8767	35.1104	37.3218	33.3223	32.5280	29.5862	29.6125	30.7845	31.0669	34.2516	35.8489	39.5532 (65)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 660.0895 (64a)												

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	143.8635	143.8635	143.8635	143.8635	143.8635	143.8635	143.8635	143.8635	143.8635	143.8635	143.8635	143.8635 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	149.1993	165.1849	149.1993	154.1726	149.1993	154.1726	149.1993	149.1993	154.1726	149.1993	154.1726	149.1993 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	290.2324	293.2441	285.6547	269.4978	249.1025	229.9339	217.1281	214.1164	221.7058	237.8627	258.2579	277.4266 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3864	37.3864	37.3864	37.3864	37.3864	37.3864	37.3864	37.3864	37.3864	37.3864	37.3864	37.3864 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908 (71)
Water heating gains (Table 5)	53.5977	52.2477	50.1637	46.2810	43.7204	41.0919	39.8017	41.3771	43.1485	46.0371	49.7901	53.1629 (72)
Total internal gains	559.1884	576.8358	551.1768	536.1105	508.1813	491.3575	472.2881	470.8518	485.1860	499.2582	528.3797	545.9478 (73)

6. Solar gains												
[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m2	Table 6a	Specific data	Specific data	factor	W						
		W/m2	or Table 6b	or Table 6c	Table 6d							
East	8.7300	19.6403	0.7600	0.7000	0.7700	63.2130 (76)						
South	3.3000	46.7521	0.7600	0.7000	0.7700	56.8800 (78)						
West	5.9400	19.6403	0.7600	0.7000	0.7700	43.0109 (80)						
East	2.7600	26.0000	0.7600	0.7000	1.0000	34.3587 (82)						
West	1.0900	26.0000	0.7600	0.7000	1.0000	13.5692 (82)						
Solar gains	211.0318	400.4938	637.8384	909.7163	1105.3440	1129.3140	1075.9223	929.0807	733.9517	468.7073	260.7025	175.2139 (83)
Total gains	770.2202	977.3296	1189.0152	1445.8267	1613.5252	1620.6715	1548.2104	1399.9325	1219.1377	967.9655	789.0822	721.1617 (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	29.2281	29.2581	29.2875	29.4264	29.4526	29.5749	29.5749	29.5977	29.5277	29.4526	29.3997	29.3447
alpha	2.9485	2.9505	2.9525	2.9618	2.9635	2.9717	2.9717	2.9732	2.9685	2.9635	2.9600	2.9563
util living area	0.9743	0.9499	0.9024	0.8010	0.6596	0.5010	0.3778	0.4293	0.6512	0.8733	0.9571	0.9785 (86)
MIT	18.6394	19.0318	19.5824	20.2189	20.6608	20.8906	20.9647	20.9481	20.7583	20.1064	19.2428	18.5625 (87)
Th 2	19.9769	19.9779	19.9788	19.9831	19.9839	19.9877	19.9877	19.9884	19.9863	19.9839	19.9823	19.9806 (88)
util rest of house	0.9699	0.9417	0.8867	0.7708	0.6113	0.4339	0.2965	0.3436	0.5847	0.8461	0.9486	0.9748 (89)
MIT 2	17.8243	18.2104	18.7458	19.3476	19.7391	19.9251	19.9736	19.9662	19.8330	19.2615	18.4263	17.7508 (90)
Living area fraction	17.9230	18.3098	18.8471	19.4531	19.8507	20.0420	20.0936	20.0850	19.9450	19.3638	18.5251	17.8491 (91)
MIT	17.9230	18.3098	18.8471	19.4531	19.8507	20.0420	20.0936	20.0850	19.9450	19.3638	18.5251	17.8491 (92)
Temperature adjustment												0.0000
adjusted MIT	17.9230	18.3098	18.8471	19.4531	19.8507	20.0420	20.0936	20.0850	19.9450	19.3638	18.5251	17.8491 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9576	0.9242	0.8655	0.7530	0.6045	0.4377	0.3053	0.3521	0.5817	0.8260	0.9324	0.9639	(94)
Useful gains	737.5954	903.2259	1029.0346	1088.6720	975.3769	709.3348	472.6361	492.9513	709.1890	799.4969	735.7612	695.1581	(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	1906.4979	1874.7437	1724.4335	1466.9215	1131.9730	752.6592	483.1823	509.2724	809.6977	1217.1246	1589.5772	1902.5605	(97)
Space heating kWh	869.6634	652.8600	517.3767	272.3396	116.5075	0.0000	0.0000	0.0000	0.0000	310.7150	614.7475	898.3074	(98a)
Space heating requirement - total per year (kWh/year)												4252.5171	
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	869.6634	652.8600	517.3767	272.3396	116.5075	0.0000	0.0000	0.0000	0.0000	310.7150	614.7475	898.3074	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4252.5171	
Space heating per m2											(98c) / (4) =	34.3166	(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	1300.0795	1023.4669	1050.3198	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8494	0.8970	0.8678	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1104.2878	918.0872	911.4199	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1767.7509	1689.4164	1529.0521	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	477.6934	573.8689	459.5184	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	119.4234	143.4672	114.8796	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												377.7702	(107)
Energy for space heating												34.3166	(99)
Energy for space cooling												3.0485	(108)
Total												37.3651	(109)
Fabric Energy Efficiency (DFEE)												37.4	(109)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	85.6700 (1b)	x 2.5900 (2b)	= 221.8853 (1b) - (3b)	
First floor	38.2500 (1c)	x 3.3400 (2c)	= 127.7550 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.9200		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	349.6403 (5)	

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1144	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3644	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3371	(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	0.4298 0.4213 0.4129 0.3708 0.3624 0.3202 0.3202 0.3118 0.3371 0.3624 0.3792 0.3961		(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	0.5924 0.5888 0.5852 0.5687 0.5657 0.5513 0.5513 0.5486 0.5568 0.5657 0.5719 0.5784		(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	
TER Semi-glazed door			1,8900	1.0000	1,8900			(26a)
TER Opening Type (Uw = 1.20)			17,9700	1.1450	20,5763			(27)
8			1,0900	1.5918	1,7350			(27a)
13-15			2,7600	1.5918	4,3933			(27a)
Floor 1 P/a 0.48			85,6700	0.1300	11,1371			(28a)
External Wall 1 Clad	135.5100	11.1300	124,3800	0.1800	22,3884			(29a)
External Wall 2 Garage	12.8400		12,8400	0.1800	2,3112			(29a)
External Wall 4 Dormer	11.8000	8.7300	3,0700	0.1800	0,5526			(29a)
External Wall 3 "Attic"	28.0900		28,0900	0.1800	5,0562			(29a)
External Roof 1 Sloping	53.4200	3.8500	49,5700	0.1100	5,4527			(30)
External Roof 2 Horz	28.8900		28,8900	0.1100	3,1779			(30)
Roof 3 "attic"	11.4800		11,4800	0.1100	1,2628			(30)
Total net area of external elements Aum(A, m2)			367,7000					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	79,9335		(33)

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

118.8301 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	21.2800	0.0900	1,9152
E5 Ground floor (normal)	41.1000	0.1600	6,5760
E11 Eaves (insulation at rafter level)	16.7000	0.0400	0,6680
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0,2160
E13 Gable (insulation at rafter level)	17.8100	0.0800	1,4248
R4 Ridge (vaulted ceiling)	10.8000	0.0800	0,8640
R7 Flat ceiling (inverted)	4.0000	0.0400	0,1600
E6 Intermediate floor within a dwelling	19.7500	0.0000	0,0000
E10 Eaves (insulation at ceiling level)	10.8000	0.0600	0,6480
E12 Gable (insulation at ceiling level)	5.3500	0.0600	0,3210
E24 Eaves (insulation at ceiling level - inverted)	5.3500	0.2400	1,2840

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

13.6450 (36)

Point Thermal bridges

(33) + (36) + (36a) = 93.5785 (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	68.3461	67.9324	67.5268	65.6218	65.2654	63.6063	63.6063	63.2990	64.2454	65.2654	65.9865	66.7402
Heat transfer coeff	161.9247	161.5109	161.1053	159.2004	158.8439	157.1848	157.1848	156.8775	157.8239	158.8439	159.5650	160.3188
Average = Sum(39)m / 12 =												159.1987

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3067	1.3033	1.3001	1.2847	1.2818	1.2684	1.2684	1.2660	1.2736	1.2818	1.2876	1.2937
HLP (average)												1.2847
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

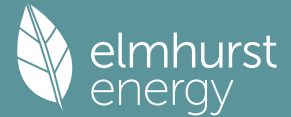
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8773 (42)
Hot water usage for mixer showers													0.0000 (42a)
Hot water usage for baths	31.2843	30.8197	30.1654	28.9591	28.0558	27.0541	26.5131	27.1628	27.8702	28.9420	30.1732	31.1786	31.1786 (42b)
Hot water usage for other uses	44.0961	42.4926	40.8891	39.2856	37.6821	36.0787	36.0787	37.6821	39.2856	40.8891	42.4926	44.0961	44.0961 (42c)
Average daily hot water use (litres/day)													69.0929 (43)
Daily hot water use	75.3805	73.3124	71.0546	68.2447	65.7379	63.1328	62.5917	64.8449	67.1558	69.8311	72.6658	75.2747	75.2747 (44)
Energy conte	119.3842	104.3958	109.2083	93.4236	88.4959	77.6291	75.6993	80.2916	82.8099	94.7602	103.5258	117.8620	117.8620 (45)
Energy content (annual)													Total = Sum(45)m = 1147.4856
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													
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month	101.4766	88.7364	92.8270	79.4101	75.2215	65.9847	64.3444	68.2478	70.3884	80.5461	87.9969	100.1827	100.1827 (62)
WWHRs	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	101.4766	88.7364	92.8270	79.4101	75.2215	65.9847	64.3444	68.2478	70.3884	80.5461	87.9969	100.1827	100.1827 (64)
12Total per year (kWh/year)													975.3628 (64)
Electric shower(s)	58.0301	51.7053	56.4602	53.8793	54.8904	52.3601	54.1054	54.8904	53.8793	56.4602	55.3986	58.0301	58.0301 (64a)
Heat gains from water heating, kWh/month	39.8767	35.1104	37.3218	33.3223	32.5280	29.5862	29.6125	30.7845	31.0669	34.2516	35.8489	39.5532	39.5532 (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	143.8635	143.8635	143.8635	143.8635	143.8635	143.8635	143.8635	143.8635	143.8635	143.8635	143.8635	143.8635
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	149.1993	165.1849	149.1993	154.1726	149.1993	154.1726	149.1993	149.1993	154.1726	149.1993	154.1726	149.1993
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	290.2324	293.2441	285.6547	269.4978	249.1025	229.9339	217.1281	214.1164	221.7058	237.8627	258.2579	277.4266
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3864	37.3864	37.3864	37.3864	37.3864	37.3864	37.3864	37.3864	37.3864	37.3864	37.3864	37.3864
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Losses e.g. evaporation (negative values) (Table 5)												

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	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	(71)
Water heating gains (Table 5)	53.5977	52.2477	50.1637	46.2810	43.7204	41.0919	39.8017	41.3771	43.1485	46.0371	49.7901	53.1629	(72)
Total internal gains	559.1884	576.8358	551.1768	536.1105	508.1813	491.3575	472.2881	470.8518	485.1860	499.2582	528.3797	545.9478	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W							
East	8.7300	19.6403	0.6300	0.7000	0.7700	52.4003 (76)							
South	3.3000	46.7521	0.6300	0.7000	0.7700	47.1505 (78)							
West	5.9400	19.6403	0.6300	0.7000	0.7700	35.6538 (80)							
East	2.7600	26.0000	0.6300	0.7000	1.0000	28.4815 (82)							
West	1.0900	26.0000	0.6300	0.7000	1.0000	11.2481 (82)							
Solar gains	174.9343	331.9883	528.7345	754.1069	916.2720	936.1418	891.8829	770.1590	608.4073	388.5337	216.1086	145.2431	(83)
Total gains	734.1227	908.8241	1079.9112	1290.2174	1424.4532	1427.4994	1364.1711	1241.0108	1093.5933	887.7919	744.4883	691.1909	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	25.2611	25.3258	25.3896	25.6934	25.7510	26.0228	26.0228	26.0738	25.9175	25.7510	25.6347	25.5141	
tau	2.6841	2.6884	2.6926	2.7129	2.7167	2.7349	2.7349	2.7383	2.7278	2.7167	2.7090	2.7009	
util living area	0.9778	0.9606	0.9285	0.8562	0.7441	0.5952	0.4646	0.5180	0.7302	0.9049	0.9649	0.9810	(86)
MIT	18.2004	18.5631	19.1171	19.8344	20.4075	20.7770	20.9176	20.8875	20.5866	19.7951	18.8744	18.1486	(87)
Th 2	19.8356	19.8382	19.8408	19.8528	19.8551	19.8656	19.8656	19.8676	19.8616	19.8551	19.8505	19.8457	(88)
util rest of house	0.9737	0.9536	0.9154	0.8294	0.6954	0.5167	0.3596	0.4114	0.6612	0.8811	0.9573	0.9775	(89)
MIT 2	17.2976	17.6570	18.2015	18.8971	19.4222	19.7372	19.8333	19.8198	19.5965	18.8784	17.9769	17.2528	(90)
Living area fraction	17.4069	17.7667	18.3124	19.0106	19.5415	19.8631	19.9645	19.9491	19.7163	18.9894	18.0856	17.3612	(91)
MIT	17.4069	17.7667	18.3124	19.0106	19.5415	19.8631	19.9645	19.9491	19.7163	18.9894	18.0856	17.3612	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.4069	17.7667	18.3124	19.0106	19.5415	19.8631	19.9645	19.9491	19.7163	18.9894	18.0856	17.3612	(93)

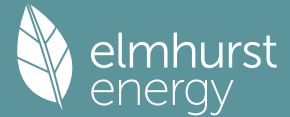
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9614	0.9361	0.8927	0.8056	0.6802	0.5165	0.3694	0.4196	0.6511	0.8579	0.9410	0.9665	(94)
Useful gains	705.7618	850.7271	964.0149	1039.3740	968.9558	737.3071	503.8729	520.7815	712.0125	761.5945	700.5559	668.0075	(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	2122.3240	2078.1085	1903.0338	1609.6095	1245.5697	827.2742	528.8554	556.7724	886.3936	1332.6004	1752.9135	2109.9904	(97)
Space heating kWh	1053.9223	824.8003	698.6301	410.5696	205.8008	0.0000	0.0000	0.0000	0.0000	424.8284	757.6975	1072.8353	(98a)
Space heating requirement - total per year (kWh/year)												5449.0842	
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	1053.9223	824.8003	698.6301	410.5696	205.8008	0.0000	0.0000	0.0000	0.0000	424.8284	757.6975	1072.8353	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5449.0842	
Space heating per m2										(98c) / (4) =		43.9726	(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	1477.5370	1163.1674	1192.2693	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7501	0.8142	0.7766	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1108.3421	947.0308	925.9457	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1552.6123	1484.3669	1351.6574	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	319.8745	399.7781	316.7295	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	79.9686	99.9445	79.1824	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												259.0955	(107)
Energy for space heating												43.9726	(99)
Energy for space cooling												2.0908	(108)
Total												46.0634	(109)
Fabric Energy Efficiency (TFEE)												46.1	(109)

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1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	85.6700 (1b)	x 2.5900 (2b)	= 221.8853 (1b) - (3b)
First floor	38.2500 (1c)	x 3.3400 (2c)	= 127.7550 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 349.6403 (5)

2. Ventilation rate

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		2.0000 (17)
Infiltration rate		0.1000 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.0925 (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	0.1179	0.1156	0.1133	0.1018	0.0994	0.0879	0.0879	0.0856	0.0925	0.0994	0.1041	0.1087 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												81.0000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2129	0.2106	0.2083	0.1967	0.1944	0.1829	0.1829	0.1806	0.1875	0.1944	0.1991	0.2037 (25)

3. Heat losses and heat loss parameter

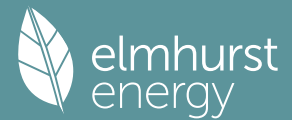
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			17.9700	1.1450	20.5763		(27)
Door			1.8900	1.0000	1.8900		(26a)
8			1.0900	1.2357	1.3470		(27a)
13-15			2.7600	1.2357	3.4106		(27a)
Floor 1 P/a 0.48			85.6700	0.1200	10.2804	110.0000	9423.7000 (28a)
External Wall 1 Clad	135.5100	11.1300	124.3800	0.1500	18.6570	9.0000	1119.4200 (29a)
External Wall 2 Garage	12.8400		12.8400	0.1400	1.7976	9.0000	115.5600 (29a)
External Wall 4 Dormer	11.8000	8.7300	3.0700	0.1800	0.5526	18.0000	55.2600 (29a)
External Wall 3 "Attic"	28.0900		28.0900	0.0900	2.5281	9.0000	252.8100 (29a)
External Roof 1 Sloping	53.4200	3.8500	49.5700	0.1300	6.4441	9.0000	446.1300 (30)
External Roof 2 Horz	28.8900		28.8900	0.0900	2.6001	9.0000	260.0100 (30)
Roof 3 "attic"	11.4800		11.4800	0.0900	1.0332	9.0000	103.3200 (30)
Total net area of external elements Aum(A, m ²)			367.7000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	71.1170	(33)
Internal Wall 1 GF			135.8400			9.0000	1222.5600 (32c)
Internal Wall 2 FF			77.1000			9.0000	693.9000 (32c)
Internal Floor 1			38.2500			18.0000	688.5000 (32d)
Internal Ceiling 1			38.2500			9.0000	344.2500 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14725.4200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		118.8301 (35)

List of Thermal Bridges	K1 Element	Length	Psi-value	Total
E16 Corner (normal)		21.2800	0.0300	0.6384
E5 Ground floor (normal)		41.1000	0.0210	0.8631
E11 Eaves (insulation at rafter level)		16.7000	0.0390	0.6513
E17 Corner (inverted - internal area greater than external area)		2.4000	-0.0150	-0.0360
E13 Gable (insulation at rafter level)		17.8100	0.0240	0.4274
R4 Ridge (vaulted ceiling)		10.8000	0.1200	1.2960
R7 Flat ceiling (inverted)		4.0000	0.1200	0.4800
E6 Intermediate floor within a dwelling		19.7500	0.0800	1.5800
E10 Eaves (insulation at ceiling level)		10.8000	0.0440	0.4752
E12 Gable (insulation at ceiling level)		5.3500	0.0510	0.2728
E24 Eaves (insulation at ceiling level - inverted)		5.3500	0.1500	0.8025
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				7.4508 (36)
Point Thermal bridges				(36a) = 0.0000
Total fabric heat loss				(33) + (36) + (36a) = 78.5678 (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	24.5690	24.3022	24.0354	22.7013	22.4345	21.1004	21.1004	20.8335	21.6340	22.4345	22.9681	23.5017 (38)
Heat transfer coeff	103.1368	102.8700	102.6032	101.2691	101.0023	99.6682	99.6682	99.4014	100.2018	101.0023	101.5359	102.0696 (39)
Average = Sum(39)m / 12 =												101.2024
HLP (average)	0.8323	0.8301	0.8280	0.8172	0.8151	0.8043	0.8043	0.8021	0.8086	0.8151	0.8194	0.8237 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8773 (42)
Hot water usage for mixer showers												0.0000 (42a)
Hot water usage for baths	83.5871	82.3457	80.5976	77.3743	74.9608	72.2846	70.8390	72.5749	74.4650	77.3287	80.6183	83.3045 (42b)
Hot water usage for other uses	44.0961	42.4926	40.8891	39.2856	37.6821	36.0787	36.0787	37.6821	39.2856	40.8891	42.4926	44.0961 (42c)
Average daily hot water use (litres/day)												117.5858 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	127.6832	124.8383	121.4867	116.6600	112.6430	108.3632	106.9177	110.2571	113.7507	118.2178	123.1109	127.4006 (44)
Distribution loss (46)m = 0.15 x (45)m	202.2190	177.7681	186.7206	159.7017	151.6391	133.2453	129.3077	136.5213	140.2659	160.4204	175.3941	199.4786 (45)
Water storage loss:												1952.6818
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8640 (55)
Total storage loss												26.7840 (56)
If cylinder contains dedicated solar storage												26.7840 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	252.2654	222.9713	236.7670	208.1337	201.6855	181.6773	179.3541	186.5677	188.6979	210.4668	223.8261	249.5250 (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	252.2654	222.9713	236.7670	208.1337	201.6855	181.6773	179.3541	186.5677	188.6979	210.4668	223.8261	249.5250 (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	107.2749	95.2705	102.1217	91.8464	90.4571	83.0496	83.0319	85.4305	85.3840	93.3769	97.0641	106.3638 (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	172.6363	172.6363	172.6363	172.6363	172.6363	172.6363	172.6363	172.6363	172.6363	172.6363	172.6363	172.6363 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.9561	29.2713	23.8050	18.0220	13.4716	11.3733	12.2893	15.9740	21.4403	27.2234	31.7738	33.8721 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	433.1826	437.6777	426.3503	402.2355	371.7948	343.1849	324.0718	319.5767	330.9041	355.0190	385.4596	414.0695 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1409	55.1409	55.1409	55.1409	55.1409	55.1409	55.1409	55.1409	55.1409	55.1409	55.1409	55.1409 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908 (71)
Water heating gains (Table 5)	144.1868	141.7715	137.2604	127.5645	121.5821	115.3467	111.6020	114.8259	118.5889	125.5066	134.8113	142.9620 (72)
Total internal gains	723.0118	721.4069	700.1020	660.5082	619.5349	582.5913	560.6494	563.0629	583.6197	620.4353	664.7310	703.5899 (73)

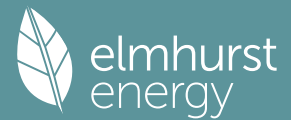
6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
East	8.7300	19.6403	0.7600	0.7000	0.7700	63.2130 (76)						
South	3.3000	46.7521	0.7600	0.7000	0.7700	56.8800 (78)						
West	5.9400	19.6403	0.7600	0.7000	0.7700	43.0109 (80)						
East	2.7600	26.0000	0.7600	0.7000	1.0000	34.3587 (82)						
West	1.0900	26.0000	0.7600	0.7000	1.0000	13.5692 (82)						
Solar gains	211.0318	400.4938	637.8384	909.7163	1105.3440	1129.3140	1075.9223	929.0807	733.9517	468.7073	260.7025	175.2139 (83)
Total gains	934.0436	1121.9007	1337.9404	1570.2245	1724.8789	1711.9053	1636.5717	1492.1436	1317.5714	1089.1426	925.4334	878.8038 (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	39.6599	39.7627	39.8661	40.3913	40.4980	41.0401	41.0401	41.1503	40.8216	40.4980	40.2852	40.0746
alpha	3.6440	3.6508	3.6577	3.6928	3.6999	3.7360	3.7360	3.7434	3.7214	3.6999	3.6857	3.6716
util living area	0.9477	0.9070	0.8249	0.6806	0.5168	0.3667	0.2665	0.3039	0.5010	0.7728	0.9157	0.9562 (86)
Living	19.8855	20.1292	20.4425	20.7228	20.8574	20.9049	20.9145	20.9129	20.8783	20.6583	20.2194	19.8370
Non living	18.9108	19.2147	19.5968	19.9310	20.0785	20.1342	20.1421	20.1430	20.1079	19.8689	19.3391	18.8559
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.4298	20.1292	20.4425	20.7228	20.8574	20.9049	20.9145	20.9129	20.8783	20.6583	20.2194	19.9997 (87)
Th 2	20.2254	20.2273	20.2291	20.2384	20.2403	20.2496	20.2496	20.2515	20.2459	20.2403	20.2366	20.2329 (88)
util rest of house	0.9405	0.8952	0.8050	0.6509	0.4801	0.3254	0.2216	0.2554	0.4523	0.7411	0.9029	0.9500 (89)
MIT 2	19.7013	19.2147	19.5968	19.9310	20.0785	20.1342	20.1421	20.1430	20.1079	19.8689	19.3391	19.1041 (90)
Living area fraction												fLA = Living area / (4) = 0.1210 (91)

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MIT	19.7895	19.3254	19.6992	20.0269	20.1728	20.2275	20.2356	20.2362	20.2011	19.9644	19.4457	19.2125 (92)
Temperature adjustment												0.0000
adjusted MIT	19.7895	19.3254	19.6992	20.0269	20.1728	20.2275	20.2356	20.2362	20.2011	19.9644	19.4457	19.2125 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9359	0.8792	0.7900	0.6422	0.4767	0.3242	0.2208	0.2544	0.4493	0.7285	0.8873	0.9402 (94)
Useful gains	874.2177	986.4059	1057.0314	1008.4223	822.2868	555.0169	361.3395	379.5989	592.0205	793.4898	821.1098	826.2181 (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	1597.5395	1483.9379	1354.2785	1126.8094	855.7717	560.8807	362.3498	381.3199	611.3459	945.8281	1253.5293	1532.3155 (97)
Space heating kWh	538.1514	334.3415	221.1519	85.2387	24.9127	0.0000	0.0000	0.0000	0.0000	113.3397	311.3421	525.3365 (98a)
Space heating requirement - total per year (kWh/year)												2153.8145
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	538.1514	334.3415	221.1519	85.2387	24.9127	0.0000	0.0000	0.0000	0.0000	113.3397	311.3421	525.3365 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2153.8145
Space heating per m2										(98c) / (4) =		17.3807 (99)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												373.9506 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	538.1514	334.3415	221.1519	85.2387	24.9127	0.0000	0.0000	0.0000	0.0000	113.3397	311.3421	525.3365 (98)
Space heating efficiency (main heating system 1)	373.9506	373.9506	373.9506	373.9506	373.9506	0.0000	0.0000	0.0000	0.0000	373.9506	373.9506	373.9506 (210)
Space heating fuel (main heating system)	143.9098	89.4080	59.1393	22.7941	6.6620	0.0000	0.0000	0.0000	0.0000	30.3087	83.2576	140.4829 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	252.2654	222.9713	236.7670	208.1337	201.6855	181.6773	179.3541	186.5677	188.6979	210.4668	223.8261	249.5250 (64)
Efficiency of water heater (217)m	200.3638	200.3638	200.3638	200.3638	200.3638	200.3638	200.3638	200.3638	200.3638	200.3638	200.3638	200.3638 (216)
Fuel for water heating, kWh/month	125.9037	111.2832	118.1685	103.8779	100.6596	90.6737	89.5142	93.1145	94.1776	105.0423	111.7098	124.5360 (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	20.7227	18.7173	20.7227	20.0542	20.7227	20.0542	20.7227	20.7227	20.0542	20.7227	20.0542	20.7227 (231)
Lighting	28.8463	23.1416	20.8364	15.2657	11.7916	9.6339	10.7567	13.9820	18.1612	23.8285	26.9142	29.6480 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-62.1896	-88.7352	-128.2262	-143.0910	-153.8814	-143.1385	-141.3160	-133.2038	-117.8307	-99.8060	-68.1775	-53.4893 (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	-27.9661	-61.7087	-127.9971	-200.2986	-270.3476	-273.9462	-270.2568	-226.3893	-163.8029	-92.5166	-38.7602	-21.9557 (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												575.9624 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												200.3638
Water heating fuel used												1268.6610 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5720) mechanical ventilation fans (SFP = 0.5720)												243.9930 (230a)
Total electricity for the above, kWh/year												243.9930 (231)
Electricity for lighting (calculated in Appendix L)												232.8061 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-3109.0309 (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												-787.6084 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	575.9624	16.4900	94.9762 (240)
Total CO2 associated with community systems			0.0000 (473)

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Water heating (other fuel)	1268.6610	16.4900	209.2022 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	243.9930	16.4900	40.2344 (249)
Energy for lighting	232.8061	16.4900	38.3897 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1333.0852	16.4900	-219.8257
PV Unit electricity exported	-1775.9457	5.5900	-99.2754
Total			-319.1011 (252)
Total energy cost			63.7015 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.1358 (257)
SAP value		97.7993
SAP rating (Section 12)		98 (258)
SAP band		A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	575.9624	0.1572	90.5424 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1268.6610	0.1409	178.7377 (264)
Space and water heating			269.2801 (265)
Pumps, fans and electric keep-hot	243.9930	0.1387	33.8448 (267)
Energy for lighting	232.8061	0.1443	33.6011 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1333.0852	0.1346	-179.4715
PV Unit electricity exported	-1775.9457	0.1249	-221.7435
Total			-401.2150 (269)
Total CO2, kg/year			-64.4890 (272)
CO2 emissions per m2			-0.5200 (273)
EI value			100.5116
EI rating			101 (274)
EI band			A

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

1. Overall dwelling characteristics

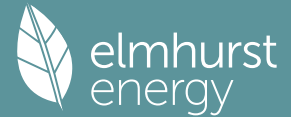
	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	85.6700 (1b)	x 2.5900 (2b)	= 221.8853 (1b) - (3b)
First floor	38.2500 (1c)	x 3.3400 (2c)	= 127.7550 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 349.6403 (5)

2. Ventilation rate

		m3 per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50		2.0000 (17)
Infiltration rate		0.1000 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.0925 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	6.3000	6.0000	5.8000	5.1000	5.1000	4.6000	4.6000	4.5000	4.9000	5.7000	5.9000	6.3000 (22)
Wind factor	1.5750	1.5000	1.4500	1.2750	1.2750	1.1500	1.1500	1.1250	1.2250	1.4250	1.4750	1.5750 (22a)
Adj infilt rate	0.1457	0.1388	0.1341	0.1179	0.1179	0.1064	0.1064	0.1041	0.1133	0.1318	0.1364	0.1457 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												81.0000 (23c)

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Effective ac 0.2407 0.2337 0.2291 0.2129 0.2129 0.2014 0.2014 0.1991 0.2083 0.2268 0.2314 0.2407 (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
Window (Uw = 1.20)			17.9700	1.1450	20.5763		(27)
Door			1.8900	1.0000	1.8900		(26a)
8			1.0900	1.2357	1.3470		(27a)
13-15			2.7600	1.2357	3.4106		(27a)
Floor 1 P/a 0.48			85.6700	0.1200	10.2804	110.0000	9423.7000 (28a)
External Wall 1 Clad	135.5100	11.1300	124.3800	0.1500	18.6570	9.0000	1119.4200 (29a)
External Wall 2 Garage	12.8400		12.8400	0.1400	1.7976	9.0000	115.5600 (29a)
External Wall 4 Dormer	11.8000	8.7300	3.0700	0.1800	0.5526	18.0000	55.2600 (29a)
External Wall 3 "Attic"	28.0900		28.0900	0.0900	2.5281	9.0000	252.8100 (29a)
External Roof 1 Sloping	53.4200	3.8500	49.5700	0.1300	6.4441	9.0000	446.1300 (30)
External Roof 2 Horz	28.8900		28.8900	0.0900	2.6001	9.0000	260.0100 (30)
Roof 3 "attic"	11.4800		11.4800	0.0900	1.0332	9.0000	103.3200 (30)
Total net area of external elements Aum(A, m2)			367.7000				(31)
Fabric heat loss, W/K = Sum (A x U)					71.1170		(32)
Internal Wall 1 GF			135.8400			9.0000	1222.5600 (32c)
Internal Wall 2 FF			77.1000			9.0000	693.9000 (32c)
Internal Floor 1			38.2500			18.0000	688.5000 (32d)
Internal Ceiling 1			38.2500			9.0000	344.2500 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14725.4200 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 118.8301 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	21.2800	0.0300	0.6384
E5 Ground floor (normal)	41.1000	0.0210	0.8631
E11 Eaves (insulation at rafter level)	16.7000	0.0390	0.6513
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0150	-0.0360
E13 Gable (insulation at rafter level)	17.8100	0.0240	0.4274
R4 Ridge (vaulted ceiling)	10.8000	0.1200	1.2960
R7 Flat ceiling (inverted)	4.0000	0.1200	0.4800
E6 Intermediate floor within a dwelling	19.7500	0.0800	1.5800
E10 Eaves (insulation at ceiling level)	10.8000	0.0440	0.4752
E12 Gable (insulation at ceiling level)	5.3500	0.0510	0.2728
E24 Eaves (insulation at ceiling level - inverted)	5.3500	0.1500	0.8025

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.4508 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 78.5678 (37)

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

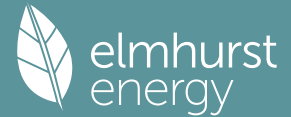
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	27.7708	26.9704	26.4367	24.5690	24.5690	23.2349	23.2349	22.9681	24.0354	26.1699	26.7036	27.7708 (38)
Average = Sum(39)m / 12 =	106.3387	105.5382	105.0046	103.1368	103.1368	101.8027	101.8027	101.5359	102.6032	104.7378	105.2714	106.3387 (39)
HLP	0.8581	0.8517	0.8474	0.8323	0.8323	0.8215	0.8215	0.8194	0.8280	0.8452	0.8495	0.8581 (40)
HLP (average)												0.8387
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage for mixer showers												
Hot water usage for baths												
Hot water usage for other uses												
Average daily hot water use (litres/day)												
Daily hot water use	127.6832	124.8383	121.4867	116.6600	112.6430	108.3632	106.9177	110.2571	113.7507	118.2178	123.1109	127.4006 (44)
Energy content (annual)	202.2190	177.7681	186.7206	159.7017	151.6391	133.2453	129.3077	136.5213	140.2659	160.4204	175.3941	199.4786 (45)
Distribution loss (46)m = 0.15 x (45)m	30.3329	26.6652	28.0081	23.9553	22.7459	19.9868	19.3962	20.4782	21.0399	24.0631	26.3091	29.9218 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8640 (55)
Total storage loss	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840 (56)
If cylinder contains dedicated solar storage	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	252.2654	222.9713	236.7670	208.1337	201.6855	181.6773	179.3541	186.5677	188.6979	210.4668	223.8261	249.5250 (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	252.2654	222.9713	236.7670	208.1337	201.6855	181.6773	179.3541	186.5677	188.6979	210.4668	223.8261	249.5250 (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	107.2749	95.2705	102.1217	91.8464	90.4571	83.0496	83.0319	85.4305	85.3840	93.3769	97.0641	106.3638 (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	172.6363	172.6363	172.6363	172.6363	172.6363	172.6363	172.6363	172.6363	172.6363	172.6363	172.6363	172.6363
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.9561	29.2713	23.8050	18.0220	13.4716	11.3733	12.2893	15.9740	21.4403	27.2234	31.7738	33.8721
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	433.1826	437.6777	426.3503	402.2355	371.7948	343.1849	324.0718	319.5767	330.9041	355.0190	385.4596	414.0695
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1409	55.1409	55.1409	55.1409	55.1409	55.1409	55.1409	55.1409	55.1409	55.1409	55.1409	55.1409
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Losses e.g. evaporation (negative values) (Table 5)	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908
Water heating gains (Table 5)	144.1868	141.7715	137.2604	127.5645	121.5821	115.3467	111.6020	114.8259	118.5889	125.5066	134.8113	142.9620
Total internal gains	723.0118	721.4069	700.1020	660.5082	619.5349	582.5913	560.6494	563.0629	583.6197	620.4353	664.7310	703.5899

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
East	8.7300	26.5524	0.7600	0.7000	0.7700	85.4599 (76)						
South	3.3000	59.0235	0.7600	0.7000	0.7700	71.8099 (78)						
West	5.9400	26.5524	0.7600	0.7000	0.7700	58.1480 (80)						
East	2.7600	36.0000	0.7600	0.7000	1.0000	47.5736 (82)						
West	1.0900	36.0000	0.7600	0.7000	1.0000	18.7881 (82)						
Solar gains	281.7794	459.2270	717.8398	1046.5129	1191.7995	1316.8182	1135.1372	1058.5080	859.7540	550.8034	335.4892	233.1632
Total gains	1004.7912	1180.6339	1417.9418	1707.0211	1811.3344	1899.4095	1695.7866	1621.5709	1443.3738	1171.2387	1000.2202	936.7531

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	38.4657	38.7575	38.9544	39.6599	39.6599	40.1796	40.1796	40.2852	39.8661	39.0537	38.8557	38.4657
alpha	3.5644	3.5838	3.5970	3.6440	3.6440	3.6786	3.6786	3.6857	3.6577	3.6036	3.5904	3.5644
util living area	0.9103	0.8642	0.7674	0.6178	0.4848	0.3386	0.2860	0.2799	0.4281	0.6811	0.8500	0.9191
Living	20.1617	20.3295	20.5753	20.7790	20.8665	20.9058	20.9118	20.9125	20.8933	20.7627	20.4733	20.1481
Non living	19.2395	19.4466	19.7400	19.9803	20.0728	20.1194	20.1245	20.1271	20.1042	19.9611	19.6282	19.2243
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.5711	20.3295	20.5753	20.7790	20.8665	20.9058	20.9118	20.9125	20.8933	20.7627	20.4733	20.2672
Th 2	20.2032	20.2088	20.2125	20.2254	20.2254	20.2347	20.2347	20.2366	20.2291	20.2143	20.2106	20.2032
util rest of house	0.8972	0.8466	0.7416	0.5853	0.4472	0.2994	0.2412	0.2331	0.3786	0.6387	0.8264	0.9066
MIT 2	19.8190	19.4466	19.7400	19.9803	20.0728	20.1194	20.1245	20.1271	20.1042	19.9611	19.6282	19.4007
Living area fraction	19.9101	19.5535	19.8411	20.0770	20.1689	20.2146	20.2198	20.2221	20.1997	20.0581	19.7305	19.5056
MIT	19.9101	19.5535	19.8411	20.0770	20.1689	20.2146	20.2198	20.2221	20.1997	20.0581	19.7305	19.5056
Temperature adjustment												0.0000
adjusted MIT	19.9101	19.5535	19.8411	20.0770	20.1689	20.2146	20.2198	20.2221	20.1997	20.0581	19.7305	19.5056

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8918	0.8300	0.7284	0.5788	0.4444	0.2984	0.2403	0.2322	0.3766	0.6297	0.8101	0.8938
Useful gains	896.0863	979.8707	1032.8726	987.9963	805.0271	566.7429	407.5612	376.5773	543.6231	737.5804	810.2804	837.2286
Ext temp.	6.6000	6.8000	8.0000	9.7000	12.1000	14.6000	16.2000	16.5000	14.8000	12.2000	9.5000	7.0000
Heat loss rate W	1415.3737	1345.9785	1243.3665	1070.2506	832.1992	571.5804	409.2260	377.9305	554.0274	823.0423	1076.9802	1329.8287
Space heating kWh	386.3498	246.0245	156.6075	59.2231	20.2160	0.0000	0.0000	0.0000	0.0000	63.5836	192.0238	366.4944
Space heating requirement - total per year (kWh/year)												1490.5228
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
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	386.3498	246.0245	156.6075	59.2231	20.2160	0.0000	0.0000	0.0000	0.0000	63.5836	192.0238	366.4944
Space heating requirement after solar contribution - total per year (kWh/year)												1490.5228
Space heating per m ²										(98c) / (4) =		12.0281

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

Fraction of space heat from secondary/supplementary system (Table 11)												
Efficiency of main space heating system 1 (in %)												
Efficiency of main space heating system 2 (in %)												
Efficiency of secondary/supplementary heating system, %												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	386.3498	246.0245	156.6075	59.2231	20.2160	0.0000	0.0000	0.0000	0.0000	63.5836	192.0238	366.4944
Space heating efficiency (main heating system 1)	372.1878	372.1878	372.1878	372.1878	372.1878	0.0000	0.0000	0.0000	0.0000	372.1878	372.1878	372.1878
Space heating fuel (main heating system)	103.8051	66.1022	42.0775	15.9122	5.4317	0.0000	0.0000	0.0000	0.0000	17.0837	51.5933	98.4703
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
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
Space heating fuel (secondary)												0.0000

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating															
Water heating requirement	252.2654	222.9713	236.7670	208.1337	201.6855	181.6773	179.3541	186.5677	188.6979	210.4668	223.8261	249.5250	200.0601	(64)	
Efficiency of water heater	200.0601	200.0601	200.0601	200.0601	200.0601	200.0601	200.0601	200.0601	200.0601	200.0601	200.0601	200.0601	200.0601	(216)	
(217)m	200.0601	200.0601	200.0601	200.0601	200.0601	200.0601	200.0601	200.0601	200.0601	200.0601	200.0601	200.0601	200.0601	(217)	
Fuel for water heating, kWh/month	126.0948	111.4522	118.3479	104.0356	100.8124	90.8113	89.6501	93.2558	94.3206	105.2018	111.8794	124.7250	200.0601	(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	20.7227	18.7173	20.7227	20.0542	20.7227	20.0542	20.7227	20.7227	20.0542	20.7227	20.0542	20.7227	20.0542	(231)	
Lighting	28.8463	23.1416	20.8364	15.2657	11.7916	9.6339	10.7567	13.9820	18.1612	23.8285	26.9142	29.6480	29.6480	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)															
(233a)m	-76.5571	-96.0198	-135.8778	-152.6917	-158.9248	-152.7719	-144.5292	-141.4026	-127.7684	-109.0204	-80.5309	-65.9455	-65.9455	(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	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	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	0.0000	(235c)	
Electricity generated by PVs (Appendix M) (negative quantity)															
(233b)m	-42.5527	-74.7299	-149.9748	-239.8735	-296.5689	-331.9547	-288.0943	-266.1008	-199.5752	-114.7826	-55.6378	-33.3926	-33.3926	(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	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	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	0.0000	(235d)	
Annual totals kWh/year															
Space heating fuel - main system 1														400.4760	(211)
Space heating fuel - main system 2														0.0000	(213)
Space heating fuel - secondary														0.0000	(215)
Efficiency of water heater														200.0601	
Water heating fuel used														1270.5868	(219)
Space cooling fuel														0.0000	(221)
Electricity for pumps and fans:															
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5720)															
mechanical ventilation fans (SFP = 0.5720)														243.9930	(230a)
Total electricity for the above, kWh/year														243.9930	(231)
Electricity for lighting (calculated in Appendix L)														232.8061	(232)
Energy saving/generation technologies (Appendices M ,N and Q)															
PV generation														-3535.2779	(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														-1387.4159	(238)

10a. Fuel costs - using BEDF prices (533)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	400.4760	21.5100	86.1424	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1270.5868	21.5100	273.3032	(247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(247a)
Pumps, fans and electric keep-hot	243.9930	21.5100	52.4829	(249)
Energy for lighting	232.8061	21.5100	50.0766	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1442.0401	21.5100	-310.1828	
PV Unit electricity exported	-2093.2378	5.5900	-117.0120	
Total			-427.1948	(252)
Total energy cost			34.8103	(255)

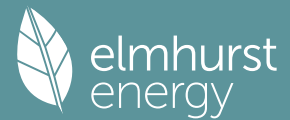
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	400.4760	0.1575	63.0915	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1270.5868	0.1409	179.0090	(264)
Space and water heating			242.1005	(265)
Pumps, fans and electric keep-hot	243.9930	0.1387	33.8448	(267)
Energy for lighting	232.8061	0.1443	33.6011	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1442.0401	0.1352	-194.9805	
PV Unit electricity exported	-2093.2378	0.1261	-263.9563	
Total			-458.9368	(269)
Total CO2, kg/year			-149.3903	(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	400.4760	1.5832	634.0193	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1270.5868	1.5209	1932.4964	(278)
Space and water heating			2566.5157	(279)
Pumps, fans and electric keep-hot	243.9930	1.5128	369.1126	(281)
Energy for lighting	232.8061	1.5338	357.0858	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1442.0401	1.4997	-2162.6790	
PV Unit electricity exported	-2093.2378	0.4629	-968.9749	

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Total
Total Primary energy kWh/year

-3131.6539 (283)
161.0602 (286)

SAP 10 EPC IMPROVEMENTS

SEC1 - ASHP ROI TF 0.15 improv

Current energy efficiency rating: A 98
Current environmental impact rating: A 101

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.3	-£ 59	-40 kg (26.8%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£59	0.32 kg/m ²	A 99
Total Savings	£59	0.32 kg/m²	A 101

Potential energy efficiency rating: A 99
Potential environmental impact rating: A 101

Fuel prices for cost data on this page from database revision number 533 TEST (30 Nov 2023)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South West England):

	Current	Potential	Saving
Electricity	£462	£393	£69
Space heating	£139	£156	-£17
Water heating	£273	£187	£87
Lighting	£50	£50	£0
Generated (PV)	-£427	-£417	-£10
Total cost of fuels	£35	-£24	£59
Total cost of uses	£35	-£24	£60
Delivered energy	-11 kWh/m ²	-14 kWh/m ²	3 kWh/m ²
Carbon dioxide emissions	-0.1 tonnes	-0.2 tonnes	0.0 tonnes
CO2 emissions per m ²	-1 kg/m ²	-2 kg/m ²	0 kg/m ²
Primary energy	1 kWh/m ²	-2 kWh/m ²	3 kWh/m ²

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	85.6700 (1b)	x 2.5900 (2b)	= 221.8853 (1b) - (3b)
First floor	38.2500 (1c)	x 3.3400 (2c)	= 127.7550 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	349.6403 (5)

2. Ventilation rate

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure Test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		2.0000 (17)
Infiltration rate		0.1000 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.0925 (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												

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	0.1179	0.1156	0.1133	0.1018	0.0994	0.0879	0.0879	0.0856	0.0925	0.0994	0.1041	0.1087 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												81.0000 (23c)
Effective ac	0.2129	0.2106	0.2083	0.1967	0.1944	0.1829	0.1829	0.1806	0.1875	0.1944	0.1991	0.2037 (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
Window (Uw = 1.20)			17.9700	1.1450	20.5763		(27)
Door			1.8900	1.0000	1.8900		(26a)
8			1.0900	1.2357	1.3470		(27a)
13-15			2.7600	1.2357	3.4106		(27a)
Floor 1 P/a 0.48			85.6700	0.1200	10.2804	110.0000	9423.7000 (28a)
External Wall 1 Clad	135.5100	11.1300	124.3800	0.1500	18.6570	9.0000	1119.4200 (29a)
External Wall 2 Garage	12.8400		12.8400	0.1400	1.7976	9.0000	115.5600 (29a)
External Wall 4 Dormer	11.8000	8.7300	3.0700	0.1800	0.5526	18.0000	55.2600 (29a)
External Wall 3 "Attic"	28.0900		28.0900	0.0900	2.5281	9.0000	252.8100 (29a)
External Roof 1 Sloping	53.4200	3.8500	49.5700	0.1300	6.4441	9.0000	446.1300 (30)
External Roof 2 Horz	28.8900		28.8900	0.0900	2.6001	9.0000	260.0100 (30)
Roof 3 "attic"	11.4800		11.4800	0.0900	1.0332	9.0000	103.3200 (30)
Total net area of external elements Aum(A, m2)			367.7000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	71.1170		(33)
Internal Wall 1 GF			135.8400			9.0000	1222.5600 (32c)
Internal Wall 2 FF			77.1000			9.0000	693.9000 (32c)
Internal Floor 1			38.2500			18.0000	688.5000 (32d)
Internal Ceiling 1			38.2500			9.0000	344.2500 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14725.4200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							118.8301 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	21.2800	0.0300	0.6384
E5 Ground floor (normal)	41.1000	0.0210	0.8631
E11 Eaves (insulation at rafter level)	16.7000	0.0390	0.6513
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0150	-0.0360
E13 Gable (insulation at rafter level)	17.8100	0.0240	0.4274
R4 Ridge (vaulted ceiling)	10.8000	0.1200	1.2960
R7 Flat ceiling (inverted)	4.0000	0.1200	0.4800
E6 Intermediate floor within a dwelling	19.7500	0.0800	1.5800
E10 Eaves (insulation at ceiling level)	10.8000	0.0440	0.4752
E12 Gable (insulation at ceiling level)	5.3500	0.0510	0.2728
E24 Eaves (insulation at ceiling level - inverted)	5.3500	0.1500	0.8025

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.4508 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 78.5678 (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	24.5690	24.3022	24.0354	22.7013	22.4345	21.1004	21.1004	20.8335	21.6340	22.4345	22.9681	23.5017 (38)
Average = Sum(39)m / 12 =	103.1368	102.8700	102.6032	101.2691	101.0023	99.6682	99.6682	99.4014	100.2018	101.0023	101.5359	102.0696 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.8323	0.8301	0.8280	0.8172	0.8151	0.8043	0.8043	0.8021	0.8086	0.8151	0.8194	0.8237 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

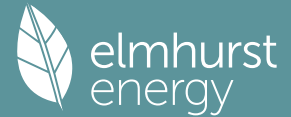
Assumed occupancy	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage for mixer showers												2.8773 (42)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for other uses	83.5871	82.3457	80.5976	77.3743	74.9608	72.2846	70.8390	72.5749	74.4650	77.3287	80.6183	83.3045 (42b)
Average daily hot water use (litres/day)	44.0961	42.4926	40.8891	39.2856	37.6821	36.0787	36.0787	37.6821	39.2856	40.8891	42.4926	44.0961 (42c)
												117.5858 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	127.6832	124.8383	121.4867	116.6600	112.6430	108.3632	106.9177	110.2571	113.7507	118.2178	123.1109	127.4006 (44)
Energy content (annual)	202.2190	177.7681	186.7206	159.7017	151.6391	133.2453	129.3077	136.5213	140.2659	160.4204	175.3941	199.4786 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1952.6818
Water storage loss:	30.3329	26.6652	28.0081	23.9553	22.7459	19.9868	19.3962	20.4782	21.0399	24.0631	26.3091	29.9218 (46)

Store volume	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
a) If manufacturer declared loss factor is known (kWh/day):												250.0000 (47)
Temperature factor from Table 2b												1.6000 (48)
Enter (49) or (54) in (55)												0.5400 (49)
Total storage loss												0.8640 (55)
26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840 (56)
If cylinder contains dedicated solar storage	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)

Total heat required for water heating calculated for each month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
WWHRs	252.2654	222.9713	235.3712	201.3801	188.8912	169.0705	166.3271	174.4713	183.2951	209.0711	223.8261	249.5250 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Aperture area of solar collector	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Zero-loss collector efficiency												3.0000 (H1)
Collector linear heat loss coefficient												0.8000 (H2)
Collector 2nd order heat loss coefficient												1.8000 (H3)
Collector loop efficiency												0.0000 (H4)
Incidence angle modifier												0.9000 (H5)
Overshading factor												1.0000 (H6)
Overall heat loss coefficient of system												0.8000 (H8)
Heat loss coefficient of collector loop												6.5000 (H10)
												3.9667 (H11)

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Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												611.4299 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												611.4299
Solar input	-0.0000	-16.2260	-57.8120	-79.0056	-102.4735	-94.3334	-93.6150	-82.2278	-57.1343	-28.6024	-0.0000	-0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	252.2654	206.7454	177.5592	122.3745	86.4177	74.7372	72.7122	92.2435	126.1607	180.4687	223.8261	249.5250 (64)
												Total per year (kWh/year) = Sum(64)m = 1865.0355 (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	107.2749	95.2705	101.0051	86.4435	80.2217	72.9643	72.6104	75.7533	81.0617	92.2603	97.0641	106.3638 (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
	172.6363	172.6363	172.6363	172.6363	172.6363	172.6363	172.6363	172.6363	172.6363	172.6363	172.6363	172.6363 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	32.9561	29.2713	23.8050	18.0220	13.4716	11.3733	12.2893	15.9740	21.4403	27.2234	31.7738	33.8721 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	433.1826	437.6777	426.3503	402.2355	371.7948	343.1849	324.0718	319.5767	330.9041	355.0190	385.4596	414.0695 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	55.1409	55.1409	55.1409	55.1409	55.1409	55.1409	55.1409	55.1409	55.1409	55.1409	55.1409	55.1409 (69)
Pumps, fans												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908	-115.0908 (71)
Water heating gains (Table 5)												
	144.1868	141.7715	135.7596	120.0605	107.8248	101.3393	97.5946	101.8189	112.5857	124.0058	134.8113	142.9620 (72)
Total internal gains	723.0118	721.4069	698.6012	653.0042	605.7776	568.5838	546.6419	550.0560	577.6165	618.9345	664.7310	703.5899 (73)

6. Solar gains

[Jan]		Area	Solar flux	g	FF	Access	Gains					
		m2	Table 6a	Specific data	Specific data	factor	W					
			W/m2	or Table 6b	or Table 6c	Table 6d						
East		8.7300	19.6403	0.7600	0.7000	0.7700	63.2130 (76)					
South		3.3000	46.7521	0.7600	0.7000	0.7700	56.8800 (78)					
West		5.9400	19.6403	0.7600	0.7000	0.7700	43.0109 (80)					
East		2.7600	26.0000	0.7600	0.7000	1.0000	34.3587 (82)					
West		1.0900	26.0000	0.7600	0.7000	1.0000	13.5692 (82)					
Solar gains	211.0318	400.4938	637.8384	909.7163	1105.3440	1129.3140	1075.9223	929.0807	733.9517	468.7073	260.7025	175.2139 (83)
Total gains	934.0436	1121.9007	1336.4396	1562.7205	1711.1215	1697.8978	1622.5642	1479.1367	1311.5682	1087.6418	925.4334	878.8038 (84)

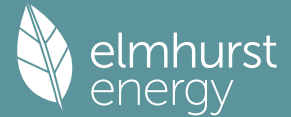
7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	39.6599	39.7627	39.8661	40.3913	40.4980	41.0401	41.0401	41.1503	40.8216	40.4980	40.2852	40.0746
alpha	3.6440	3.6508	3.6577	3.6928	3.6999	3.7360	3.7360	3.7434	3.7214	3.6999	3.6857	3.6716
util living area	0.9477	0.9070	0.8253	0.6828	0.5203	0.3696	0.2688	0.3065	0.5030	0.7733	0.9157	0.9562 (86)
Living	19.8855	20.1292	20.4416	20.7207	20.8560	20.9046	20.9145	20.9127	20.8778	20.6576	20.2194	19.8370
Non living	18.9108	19.2147	19.5958	19.9288	20.0772	20.1339	20.1420	20.1429	20.1075	19.8681	19.3391	18.8559
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.4298	20.1292	20.4416	20.7207	20.8560	20.9046	20.9145	20.9127	20.8778	20.6576	20.2194	19.9997 (87)
Th 2	20.2254	20.2273	20.2291	20.2384	20.2403	20.2496	20.2496	20.2515	20.2459	20.2403	20.2366	20.2329 (88)
util rest of house	0.9405	0.8952	0.8055	0.6531	0.4835	0.3280	0.2235	0.2576	0.4542	0.7417	0.9029	0.9500 (89)
MIT 2	19.7013	19.2147	19.5958	19.9288	20.0772	20.1339	20.1420	20.1429	20.1075	19.8681	19.3391	19.1041 (90)
Living area fraction												FLA = Living area / (4) = 0.1210 (91)
MIT	19.7895	19.3254	19.6982	20.0246	20.1715	20.2272	20.2355	20.2361	20.2007	19.9637	19.4457	19.2125 (92)
Temperature adjustment												0.0000
adjusted MIT	19.7895	19.3254	19.6982	20.0246	20.1715	20.2272	20.2355	20.2361	20.2007	19.9637	19.4457	19.2125 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9359	0.8792	0.7904	0.6443	0.4800	0.3268	0.2227	0.2566	0.4512	0.7291	0.8873	0.9402 (94)
Useful gains	874.2177	986.4059	1056.3884	1006.9062	821.3925	554.8318	361.3038	379.5380	591.7168	793.0118	821.1098	826.2181 (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	1597.5395	1483.9379	1354.1753	1126.5798	855.6416	560.8540	362.3444	381.3109	611.3016	945.7534	1253.5293	1532.3155 (97)
Space heating kWh	538.1514	334.3415	221.5534	86.1650	25.4813	0.0000	0.0000	0.0000	0.0000	113.6398	311.3421	525.3365 (98a)
Space heating requirement - total per year (kWh/year)												2156.0111
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	538.1514	334.3415	221.5534	86.1650	25.4813	0.0000	0.0000	0.0000	0.0000	113.6398	311.3421	525.3365 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2156.0111
Space heating per m2												(98c) / (4) = 17.3984 (99)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													373.9506 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	538.1514	334.3415	221.5534	86.1650	25.4813	0.0000	0.0000	0.0000	0.0000	113.6398	311.3421	525.3365	(98)
Space heating efficiency (main heating system 1)	373.9506	373.9506	373.9506	373.9506	373.9506	0.0000	0.0000	0.0000	0.0000	373.9506	373.9506	373.9506	(210)
Space heating fuel (main heating system)	143.9098	89.4080	59.2467	23.0418	6.8141	0.0000	0.0000	0.0000	0.0000	30.3890	83.2576	140.4829	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	252.2654	206.7454	177.5592	122.3745	86.4177	74.7372	72.7122	92.2435	126.1607	180.4687	223.8261	249.5250	(64)
Efficiency of water heater (217)m	200.3638	200.3638	200.3638	200.3638	200.3638	200.3638	200.3638	200.3638	200.3638	200.3638	200.3638	200.3638	(216)
Fuel for water heating, kWh/month	125.9037	103.1850	88.6184	61.0761	43.1304	37.3007	36.2901	46.0380	62.9658	90.0705	111.7098	124.5360	(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	27.5172	24.8543	27.5172	26.6296	27.5172	26.6296	27.5172	27.5172	26.6296	27.5172	26.6296	27.5172	(231)
Lighting	28.8463	23.1416	20.8364	15.2657	11.7916	9.6339	10.7567	13.9820	18.1612	23.8285	26.9142	29.6480	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-62.3102	-88.6502	-126.3290	-137.9769	-144.0355	-133.0436	-131.3060	-125.7183	-114.3876	-99.2143	-68.3679	-53.5880	(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	-27.8455	-61.7938	-129.8943	-205.4128	-280.1935	-284.0411	-280.2668	-233.8749	-167.2460	-93.1083	-38.5698	-21.8569	(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													576.5498 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													200.3638
Water heating fuel used													930.8244 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5720) mechanical ventilation fans (SFP = 0.5720) pump for solar water heating													243.9930 (230a) 80.0000 (230g) 323.9930 (231) 232.8061 (232)
Total electricity for the above, kWh/year													
Electricity for lighting (calculated in Appendix L)													
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-3109.0309 (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													-1044.8576 (238)

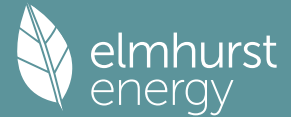
10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	576.5498	16.4900	95.0731	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	930.8244	16.4900	153.4929	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	243.9930	16.4900	40.2344	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	232.8061	16.4900	38.3897	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1284.9274	16.4900	-211.8845	
PV Unit electricity exported	-1824.1035	5.5900	-101.9674	
Total			-313.8519	(252)
Total energy cost			26.5303	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)		0.0565	(257)
SAP value		99.0835	
SAP rating (Section 12)		99	(258)
SAP band		A	

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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	576.5498	0.1572	90.6253 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	930.8244	0.1459	135.7771 (264)
Space and water heating			226.4024 (265)
Pumps, fans and electric keep-hot	323.9930	0.1387	44.9418 (267)
Energy for lighting	232.8061	0.1443	33.6011 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1284.9274	0.1351	-173.5398
PV Unit electricity exported	-1824.1035	0.1246	-227.2165
Total			-400.7563 (269)
Total CO2, kg/year			-95.8110 (272)
CO2 emissions per m2			-0.7700 (273)
EI value			100.7600
EI rating			101 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	85.6700 (1b)	x 2.5900 (2b)	= 221.8853 (1b) - (3b)
First floor	38.2500 (1c)	x 3.3400 (2c)	= 127.7550 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 349.6403 (5)

2. Ventilation rate

		m3 per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	2.0000	(17)
Infiltration rate	0.1000	(18)
Number of sides sheltered	1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.0925 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	6.3000	6.0000	5.8000	5.1000	5.1000	4.6000	4.6000	4.5000	4.9000	5.7000	5.9000	6.3000 (22)
Wind factor	1.5750	1.5000	1.4500	1.2750	1.2750	1.1500	1.1500	1.1250	1.2250	1.4250	1.4750	1.5750 (22a)
Adj infilt rate	0.1457	0.1388	0.1341	0.1179	0.1179	0.1064	0.1064	0.1041	0.1133	0.1318	0.1364	0.1457 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												81.0000 (23c)
Effective ac	0.2407	0.2337	0.2291	0.2129	0.2129	0.2014	0.2014	0.1991	0.2083	0.2268	0.2314	0.2407 (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
Window (Uw = 1.20)			17.9700	1.1450	20.5763		(27)
Door			1.8900	1.0000	1.8900		(26a)
8			1.0900	1.2357	1.3470		(27a)
13-15			2.7600	1.2357	3.4106		(27a)
Floor 1 P/a 0.48			85.6700	0.1200	10.2804	110.0000	9423.7000 (28a)
External Wall 1 Clad	135.5100	11.1300	124.3800	0.1500	18.6570	9.0000	1119.4200 (29a)
External Wall 2 Garage	12.8400		12.8400	0.1400	1.7976	9.0000	115.5600 (29a)
External Wall 4 Dormer	11.8000	8.7300	3.0700	0.1800	0.5526	18.0000	55.2600 (29a)
External Wall 3 "Attic"	28.0900		28.0900	0.0900	2.5281	9.0000	252.8100 (29a)
External Roof 1 Sloping	53.4200	3.8500	49.5700	0.1300	6.4441	9.0000	446.1300 (30)
External Roof 2 Horz	28.8900		28.8900	0.0900	2.6001	9.0000	260.0100 (30)
Roof 3 "attic"	11.4800		11.4800	0.0900	1.0332	9.0000	103.3200 (30)
Total net area of external elements Aum(A, m2)			367.7000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	71.1170		(33)
Internal Wall 1 GF			135.8400			9.0000	1222.5600 (32c)
Internal Wall 2 FF			77.1000			9.0000	693.9000 (32c)

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Internal Floor 1	38.2500	18.0000	688.5000 (32d)
Internal Ceiling 1	38.2500	9.0000	344.2500 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14725.4200 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 118.8301 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	21.2800	0.0300	0.6384
E5 Ground floor (normal)	41.1000	0.0210	0.8631
E11 Eaves (insulation at rafter level)	16.7000	0.0390	0.6513
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0150	-0.0360
E13 Gable (insulation at rafter level)	17.8100	0.0240	0.4274
R4 Ridge (vaulted ceiling)	10.8000	0.1200	1.2960
R7 Flat ceiling (inverted)	4.0000	0.1200	0.4800
E6 Intermediate floor within a dwelling	19.7500	0.0800	1.5800
E10 Eaves (insulation at ceiling level)	10.8000	0.0440	0.4752
E12 Gable (insulation at ceiling level)	5.3500	0.0510	0.2728
E24 Eaves (insulation at ceiling level - inverted)	5.3500	0.1500	0.8025

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.4508 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 78.5678 (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	27.7708	26.9704	26.4367	24.5690	24.5690	23.2349	23.2349	22.9681	24.0354	26.1699	26.7036	27.7708 (38)
Average = Sum(39)m / 12 =	106.3387	105.5382	105.0046	103.1368	103.1368	101.8027	101.8027	101.5359	102.6032	104.7378	105.2714	106.3387 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.8581	0.8517	0.8474	0.8323	0.8323	0.8215	0.8215	0.8194	0.8280	0.8452	0.8495	0.8581 (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 2.8773 (42)

Hot water usage for mixer showers 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42a)

Hot water usage for baths 83.5871 82.3457 80.5976 77.3743 74.9608 72.2846 70.8390 72.5749 74.4650 77.3287 80.6183 83.3045 83.3045 (42b)

Hot water usage for other uses 44.0961 42.4926 40.8891 39.2856 37.6821 36.0787 36.0787 37.6821 39.2856 40.8891 42.4926 44.0961 44.0961 (42c)

Average daily hot water use (litres/day) 117.5858 (43)

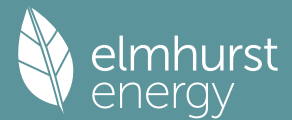
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	127.6832	124.8383	121.4867	116.6600	112.6430	108.3632	106.9177	110.2571	113.7507	118.2178	123.1109	127.4006 (44)
Energy content (annual)	202.2190	177.7681	186.7206	159.7017	151.6391	133.2453	129.3077	136.5213	140.2659	160.4204	175.3941	199.4786 (45)
Distribution loss (46)m = 0.15 x (45)m	30.3329	26.6652	28.0081	23.9553	22.7459	19.9868	19.3962	20.4782	21.0399	24.0631	26.3091	29.9218 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8640 (55)
Total storage loss	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840 (56)
If cylinder contains dedicated solar storage												
Primary loss	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840 (57)
Combi loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	18.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
WWHRS	252.2654	222.9713	235.3712	201.3801	188.8912	169.0705	166.3271	174.4713	183.2951	209.0711	223.8261	249.5250 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Aperture area of solar collector	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Zero-loss collector efficiency												3.0000 (H1)
Collector linear heat loss coefficient												0.8000 (H2)
Collector 2nd order heat loss coefficient												1.8000 (H3)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												739.3512 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												739.3512
Solar input	-7.8233	-25.7775	-70.2547	-94.4461	-111.1687	-110.4119	-98.4080	-95.3947	-71.9574	-42.1246	-11.5844	-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	244.4422	197.1939	165.1165	106.9340	77.7224	58.6586	67.9191	79.0766	111.3377	166.9465	212.2417	249.5250 (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	107.2749	95.2705	101.0051	86.4435	80.2217	72.9643	72.6104	75.7533	81.0617	92.2603	97.0641	106.3638 (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	32.9561	29.2713	23.8050	18.0220	13.4716	11.3733	12.2893	15.9740	21.4403	27.2234	31.7738	33.8721 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	433.1826	437.6777	426.3503	402.2355	371.7948	343.1849	324.0718	319.5767	330.9041	355.0190	385.4596	414.0695 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1409	55.1409	55.1409	55.1409	55.1409	55.1409	55.1409	55.1409	55.1409	55.1409	55.1409	55.1409 (69)

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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)	(negative values)	(negative values)	(negative values)	(negative values)	(negative values)	(negative values)	(negative values)	(negative values)	(negative values)	(negative values)	(negative values)	(71)
Water heating gains (Table 5)	144.1868	141.7715	135.7596	120.0605	107.8248	101.3393	97.5946	101.8189	112.5857	124.0058	134.8113	142.9620	(72)
Total internal gains	723.0118	721.4069	698.6012	653.0042	605.7776	568.5838	546.6419	550.0560	577.6165	618.9345	664.7310	703.5899	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W							
East	8.7300	26.5524	0.7600	0.7000	0.7700	85.4599 (76)							
South	3.3000	59.0235	0.7600	0.7000	0.7700	71.8099 (78)							
West	5.9400	26.5524	0.7600	0.7000	0.7700	58.1480 (80)							
East	2.7600	36.0000	0.7600	0.7000	1.0000	47.5736 (82)							
West	1.0900	36.0000	0.7600	0.7000	1.0000	18.7881 (82)							
Solar gains	281.7794	459.2270	717.8398	1046.5129	1191.7995	1316.8182	1135.1372	1058.5080	859.7540	550.8034	335.4892	233.1632	(83)
Total gains	1004.7912	1180.6339	1416.4410	1699.5171	1797.5770	1885.4020	1681.7791	1608.5640	1437.3706	1169.7379	1000.2202	936.7531	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)	38.4657	38.7575	38.9544	39.6599	39.6599	40.1796	40.1796	40.2852	39.8661	39.0537	38.8557	38.4657	21.0000 (85)
alpha	3.5644	3.5838	3.5970	3.6440	3.6440	3.6786	3.6786	3.6857	3.6577	3.6036	3.5904	3.5644	
util living area	0.9103	0.8642	0.7678	0.6198	0.4881	0.3410	0.2884	0.2821	0.4298	0.6817	0.8500	0.9191	(86)
Living	20.1617	20.3295	20.5746	20.7775	20.8655	20.9056	20.9116	20.9124	20.8931	20.7622	20.4733	20.1481	
Non living	19.2395	19.4466	19.7392	19.9788	20.0718	20.1192	20.1244	20.1270	20.1040	19.9607	19.6282	19.2243	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.5711	20.3295	20.5746	20.7775	20.8655	20.9056	20.9116	20.9124	20.8931	20.7622	20.4733	20.2672	(87)
Th 2	20.2032	20.2088	20.2125	20.2254	20.2254	20.2347	20.2347	20.2366	20.2291	20.2143	20.2106	20.2032	(88)
util rest of house	0.8972	0.8466	0.7420	0.5873	0.4503	0.3016	0.2432	0.2350	0.3800	0.6393	0.8264	0.9066	(89)
MIT 2	19.8190	19.4466	19.7392	19.9788	20.0718	20.1192	20.1244	20.1270	20.1040	19.9607	19.6282	19.4007	(90)
Living area fraction	19.9101	19.5535	19.8403	20.0755	20.1679	20.2144	20.2197	20.2221	20.1995	20.0577	19.7305	19.5056	(91)
MIT	19.9101	19.5535	19.8403	20.0755	20.1679	20.2144	20.2197	20.2221	20.1995	20.0577	19.7305	19.5056	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9101	19.5535	19.8403	20.0755	20.1679	20.2144	20.2197	20.2221	20.1995	20.0577	19.7305	19.5056	(93)

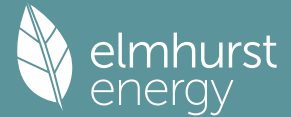
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8918	0.8300	0.7289	0.5807	0.4475	0.3005	0.2423	0.2341	0.3781	0.6303	0.8101	0.8938	(94)
Useful gains	896.0863	979.8707	1032.3843	986.9491	804.3260	566.6053	407.5059	376.5333	543.4671	737.2912	810.2804	837.2286	(95)
Ext temp.	6.6000	6.8000	8.0000	9.7000	12.1000	14.6000	16.2000	16.5000	14.8000	12.2000	9.5000	7.0000	(96)
Heat loss rate W	1415.3737	1345.9785	1243.2883	1070.0928	832.0962	571.5603	409.2177	377.9238	554.0043	822.9972	1076.9802	1329.8287	(97)
Space heating kWh	386.3498	246.0245	156.9125	59.8635	20.6610	0.0000	0.0000	0.0000	0.0000	63.7653	192.0238	366.4944	(98a)
Space heating requirement - total per year (kWh/year)												1492.0948	
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	386.3498	246.0245	156.9125	59.8635	20.6610	0.0000	0.0000	0.0000	0.0000	63.7653	192.0238	366.4944	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1492.0948	
Space heating per m2										(98c) / (4) =		12.0408	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Fraction of space heat from main system(s)													0.0000 (201)
Efficiency of main space heating system 1 (in %)													1.0000 (202)
Efficiency of main space heating system 2 (in %)													372.1878 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (207)
													0.0000 (208)
Space heating requirement	386.3498	246.0245	156.9125	59.8635	20.6610	0.0000	0.0000	0.0000	0.0000	63.7653	192.0238	366.4944	(98)
Space heating efficiency (main heating system 1)	372.1878	372.1878	372.1878	372.1878	372.1878	0.0000	0.0000	0.0000	0.0000	372.1878	372.1878	372.1878	(210)
Space heating fuel (main heating system)	103.8051	66.1022	42.1595	16.0842	5.5512	0.0000	0.0000	0.0000	0.0000	17.1326	51.5933	98.4703	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	244.4422	197.1939	165.1165	106.9340	77.7224	58.6586	67.9191	79.0766	111.3377	166.9465	212.2417	249.5250	(64)
Efficiency of water heater (217)m	200.0601	200.0601	200.0601	200.0601	200.0601	200.0601	200.0601	200.0601	200.0601	200.0601	200.0601	200.0601	(216)
Fuel for water heating, kWh/month	122.1843	98.5673	82.5334	53.4509	38.8495	29.3205	33.9493	39.5264	55.6521	83.4482	106.0889	124.7250	(219)
Space cooling fuel requirement													

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(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	27.5172	24.8543	27.5172	26.6296	27.5172	26.6296	27.5172	27.5172	26.6296	27.5172	26.6296	27.5172	26.6296	(231)
Lighting	28.8463	23.1416	20.8364	15.2657	11.7916	9.6339	10.7567	13.9820	18.1612	23.8285	26.9142	29.6480	29.6480	(232)
Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)m	-76.6373	-95.6576	-133.0113	-145.3531	-147.3557	-139.0220	-133.4465	-131.4675	-122.4707	-107.6657	-80.5644	-66.1006	-66.1006	(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	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	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	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)														
(233b)m	-42.4726	-75.0921	-152.8413	-247.2120	-308.1380	-345.7045	-299.1770	-276.0359	-204.8729	-116.1374	-55.6043	-33.2374	-33.2374	(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	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	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	0.0000	(235d)
Annual totals kWh/year														
Space heating fuel - main system 1													400.8984	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													200.0601	(219)
Water heating fuel used													868.2960	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5720)														
mechanical ventilation fans (SFP = 0.5720)													243.9930	(230a)
pump for solar water heating													80.0000	(230g)
Total electricity for the above, kWh/year													323.9930	(231)
Electricity for lighting (calculated in Appendix L)													232.8061	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-3535.2779	(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													-1709.2844	(238)

10a. Fuel costs - using BEDF prices (533)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	400.8984	21.5100	86.2332	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	868.2960	21.5100	186.7705	(247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(247a)
Pumps, fans and electric keep-hot	243.9930	21.5100	52.4829	(249)
Pump for solar water heating	80.0000	21.5100	17.2080	(249)
Energy for lighting	232.8061	21.5100	50.0766	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1378.7524	21.5100	-296.5697	
PV Unit electricity exported	-2156.5254	5.5900	-120.5498	
Total			-417.1194	(252)
Total energy cost			-24.3482	(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	400.8984	0.1575	63.1511	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	868.2960	0.1466	127.2880	(264)
Space and water heating			190.4390	(265)
Pumps, fans and electric keep-hot	323.9930	0.1387	44.9418	(267)
Energy for lighting	232.8061	0.1443	33.6011	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1378.7524	0.1357	-187.1274	
PV Unit electricity exported	-2156.5254	0.1258	-271.2608	
Total			-458.3882	(269)
Total CO2, kg/year			-189.4062	(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	400.8984	1.5831	634.6622	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	868.2960	1.5423	1339.1803	(278)
Space and water heating			1973.8425	(279)
Pumps, fans and electric keep-hot	323.9930	1.5128	490.1366	(281)
Energy for lighting	232.8061	1.5338	357.0858	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1378.7524	1.5017	-2070.4133	
PV Unit electricity exported	-2156.5254	0.4617	-995.7624	
Total			-3066.1756	(283)
Total Primary energy kWh/year			-245.1107	(286)