

Full SAP Calculation Printout



Property Reference	OCKENDEN	Issued on Date	22/02/2023
Assessment Reference	PROPOSED	Prop Type Ref	
Property	Willow Brook, Danworth Lane, Hurstpierpoint, BN6 9LW		
SAP Rating	76 C	DER	TER
Environmental	95 A	% DER < TER	
CO ₂ Emissions (t/year)	0.26	DFEE	TFEE
Compliance Check	See BREL	% DFEE < TFEE	
% DPER < TPER		DPER	TPER
Assessor Details	Mr. Alexander Pelling	Assessor ID	T297-0001
Client	SCANDIA-HUS, Project Manager		

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	28.4400 (1b)	x 3.5100 (2b)	= 99.8244 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	28.4400		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 99.8244 (5)

2. Ventilation rate

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	0.1000 (17)
Number of sides sheltered	0.0050 (18)
	0 (19)

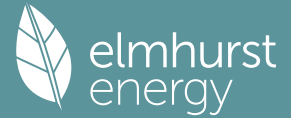
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.0050 (21)

	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	0.0064	0.0063	0.0061	0.0055	0.0054	0.0047	0.0047	0.0046	0.0050	0.0054	0.0056	0.0059 (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) =												80.1000 (23c)
Effective ac	0.1059	0.1057	0.1056	0.1050	0.1049	0.1042	0.1042	0.1041	0.1045	0.1049	0.1051	0.1054 (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
Windows (Uw = 1.00)			16.3100	0.9615	15.6827		(27)
Solid Doors			2.1000	1.0000	2.1000		(26)
Heatloss Floor 1			28.4400	0.1100	3.1284	110.0000	3128.4000 (28a)

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Timber Cladding (Actis)	101.4800	18.4100	83.0700	0.1600	13.2912	9.0000	747.6300 (29a)
Internal Gables To Loft	9.7000		9.7000	0.2000	1.9400	9.0000	87.3000 (29a)
Rafters	22.6500		22.6500	0.1500	3.3975	9.0000	203.8500 (30)
Joists	6.5000		6.5000	0.1100	0.7150	9.0000	58.5000 (30)
Total net area of external elements Aum(A, m2)			168.7700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	40.2548			(33)
Internal Wall 1			32.8500			9.0000	295.6500 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 4521.3300 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 158.9778 (35)

List of Thermal Bridges							
K1 Element	Length	Psi-value	Total				
E2 Other lintels (including other steel lintels)	13.5200	0.0530	0.7166				
E3 Sill	12.5200	0.0750	0.9390				
E4 Jamb	36.3600	0.0470	1.7089				
E5 Ground floor (normal)	24.0000	0.0290	0.6960				
E16 Corner (normal)	14.5600	0.0460	0.6698				
E11 Eaves (insulation at rafter level)	13.4800	0.0430	0.5796				
E10 Eaves (insulation at ceiling level)	4.0000	0.0550	0.2200				
E13 Gable (insulation at rafter level)	6.7400	0.0530	0.3572				
R4 Ridge (vaulted ceiling)	6.7400	0.1200	0.8088				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.6959 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	46.9507 (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	3.4877	3.4836	3.4795	3.4589	3.4548	3.4342	3.4342	3.4301	3.4424	3.4548	3.4630	3.4713 (38)	
Average = Sum(39)m / 12 =	50.4384	50.4343	50.4302	50.4096	50.4055	50.3849	50.3849	50.3808	50.3931	50.4055	50.4137	50.4220 (39)	50.4086
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.7735	1.7734	1.7732	1.7725	1.7723	1.7716	1.7716	1.7715	1.7719	1.7723	1.7726	1.7729 (40)	1.7725
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

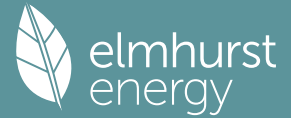
4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.1441 (42)
Hot water usage for mixer showers													
	54.2523	53.4370	52.2490	49.9758	48.2983	46.4275	45.3642	46.5433	47.8358	49.8444	52.1663	54.0445 (42a)	
Hot water usage for baths													
	18.7875	18.5084	18.1155	17.3910	16.8486	16.2471	15.9221	16.3123	16.7371	17.3808	18.1202	18.7239 (42b)	
Hot water usage for other uses													
	26.3466	25.3885	24.4305	23.4724	22.5143	21.5563	21.5563	22.5143	23.4724	24.4305	25.3885	26.3466 (42c)	91.3892 (43)
Average daily hot water use (litres/day)													
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	99.3864	97.3340	94.7949	90.8393	87.6612	84.2309	82.8426	85.3699	88.0453	91.6556	95.6750	99.1150 (44)	
Energy conte	157.4037	138.6023	145.6963	124.3544	118.0088	103.5717	100.1910	105.7058	108.5686	124.3758	136.3066	155.1901 (45)	
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m													
	23.6106	20.7903	21.8544	18.6532	17.7013	15.5358	15.0286	15.8559	16.2853	18.6564	20.4460	23.2785 (46)	
Water storage loss:													
Store volume													180.0000 (47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103 (51)
Volume factor from Table 2a													0.8736 (52)
Temperature factor from Table 2b													0.5400 (53)
Enter (49) or (54) in (55)													0.8736 (55)
Total storage loss													
	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820 (56)	
If cylinder contains dedicated solar storage													
	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820 (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													
	207.7481	184.0747	196.0407	173.0748	168.3533	152.2921	150.5354	156.0502	157.2891	174.7202	185.0270	205.5345 (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													
	207.7481	184.0747	196.0407	173.0748	168.3533	152.2921	150.5354	156.0502	157.2891	174.7202	185.0270	205.5345 (64)	2110.7403 (64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)	0.0000 (64a)
Heat gains from water heating, kWh/month													
	92.6123	82.4632	88.7196	80.3242	79.5135	73.4139	73.5890	75.4227	75.0754	81.6305	84.2983	91.8763 (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	
	68.6451	68.6451	68.6451	68.6451	68.6451	68.6451	68.6451	68.6451	68.6451	68.6451	68.6451	68.6451 (66)	

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Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	11.5020	10.2160	8.3082	6.2898	4.7017	3.9694	4.2891	5.5751	7.4829	9.5012	11.0893	11.8217 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	140.1329	141.5871	137.9227	130.1216	120.2742	111.0190	104.8360	103.3818	107.0462	114.8473	124.6947	133.9499 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	43.0086	43.0086	43.0086	43.0086	43.0086	43.0086	43.0086	43.0086	43.0086	43.0086	43.0086	43.0086 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-45.7634	-45.7634	-45.7634	-45.7634	-45.7634	-45.7634	-45.7634	-45.7634	-45.7634	-45.7634	-45.7634	-45.7634 (71)
Water heating gains (Table 5)	124.4789	122.7131	119.2467	111.5614	106.8730	101.9638	98.9100	101.3746	104.2714	109.7184	117.0810	123.4896 (72)
Total internal gains	345.0041	343.4064	334.3679	316.8631	300.7392	282.8425	273.9253	276.2219	284.6908	302.9572	321.7553	338.1515 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	2.0400	10.6334	0.5700	0.7000	0.7700	5.9980 (74)
East	8.6300	19.6403	0.5700	0.7000	0.7700	46.8667 (76)
South	5.6400	46.7521	0.5700	0.7000	0.7700	72.9098 (78)

Solar gains	125.7745	222.5512	322.5675	423.4004	491.1547	493.7749	473.5765	422.9230	357.9118	251.2243	152.2596	106.5419 (83)
Total gains	470.7786	565.9576	656.9353	740.2636	791.8939	776.6174	747.5019	699.1449	642.6026	554.1815	474.0149	444.6934 (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	24.9002	24.9022	24.9042	24.9144	24.9164	24.9266	24.9266	24.9287	24.9225	24.9164	24.9124	24.9083
alpha	2.6600	2.6601	2.6603	2.6610	2.6611	2.6618	2.6618	2.6619	2.6615	2.6611	2.6608	2.6606
util living area	0.8935	0.8418	0.7645	0.6533	0.5218	0.3908	0.2883	0.3195	0.4870	0.7064	0.8497	0.9055 (86)
MIT	19.4412	19.7360	20.1008	20.4524	20.6947	20.8201	20.8637	20.8564	20.7658	20.4303	19.8646	19.3633 (87)
Th 2	19.4886	19.4887	19.4888	19.4893	19.4894	19.4899	19.4899	19.4900	19.4897	19.4894	19.4892	19.4890 (88)
util rest of house	0.8731	0.8140	0.7257	0.6004	0.4540	0.3069	0.1928	0.2195	0.3969	0.6459	0.8180	0.8870 (89)
MIT 2	17.7811	18.1324	18.5579	18.9490	19.1961	19.3070	19.3357	19.3326	19.2693	18.9457	18.3009	17.6874 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.6042	18.9275	19.3229	19.6943	19.9391	20.0572	20.0932	20.0881	20.0113	19.6818	19.0761	18.5183 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.6042	18.9275	19.3229	19.6943	19.9391	20.0572	20.0932	20.0881	20.0113	19.6818	19.0761	18.5183 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8588	0.8021	0.7210	0.6080	0.4750	0.3393	0.2316	0.2600	0.4294	0.6543	0.8079	0.8726 (94)
Ext temp.	404.2940	453.9450	473.6786	450.1158	376.1602	263.5043	173.1269	181.7683	275.9209	362.6151	382.9447	388.0323 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	721.4791	707.4653	646.6593	544.1389	415.2963	274.9588	176.0062	185.8081	297.8865	457.7701	603.7622	721.9549 (97)
Space heating requirement - total per year (kWh/year)	235.9857	170.3656	128.6976	67.6966	29.1172	0.0000	0.0000	0.0000	0.0000	70.7953	158.9886	248.4384 (98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	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 kWh	235.9857	170.3656	128.6976	67.6966	29.1172	0.0000	0.0000	0.0000	0.0000	70.7953	158.9886	248.4384 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	235.9857	170.3656	128.6976	67.6966	29.1172	0.0000	0.0000	0.0000	0.0000	70.7953	158.9886	248.4384 (98c)
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 %)	249.9000 (206)											
Efficiency of main space heating system 2 (in %)	0.0000 (207)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating efficiency (main heating system 1)	235.9857	170.3656	128.6976	67.6966	29.1172	0.0000	0.0000	0.0000	0.0000	70.7953	158.9886	248.4384 (98)
Space heating fuel (main heating system)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)

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94.4321	68.1735	51.4997	27.0895	11.6516	0.0000	0.0000	0.0000	0.0000	28.3295	63.6209	99.4151	(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													
207.7481	184.0747	196.0407	173.0748	168.3533	152.2921	150.5354	156.0502	157.2891	174.7202	185.0270	205.5345	(64)	
Efficiency of water heater												175.1000	(216)
(217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(217)	
Fuel for water heating, kWh/month													
118.6454	105.1255	111.9593	98.8434	96.1469	86.9744	85.9711	89.1206	89.8281	99.7831	105.6694	117.3812	(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	(221)	
Pumps and Fa	9.4384	8.5250	9.4384	9.1339	9.4384	9.1339	9.4384	9.4384	9.1339	9.4384	9.1339	9.4384	(231)
Lighting	10.0676	8.0766	7.2721	5.3279	4.1154	3.3623	3.7542	4.8798	6.3384	8.3164	9.3933	10.3474	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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	(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	(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	(235c)	
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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	(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	(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	(235d)	
Annual totals kWh/year													
Space heating fuel - main system 1												444.2117	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1205.4485	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.9125)													
mechanical ventilation fans (SFP = 0.9125)												111.1295	(230a)
Total electricity for the above, kWh/year												111.1295	(231)
Electricity for lighting (calculated in Appendix L)												81.2515	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												1842.0412	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	444.2117	16.4900	73.2505 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1205.4485	16.4900	198.7785 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	111.1295	16.4900	18.3253 (249)
Energy for lighting	81.2515	16.4900	13.3984 (250)
Additional standing charges			0.0000 (251)
Total energy cost			303.7526 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600 (256)
Energy cost factor (ECF)	[(255) × (256)] / [(4) + 45.0] = 1.4890 (257)
SAP value	75.8636
SAP rating (Section 12)	76 (258)
SAP band	C

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	444.2117	0.1559	69.2557 (261)

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Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1205.4485	0.1408	169.6950 (264)
Space and water heating			238.9507 (265)
Pumps, fans and electric keep-hot	111.1295	0.1387	15.4150 (267)
Energy for lighting	81.2515	0.1443	11.7271 (268)
Total CO2, kg/year			266.0928 (272)
CO2 emissions per m2			9.3600 (273)
EI value			95.1448
EI rating			95 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	28.4400 (1b)	x 3.5100 (2b)	= 99.8244 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	28.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	99.8244 (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) =	Air changes per hour 0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	0.1000 (17)
Infiltration rate	0.0050 (18)
Number of sides sheltered	0 (19)

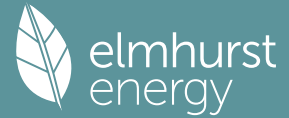
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.0050 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.1000	3.8000	3.7000	3.5000	3.5000	3.2000	3.3000	3.1000	3.1000	3.4000	3.3000	3.7000 (22)
Wind factor	1.0250	0.9500	0.9250	0.8750	0.8750	0.8000	0.8250	0.7750	0.7750	0.8500	0.8250	0.9250 (22a)
Adj infilt rate	0.0051	0.0047	0.0046	0.0044	0.0044	0.0040	0.0041	0.0039	0.0039	0.0043	0.0041	0.0046 (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) =												80.1000 (23c)
Effective ac	0.1046	0.1042	0.1041	0.1039	0.1039	0.1035	0.1036	0.1034	0.1034	0.1037	0.1036	0.1041 (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
Windows (Uw = 1.00)			16.3100	0.9615	15.6827		(27)
Solid Doors			2.1000	1.0000	2.1000		(26)
Heatloss Floor 1			28.4400	0.1100	3.1284	110.0000	3128.4000 (28a)
Timber Cladding (Actis)	101.4800	18.4100	83.0700	0.1600	13.2912	9.0000	747.6300 (29a)
Internal Gables To Loft	9.7000		9.7000	0.2000	1.9400	9.0000	87.3000 (29a)
Rafters	22.6500		22.6500	0.1500	3.3975	9.0000	203.8500 (30)
Joists	6.5000		6.5000	0.1100	0.7150	9.0000	58.5000 (30)
Total net area of external elements Aum(A, m2)			168.7700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.2548		(33)
Internal Wall 1			32.8500			9.0000	295.6500 (32c)

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Heat capacity $C_m = \text{Sum}(A \times k)$

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

List of Thermal Bridges

K1 Element
E2 Other lintels (including other steel lintels)
E3 Sill
E4 Jamb
E5 Ground floor (normal)
E16 Corner (normal)
E11 Eaves (insulation at rafter level)
E10 Eaves (insulation at ceiling level)
E13 Gable (insulation at rafter level)
R4 Ridge (vaulted ceiling)

(28)...(30) + (32) + (32a)...(32e) = 4521.3300 (34)
158.9778 (35)

Length	Psi-value	Total
13.5200	0.0530	0.7166
12.5200	0.0750	0.9390
36.3600	0.0470	1.7089
24.0000	0.0290	0.6960
14.5600	0.0460	0.6698
13.4800	0.0430	0.5796
4.0000	0.0550	0.2200
6.7400	0.0530	0.3572
6.7400	0.1200	0.8088

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

Point Thermal bridges

Total fabric heat loss

6.6959 (36)
(36a) = 0.0000
(33) + (36) + (36a) = 46.9507 (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	3.4466	3.4342	3.4301	3.4219	3.4219	3.4095	3.4136	3.4054	3.4054	3.4177	3.4136	3.4301 (38)
Heat transfer coeff	50.3973	50.3849	50.3808	50.3725	50.3725	50.3602	50.3643	50.3561	50.3561	50.3684	50.3643	50.3808 (39)
Average = Sum(39)m / 12 =												50.3715

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.7721	1.7716	1.7715	1.7712	1.7712	1.7708	1.7709	1.7706	1.7706	1.7710	1.7709	1.7715 (40)
HLP (average)												1.7712
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

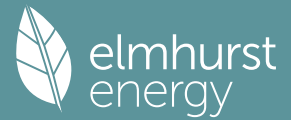
4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.1441 (42)
Hot water usage for mixer showers	54.2523	53.4370	52.2490	49.9758	48.2983	46.4275	45.3642	46.5433	47.8358	49.8444	52.1663	54.0445 (42a)
Hot water usage for baths	18.7875	18.5084	18.1155	17.3910	16.8486	16.2471	15.9221	16.3123	16.7371	17.3808	18.1202	18.7239 (42b)
Hot water usage for other uses	26.3466	25.3885	24.4305	23.4724	22.5143	21.5563	21.5563	22.5143	23.4724	24.4305	25.3885	26.3466 (42c)
Average daily hot water use (litres/day)												91.3892 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	99.3864	97.3340	94.7949	90.8393	87.6612	84.2309	82.8426	85.3699	88.0453	91.6556	95.6750	99.1150 (44)
Energy content (annual)	157.4037	138.6023	145.6963	124.3544	118.0088	103.5717	100.1910	105.7058	108.5686	124.3758	136.3066	155.1901 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m =											1517.9751
	23.6106	20.7903	21.8544	18.6532	17.7013	15.5358	15.0286	15.8559	16.2853	18.6564	20.4460	23.2785 (46)
Water storage loss:												
Store volume												180.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8736 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.8736 (55)
Total storage loss	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820 (56)
If cylinder contains dedicated solar storage	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820 (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	207.7481	184.0747	196.0407	173.0748	168.3533	152.2921	150.5354	156.0502	157.2891	174.7202	185.0270	205.5345 (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	207.7481	184.0747	196.0407	173.0748	168.3533	152.2921	150.5354	156.0502	157.2891	174.7202	185.0270	205.5345 (64)
	Total per year (kWh/year) = Sum(64)m =											2110.7403 (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	92.6123	82.4632	88.7196	80.3242	79.5135	73.4139	73.5890	75.4227	75.0754	81.6305	84.2983	91.8763 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	68.6451	68.6451	68.6451	68.6451	68.6451	68.6451	68.6451	68.6451	68.6451	68.6451	68.6451	68.6451 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	11.5020	10.2160	8.3082	6.2898	4.7017	3.9694	4.2891	5.5751	7.4829	9.5012	11.0893	11.8217 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	140.1329	141.5871	137.9227	130.1216	120.2742	111.0190	104.8360	103.3818	107.0462	114.8473	124.6947	133.9499 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	43.0086	43.0086	43.0086	43.0086	43.0086	43.0086	43.0086	43.0086	43.0086	43.0086	43.0086	43.0086 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												

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	-45.7634	-45.7634	-45.7634	-45.7634	-45.7634	-45.7634	-45.7634	-45.7634	-45.7634	-45.7634	-45.7634	-45.7634 (71)
Water heating gains (Table 5)	124.4789	122.7131	119.2467	111.5614	106.8730	101.9638	98.9100	101.3746	104.2714	109.7184	117.0810	123.4896 (72)
Total internal gains	345.0041	343.4064	334.3679	316.8631	300.7392	282.8425	273.9253	276.2219	284.6908	302.9572	321.7553	338.1515 (73)

6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF		Access factor Table 6d	Gains W	
North			2.0400	12.6762		0.5700		0.7000		0.7700	7.1503	(74)
East			8.6300	23.6925		0.5700		0.7000		0.7700	56.5363	(76)
South			5.6400	53.2576		0.5700		0.7000		0.7700	83.0552	(78)
Solar gains	146.7418	231.1159	334.6342	459.3404	517.8378	564.9365	530.5577	474.2652	398.1086	279.2187	179.4215	124.9981 (83)
Total gains	491.7459	574.5223	669.0021	776.2035	818.5770	847.7790	804.4831	750.4870	682.7994	582.1759	501.1768	463.1496 (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	24.9205	24.9266	24.9287	24.9327	24.9327	24.9388	24.9368	24.9409	24.9409	24.9348	24.9368	24.9287
alpha	2.6614	2.6618	2.6619	2.6622	2.6622	2.6626	2.6625	2.6627	2.6627	2.6623	2.6625	2.6619
util living area	0.8749	0.8289	0.7433	0.6176	0.4741	0.3258	0.2457	0.2499	0.4359	0.6483	0.8178	0.8880 (86)
MIT	19.5969	19.8239	20.1896	20.5256	20.7476	20.8479	20.8719	20.8721	20.8006	20.5560	20.0290	19.5326 (87)
Th 2	19.4896	19.4899	19.4900	19.4902	19.4902	19.4905	19.4904	19.4906	19.4906	19.4903	19.4904	19.4900 (88)
util rest of house	0.8509	0.7986	0.7013	0.5619	0.4030	0.2443	0.1550	0.1528	0.3450	0.5785	0.7798	0.8658 (89)
MIT 2	17.9718	18.2388	18.6609	19.0256	19.2448	19.3257	19.3396	19.3401	19.2962	19.0763	18.4948	17.8963 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.7775	19.0247	19.4188	19.7693	19.9899	20.0804	20.0993	20.0996	20.0420	19.8099	19.2554	18.7075 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7775	19.0247	19.4188	19.7693	19.9899	20.0804	20.0993	20.0996	20.0420	19.8099	19.2554	18.7075 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8376	0.7880	0.6991	0.5728	0.4273	0.2768	0.1920	0.1926	0.3794	0.5944	0.7730	0.8520 (94)
Useful gains	411.8796	452.7295	467.7058	444.5926	349.8025	234.6436	154.4908	144.5066	259.0819	346.0569	387.4179	394.6146 (95)
Ext temp.	5.0000	5.4000	7.1000	9.4000	12.5000	15.3000	17.0000	17.2000	14.6000	11.6000	7.9000	5.0000 (96)
Heat loss rate W	694.3483	686.4775	620.6323	522.3266	377.2838	240.7403	156.0931	146.0147	274.0402	413.5197	571.9083	690.5970 (97)
Space heating kWh	210.1567	157.0787	113.7774	55.9685	20.4461	0.0000	0.0000	0.0000	0.0000	50.1923	132.8331	220.2109 (98a)
Space heating requirement - total per year (kWh/year)												960.6636
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	210.1567	157.0787	113.7774	55.9685	20.4461	0.0000	0.0000	0.0000	0.0000	50.1923	132.8331	220.2109 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												960.6636
Space heating per m2										(98c) / (4) =		33.7786 (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 %)												249.9000 (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	210.1567	157.0787	113.7774	55.9685	20.4461	0.0000	0.0000	0.0000	0.0000	50.1923	132.8331	220.2109 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	84.0963	62.8566	45.5292	22.3963	8.1817	0.0000	0.0000	0.0000	0.0000	20.0850	53.1545	88.1196 (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)

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Water heating requirement	207.7481	184.0747	196.0407	173.0748	168.3533	152.2921	150.5354	156.0502	157.2891	174.7202	185.0270	205.5345 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	118.6454	105.1255	111.9593	98.8434	96.1469	86.9744	85.9711	89.1206	89.8281	99.7831	105.6694	117.3812 (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	9.4384	8.5250	9.4384	9.1339	9.4384	9.1339	9.4384	9.4384	9.1339	9.4384	9.1339	9.4384 (231)
Lighting	10.0676	8.0766	7.2721	5.3279	4.1154	3.3623	3.7542	4.8798	6.3384	8.3164	9.3933	10.3474 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												384.4192 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1205.4485 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.9125)												
mechanical ventilation fans (SFP = 0.9125)												111.1295 (230a)
Total electricity for the above, kWh/year												111.1295 (231)
Electricity for lighting (calculated in Appendix L)												81.2515 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												1782.2487 (238)

10a. Fuel costs - using BEDF prices (511)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	384.4192	18.3900	70.6947 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1205.4485	18.3900	221.6820 (247)
Energy for instantaneous electric shower(s)	0.0000	18.3900	0.0000 (247a)
Pumps, fans and electric keep-hot	111.1295	18.3900	20.4367 (249)
Energy for lighting	81.2515	18.3900	14.9422 (250)
Additional standing charges			0.0000 (251)
Total energy cost			327.7555 (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	384.4192	0.1564	60.1348 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1205.4485	0.1408	169.6950 (264)
Space and water heating			229.8298 (265)
Pumps, fans and electric keep-hot	111.1295	0.1387	15.4150 (267)
Energy for lighting	81.2515	0.1443	11.7271 (268)
Total CO2, kg/year			256.9719 (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	384.4192	1.5791	607.0415 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1205.4485	1.5205	1832.9118 (278)
Space and water heating			2439.9534 (279)
Pumps, fans and electric keep-hot	111.1295	1.5128	168.1167 (281)

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Energy for lighting
Total Primary energy kWh/year

81.2515

1.5338

124.6263 (282)
2732.6964 (286)

SAP 10 EPC IMPROVEMENTS

PROPOSED

Current energy efficiency rating: C 76
Current environmental impact rating: A 95

N Solar water heating			Recommended
U Solar photovoltaic panels			Recommended
V2 Wind turbine			Recommended
Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 3.8	-£ 62	-42 kg (16.5%)
U Solar photovoltaic panels	+ 8.6	-£ 125	-93 kg (43.3%)
V2 Wind turbine	+ 29.2	-£ 402	-309 kg (254.2%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£62	1.49 kg/m²	C 80 A 96
Solar photovoltaic panels	£125	3.27 kg/m²	B 88 A 97
Wind turbine	£402	10.87 kg/m²	A 117 A 103
Total Savings	£589	15.63 kg/m²	

Potential energy efficiency rating: A 117
Potential environmental impact rating: A 103

Fuel prices for cost data on this page from database revision number 511 TEST (31 Jan 2023)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£328	£265	£62
Space heating	£91	£106	-£15
Water heating	£222	£144	£77
Lighting	£15	£15	£0
Generated (PV)	-£0	-£125	£125
Generated (wind)	-£0	-£402	£402
Total cost of fuels	£328	-£262	£589
Total cost of uses	£328	-£262	£589
Delivered energy	63 kWh/m²	-50 kWh/m²	113 kWh/m²
Carbon dioxide emissions	0.3 tonnes	-0.2 tonnes	0.4 tonnes
CO2 emissions per m²	9 kg/m²	-7 kg/m²	16 kg/m²
Primary energy	96 kWh/m²	-74 kWh/m²	170 kWh/m²

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

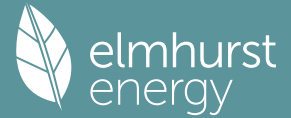
1. Overall dwelling characteristics

	Area (m²)	Storey height (m)	Volume (m³)
Ground floor	28.4400 (1b)	x 3.5100 (2b)	= 99.8244 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	28.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 99.8244 (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)

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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
Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered
Blower Door
Yes
0.1000 (17)
0.0050 (18)
0 (19)
Shelter factor (20) = $1 - [0.075 * (19)] = 1.0000$ (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.0050 (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	0.0064	0.0063	0.0061	0.0055	0.0054	0.0047	0.0047	0.0046	0.0050	0.0054	0.0056	0.0059 (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) =												80.1000 (23c)
Effective ac	0.1059	0.1057	0.1056	0.1050	0.1049	0.1042	0.1042	0.1041	0.1045	0.1049	0.1051	0.1054 (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
Windows (Uw = 1.00)			16.3100	0.9615	15.6827		(27)
Solid Doors			2.1000	1.0000	2.1000		(26)
Heatloss Floor 1			28.4400	0.1100	3.1284	110.0000	3128.4000 (28a)
Timber Cladding (Actis)	101.4800	18.4100	83.0700	0.1600	13.2912	9.0000	747.6300 (29a)
Internal Gables To Loft	9.7000		9.7000	0.2000	1.9400	9.0000	87.3000 (29a)
Rafters	22.6500		22.6500	0.1500	3.3975	9.0000	203.8500 (30)
Joists	6.5000		6.5000	0.1100	0.7150	9.0000	58.5000 (30)
Total net area of external elements Aum(A, m2)			168.7700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.2548		(33)
Internal Wall 1			32.8500			9.0000	295.6500 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 4521.3300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 158.9778 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	13.5200	0.0530	0.7166
E3 Sill	12.5200	0.0750	0.9390
E4 Jamb	36.3600	0.0470	1.7089
E5 Ground floor (normal)	24.0000	0.0290	0.6960
E16 Corner (normal)	14.5600	0.0460	0.6698
E11 Eaves (insulation at rafter level)	13.4800	0.0430	0.5796
E10 Eaves (insulation at ceiling level)	4.0000	0.0550	0.2200
E13 Gable (insulation at rafter level)	6.7400	0.0530	0.3572
R4 Ridge (vaulted ceiling)	6.7400	0.1200	0.8088
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			6.6959 (36)
Point Thermal bridges			0.0000 (36a) =
Total fabric heat loss			(33) + (36) + (36a) = 46.9507 (37)

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

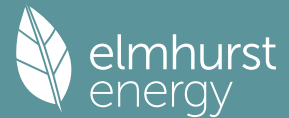
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	3.4877	3.4836	3.4795	3.4589	3.4548	3.4342	3.4342	3.4301	3.4424	3.4548	3.4630	3.4713 (38)
Heat transfer coeff	50.4384	50.4343	50.4302	50.4096	50.4055	50.3849	50.3849	50.3808	50.3931	50.4055	50.4137	50.4220 (39)
Average = Sum(39)m / 12 =												50.4086

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.7735	1.7734	1.7732	1.7725	1.7723	1.7716	1.7716	1.7715	1.7719	1.7723	1.7726	1.7729 (40)
HLP (average)												1.7725
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.1441 (42)
Hot water usage for mixer showers												
54.2523	53.4370	52.2490	49.9758	48.2983	46.4275	45.3642	46.5433	47.8358	49.8444	52.1663	54.0445 (42a)	
Hot water usage for baths												
18.7875	18.5084	18.1155	17.3910	16.8486	16.2471	15.9221	16.3123	16.7371	17.3808	18.1202	18.7239 (42b)	
Hot water usage for other uses												
26.3466	25.3885	24.4305	23.4724	22.5143	21.5563	21.5563	22.5143	23.4724	24.4305	25.3885	26.3466 (42c)	
Average daily hot water use (litres/day)												91.3892 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	99.3864	97.3340	94.7949	90.8393	87.6612	84.2309	82.8426	85.3699	88.0453	91.6556	95.6750	99.1150 (44)

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Energy content (annual)	157.4037	138.6023	145.6963	124.3544	118.0088	103.5717	100.1910	105.7058	108.5686	124.3758	136.3066	155.1901	(45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1517.9751	
Water storage loss:	23.6106	20.7903	21.8544	18.6532	17.7013	15.5358	15.0286	15.8559	16.2853	18.6564	20.4460	23.2785	(46)
Store volume												180.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kwh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.8736	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.8736	(55)
Total storage loss	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)
If cylinder contains dedicated solar storage	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(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	207.7481	184.0747	194.6450	166.3212	155.5590	139.6854	137.5085	143.9538	151.8862	173.3245	185.0270	205.5345	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)
Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
Effective solar volume												75.0000	(H14)
Reference volume												225.0000	(H15)
Storage tank correction coefficient												1.3161	(H16)
Heat delivered to hot water												580.7764	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												580.7764	
Solar input	-0.0000	-16.2841	-56.2427	-75.5176	-96.0405	-88.1722	-87.3366	-77.6602	-55.1288	-28.3937	-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	207.7481	167.7905	138.4023	90.8037	59.5185	51.5131	50.1719	66.2936	96.7574	144.9308	185.0270	205.5345	(64)
										Total per year (kwh/year) = Sum(64)m =		1464.4915	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
												0.0000	(64a)
Heat gains from water heating, kwh/month	92.6123	82.4632	87.6030	74.9213	69.2780	63.3285	63.1675	65.7456	70.7531	80.5139	84.2983	91.8763	(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	68.6451	68.6451	68.6451	68.6451	68.6451	68.6451	68.6451	68.6451	68.6451	68.6451	68.6451	68.6451	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	11.5020	10.2160	8.3082	6.2898	4.7017	3.9694	4.2891	5.5751	7.4829	9.5012	11.0893	11.8217	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	140.1329	141.5871	137.9227	130.1216	120.2742	111.0190	104.8360	103.3818	107.0462	114.8473	124.6947	133.9499	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	43.0086	43.0086	43.0086	43.0086	43.0086	43.0086	43.0086	43.0086	43.0086	43.0086	43.0086	43.0086	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-45.7634	-45.7634	-45.7634	-45.7634	-45.7634	-45.7634	-45.7634	-45.7634	-45.7634	-45.7634	-45.7634	-45.7634	(71)
Water heating gains (Table 5)	124.4789	122.7131	117.7459	104.0574	93.1156	87.9563	84.9025	88.3677	98.2682	108.2176	117.0810	123.4896	(72)
Total internal gains	345.0041	343.4064	332.8671	309.3591	286.9819	268.8350	259.9179	263.2149	278.6876	301.4564	321.7553	338.1515	(73)

6. Solar gains

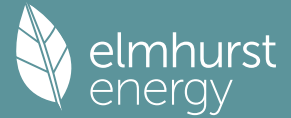
[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	2.0400	10.6334	0.5700	0.7000	0.7700	5.9980 (74)
East	8.6300	19.6403	0.5700	0.7000	0.7700	46.8667 (76)
South	5.6400	46.7521	0.5700	0.7000	0.7700	72.9098 (78)

Solar gains	125.7745	222.5512	322.5675	423.4004	491.1547	493.7749	473.5765	422.9230	357.9118	251.2243	152.2596	106.5419	(83)
Total gains	470.7786	565.9576	655.4345	732.7596	778.1365	762.6099	733.4944	686.1380	636.5994	552.6807	474.0149	444.6934	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000	(85)
Utilisation factor for gains for living area, n11,m (see Table 9a)		

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	24.9002	24.9022	24.9042	24.9144	24.9164	24.9266	24.9266	24.9287	24.9225	24.9164	24.9124	24.9083
alpha	2.6600	2.6601	2.6603	2.6610	2.6611	2.6618	2.6618	2.6619	2.6615	2.6611	2.6608	2.6606
util living area	0.8935	0.8418	0.7653	0.6573	0.5287	0.3971	0.2934	0.3251	0.4906	0.7074	0.8497	0.9055 (86)
MIT	19.4412	19.7360	20.0986	20.4456	20.6885	20.8176	20.8628	20.8552	20.7636	20.4286	19.8646	19.3633 (87)
Th 2	19.4886	19.4887	19.4888	19.4893	19.4894	19.4899	19.4899	19.4900	19.4897	19.4894	19.4892	19.4890 (88)
util rest of house	0.8731	0.8140	0.7266	0.6045	0.4605	0.3121	0.1964	0.2235	0.4001	0.6470	0.8180	0.8870 (89)
MIT 2	17.7811	18.1324	18.5556	18.9423	19.1910	19.3055	19.3354	19.3322	19.2679	18.9441	18.3009	17.6874 (90)
Living area fraction	18.6042	18.9275	19.3206	19.6876	19.9334	20.0552	20.0926	20.0872	20.0095	19.6801	19.0761	18.5183 (92)
MIT	18.6042	18.9275	19.3206	19.6876	19.9334	20.0552	20.0926	20.0872	20.0095	19.6801	19.0761	18.5183 (93)
Temperature adjustment												0.0000
adjusted MIT	18.6042	18.9275	19.3206	19.6876	19.9334	20.0552	20.0926	20.0872	20.0095	19.6801	19.0761	18.5183 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8588	0.8021	0.7218	0.6119	0.4814	0.3448	0.2358	0.2646	0.4327	0.6553	0.8079	0.8726 (94)
Useful gains	404.2940	453.9450	473.1027	448.3525	374.6083	262.9514	172.9654	181.5492	275.4290	362.1805	382.9447	388.0323 (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	721.4791	707.4653	646.5438	543.8000	415.0108	274.8582	175.9749	185.7663	297.7960	457.6850	603.7622	721.9549 (97)
Space heating kWh	235.9857	170.3656	129.0402	68.7222	30.0594	0.0000	0.0000	0.0000	0.0000	71.0553	158.9886	248.4384 (98a)
Space heating requirement - total per year (kWh/year)												1112.6555
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	235.9857	170.3656	129.0402	68.7222	30.0594	0.0000	0.0000	0.0000	0.0000	71.0553	158.9886	248.4384 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1112.6555
Space heating per m2										(98c) / (4) =		39.1229 (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 %)												249.9000 (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	235.9857	170.3656	129.0402	68.7222	30.0594	0.0000	0.0000	0.0000	0.0000	71.0553	158.9886	248.4384 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	94.4321	68.1735	51.6367	27.4999	12.0286	0.0000	0.0000	0.0000	0.0000	28.4335	63.6209	99.4151 (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	207.7481	167.7905	138.4023	90.8037	59.5185	51.5131	50.1719	66.2936	96.7574	144.9308	185.0270	205.5345 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	118.6454	95.8255	79.0418	51.8582	33.9911	29.4193	28.6533	37.8604	55.2584	82.7703	105.6694	117.3812 (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	16.2329	14.6620	16.2329	15.7093	16.2329	15.7093	16.2329	16.2329	15.7093	16.2329	15.7093	16.2329 (231)
Lighting	10.0676	8.0766	7.2721	5.3279	4.1154	3.3623	3.7542	4.8798	6.3384	8.3164	9.3933	10.3474 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-34.3914	-48.7409	-67.9925	-71.4093	-70.0880	-62.0643	-61.4086	-60.9078	-58.1703	-53.8232	-37.8640	-29.7279 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	-212.5732	-192.0016	-212.5732	-205.7160	-170.2933	-142.4000	-141.0797	-150.3305	-168.3548	-212.5732	-205.7160	-212.5732 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												445.2403 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)

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Efficiency of water heater	175.1000	
Water heating fuel used	836.3744	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.9125)		
mechanical ventilation fans (SFP = 0.9125)	111.1295	(230a)
pump for solar water heating	80.0000	(230g)
Total electricity for the above, kWh/year	191.1295	(231)
Electricity for lighting (calculated in Appendix L)	81.2515	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-656.5883	(233)
Wind generation	-3575.5408	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	-1328.7776	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	445.2403	16.4900	73.4201 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	836.3744	16.4900	137.9181 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	111.1295	16.4900	18.3253 (249)
Pump for solar water heating	80.0000	16.4900	13.1920 (249)
Energy for lighting	81.2515	16.4900	13.3984 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-656.5883	16.4900	-108.2714
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-108.2714 (252)
Wind Turbine electricity used in dwelling	-2226.1850	16.4900	-367.0979
Wind Turbine electricity exported	0.0000	5.5900	0.0000
Total			-367.0979 (252)
Total energy cost			-219.1154 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$ -1.0741 (257)
SAP value	117.4111
SAP rating (Section 12)	117 (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	445.2403	0.1559	69.3992 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	836.3744	0.1467	122.7059 (264)
Space and water heating			192.1052 (265)
Pumps, fans and electric keep-hot	191.1295	0.1387	26.5120 (267)
Energy for lighting	81.2515	0.1443	11.7271 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-656.5883	0.1361	-89.3359
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-89.3359 (269)
Wind Turbine electricity used in dwelling	-2226.1850	0.1413	-314.5362
Wind Turbine electricity exported	0.0000	0.0000	0.0000
Total			-314.5362 (269)
Total CO2, kg/year			-173.5278 (272)
CO2 emissions per m2			-6.1000 (273)
EI value			103.1662
EI rating			103 (274)
EI band			A

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1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	28.4400 (1b)	3.5100 (2b)	99.8244 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	28.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	99.8244 (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)+(7a)+(7b)+(7c) =	Air changes per hour 0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	0.1000 (17)
Infiltration rate	0.0050 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.0050 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.1000	3.8000	3.7000	3.5000	3.5000	3.2000	3.3000	3.1000	3.1000	3.4000	3.3000	3.7000 (22)
Wind factor	1.0250	0.9500	0.9250	0.8750	0.8750	0.8000	0.8250	0.7750	0.7750	0.8500	0.8250	0.9250 (22a)
Adj infilt rate	0.0051	0.0047	0.0046	0.0044	0.0044	0.0040	0.0041	0.0039	0.0039	0.0043	0.0041	0.0046 (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) =												80.1000 (23c)
Effective ac	0.1046	0.1042	0.1041	0.1039	0.1039	0.1035	0.1036	0.1034	0.1034	0.1037	0.1036	0.1041 (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
Windows (Uw = 1.00)			16.3100	0.9615	15.6827		(27)
Solid Doors			2.1000	1.0000	2.1000		(26)
Heatloss Floor 1			28.4400	0.1100	3.1284	110.0000	3128.4000 (28a)
Timber Cladding (Actis)	101.4800	18.4100	83.0700	0.1600	13.2912	9.0000	747.6300 (29a)
Internal Gables To Loft	9.7000		9.7000	0.2000	1.9400	9.0000	87.3000 (29a)
Rafters	22.6500		22.6500	0.1500	3.3975	9.0000	203.8500 (30)
Joists	6.5000		6.5000	0.1100	0.7150	9.0000	58.5000 (30)
Total net area of external elements Aum(A, m ²)			168.7700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.2548		(33)
Internal Wall 1			32.8500			9.0000	295.6500 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 4521.3300 (34)

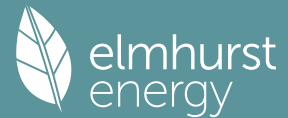
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 158.9778 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	13.5200	0.0530	0.7166
E3 Sill	12.5200	0.0750	0.9390
E4 Jamb	36.3600	0.0470	1.7089
E5 Ground floor (normal)	24.0000	0.0290	0.6960
E16 Corner (normal)	14.5600	0.0460	0.6698
E11 Eaves (insulation at rafter level)	13.4800	0.0430	0.5796
E10 Eaves (insulation at ceiling level)	4.0000	0.0550	0.2200
E13 Gable (insulation at rafter level)	6.7400	0.0530	0.3572
R4 Ridge (vaulted ceiling)	6.7400	0.1200	0.8088
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			6.6959 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 46.9507 (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	3.4466	3.4342	3.4301	3.4219	3.4219	3.4095	3.4136	3.4054	3.4054	3.4177	3.4136	3.4301 (38)

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Average = Sum(39)m / 12 =	50.3973	50.3849	50.3808	50.3725	50.3725	50.3602	50.3643	50.3561	50.3561	50.3684	50.3643	50.3808 (39)
	50.3715											50.3715
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.7721	1.7716	1.7715	1.7712	1.7712	1.7708	1.7709	1.7706	1.7706	1.7710	1.7709	1.7715 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	1.7712 (40)
												31

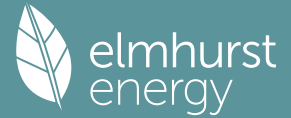
4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.1441 (42)
Hot water usage for mixer showers	54.2523	53.4370	52.2490	49.9758	48.2983	46.4275	45.3642	46.5433	47.8358	49.8444	52.1663	54.0445 (42a)
Hot water usage for baths	18.7875	18.5084	18.1155	17.3910	16.8486	16.2471	15.9221	16.3123	16.7371	17.3808	18.1202	18.7239 (42b)
Hot water usage for other uses	26.3466	25.3885	24.4305	23.4724	22.5143	21.5563	21.5563	22.5143	23.4724	24.4305	25.3885	26.3466 (42c)
Average daily hot water use (litres/day)												91.3892 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	99.3864	97.3340	94.7949	90.8393	87.6612	84.2309	82.8426	85.3699	88.0453	91.6556	95.6750	99.1150 (44)
Energy content (annual)	157.4037	138.6023	145.6963	124.3544	118.0088	103.5717	100.1910	105.7058	108.5686	124.3758	136.3066	155.1901 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m =											1517.9751
	23.6106	20.7903	21.8544	18.6532	17.7013	15.5358	15.0286	15.8559	16.2853	18.6564	20.4460	23.2785 (46)
Water storage loss:												
Store volume												180.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8736 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.8736 (55)
Total storage loss	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820 (56)
If cylinder contains dedicated solar storage	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820 (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	207.7481	184.0747	194.6450	166.3212	155.5590	139.6854	137.5085	143.9538	151.8862	173.3245	185.0270	205.5345 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												670.6242 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												670.6242
Solar input	-1.0038	-19.6720	-61.4087	-84.9698	-102.9041	-101.6865	-98.5299	-89.8047	-65.7295	-38.1468	-6.7685	-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	206.7443	164.4027	133.2362	81.3514	52.6548	37.9989	38.9786	54.1491	86.1567	135.1777	178.2585	205.5345 (64)
	Total per year (kWh/year) = Sum(64)m =											1374.6437 (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	92.6123	82.4632	87.6030	74.9213	69.2780	63.3285	63.1675	65.7456	70.7531	80.5139	84.2983	91.8763 (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	68.6451	68.6451	68.6451	68.6451	68.6451	68.6451	68.6451	68.6451	68.6451	68.6451	68.6451	68.6451 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	11.5020	10.2160	8.3082	6.2898	4.7017	3.9694	4.2891	5.5751	7.4829	9.5012	11.0893	11.8217 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	140.1329	141.5871	137.9227	130.1216	120.2742	111.0190	104.8360	103.3818	107.0462	114.8473	124.6947	133.9499 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	43.0086	43.0086	43.0086	43.0086	43.0086	43.0086	43.0086	43.0086	43.0086	43.0086	43.0086	43.0086 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-45.7634	-45.7634	-45.7634	-45.7634	-45.7634	-45.7634	-45.7634	-45.7634	-45.7634	-45.7634	-45.7634	-45.7634 (71)
Water heating gains (Table 5)												
	124.4789	122.7131	117.7459	104.0574	93.1156	87.9563	84.9025	88.3677	98.2682	108.2176	117.0810	123.4896 (72)
Total internal gains												
	345.0041	343.4064	332.8671	309.3591	286.9819	268.8350	259.9179	263.2149	278.6876	301.4564	321.7553	338.1515 (73)

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6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF		Access factor Table 6d		Gains W
North				2.0400	12.6762	0.5700		0.7000		0.7700		7.1503 (74)
East				8.6300	23.6925	0.5700		0.7000		0.7700		56.5363 (76)
South				5.6400	53.2576	0.5700		0.7000		0.7700		83.0552 (78)
Solar gains	146.7418	231.1159	334.6342	459.3404	517.8378	564.9365	530.5577	474.2652	398.1086	279.2187	179.4215	124.9981 (83)
Total gains	491.7459	574.5223	667.5013	768.6995	804.8197	833.7715	790.4756	737.4801	676.7962	580.6751	501.1768	463.1496 (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	24.9205	24.9266	24.9287	24.9327	24.9327	24.9388	24.9368	24.9409	24.9409	24.9348	24.9368	24.9287
alpha	2.6614	2.6618	2.6619	2.6622	2.6622	2.6626	2.6625	2.6627	2.6627	2.6623	2.6625	2.6619
util living area	0.8749	0.8289	0.7441	0.6215	0.4805	0.3308	0.2498	0.2541	0.4391	0.6493	0.8178	0.8880 (86)
MIT	19.5969	19.8239	20.1876	20.5199	20.7430	20.8465	20.8714	20.8715	20.7991	20.5547	20.0290	19.5326 (87)
Th 2	19.4896	19.4899	19.4900	19.4902	19.4902	19.4905	19.4904	19.4906	19.4906	19.4903	19.4904	19.4900 (88)
util rest of house	0.8509	0.7986	0.7021	0.5658	0.4089	0.2482	0.1577	0.1555	0.3478	0.5796	0.7798	0.8658 (89)
MIT 2	17.9718	18.2388	18.6588	19.0201	19.2413	19.3250	19.3394	19.3400	19.2952	19.0751	18.4948	17.8963 (90)
Living area fraction										fLA = Living area / (4) =		0.4958 (91)
MIT	18.7775	19.0247	19.4168	19.7637	19.9858	20.0793	20.0989	20.0993	20.0408	19.8087	19.2554	18.7075 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7775	19.0247	19.4168	19.7637	19.9858	20.0793	20.0989	20.0993	20.0408	19.8087	19.2554	18.7075 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8376	0.7880	0.6999	0.5765	0.4332	0.2811	0.1953	0.1958	0.3823	0.5954	0.7730	0.8520 (94)
Useful gains	411.8796	452.7295	467.1792	443.1169	348.6838	234.3577	154.4041	144.4250	258.7483	345.7295	387.4179	394.6146 (95)
Ext temp.	5.0000	5.4000	7.1000	9.4000	12.5000	15.3000	17.0000	17.2000	14.6000	11.6000	7.9000	5.0000 (96)
Heat loss rate W	694.3483	686.4775	620.5277	522.0469	377.0804	240.6880	156.0757	145.9980	273.9792	413.4570	571.9083	690.5970 (97)
Space heating kWh	210.1567	157.0787	114.0912	56.8296	21.1271	0.0000	0.0000	0.0000	0.0000	50.3892	132.8331	220.2109 (98a)
Space heating requirement - total per year (kWh/year)												962.7166
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	210.1567	157.0787	114.0912	56.8296	21.1271	0.0000	0.0000	0.0000	0.0000	50.3892	132.8331	220.2109 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												962.7166
Space heating per m2										(98c) / (4) =		33.8508 (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 %)												249.9000 (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	210.1567	157.0787	114.0912	56.8296	21.1271	0.0000	0.0000	0.0000	0.0000	50.3892	132.8331	220.2109 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	84.0963	62.8566	45.6547	22.7409	8.4542	0.0000	0.0000	0.0000	0.0000	20.1638	53.1545	88.1196 (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	206.7443	164.4027	133.2362	81.3514	52.6548	37.9989	38.9786	54.1491	86.1567	135.1777	178.2585	205.5345 (64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
(217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (217)

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Fuel for water heating, kWh/month	118.0721	93.8908	76.0915	46.4600	30.0713	21.7013	22.2608	30.9247	49.2043	77.2003	101.8038	117.3812	(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	16.2329	14.6620	16.2329	15.7093	16.2329	15.7093	16.2329	16.2329	15.7093	16.2329	15.7093	16.2329	(231)
Lighting	10.0676	8.0766	7.2721	5.3279	4.1154	3.3623	3.7542	4.8798	6.3384	8.3164	9.3933	10.3474	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-39.0854	-50.2493	-69.2087	-72.6854	-69.5984	-62.1502	-61.6048	-61.8320	-60.3547	-56.7878	-42.8113	-34.0411	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	-212.5732	-192.0016	-212.5732	-197.9011	-162.7991	-134.6820	-134.6871	-143.3948	-162.3007	-212.5732	-205.7160	-212.5732	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1													385.2407 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													175.1000
Water heating fuel used													785.0621 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.9125)													
mechanical ventilation fans (SFP = 0.9125)													111.1295 (230a)
pump for solar water heating													80.0000 (230g)
Total electricity for the above, kWh/year													191.1295 (231)
Electricity for lighting (calculated in Appendix L)													81.2515 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-680.4091 (233)
Wind generation													-3575.5408 (234)
Hydro-electric generation (Appendix N)													0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)													0.0000 (235)
Appendix Q - special features													
Energy saved or generated													-0.0000 (236)
Energy used													0.0000 (237)
Total delivered energy for all uses													-1421.5008 (238)

10a. Fuel costs - using BEDF prices (511)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	385.2407	18.3900	70.8458 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	785.0621	18.3900	144.3729 (247)
Energy for instantaneous electric shower(s)	0.0000	18.3900	0.0000 (247a)
Pumps, fans and electric keep-hot	111.1295	18.3900	20.4367 (249)
Pump for solar water heating	80.0000	18.3900	14.7120 (249)
Energy for lighting	81.2515	18.3900	14.9422 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-680.4091	18.3900	-125.1272
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-125.1272 (252)
Wind Turbine electricity used in dwelling	-2183.7755	18.3900	-401.5963
Wind Turbine electricity exported	0.0000	5.8100	0.0000
Total			-401.5963 (252)
Total energy cost			-261.4140 (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	385.2407	0.1564	60.2499 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	785.0621	0.1478	116.0698 (264)
Space and water heating			176.3198 (265)
Pumps, fans and electric keep-hot	191.1295	0.1387	26.5120 (267)
Energy for lighting	81.2515	0.1443	11.7271 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-680.4091	0.1365	-92.9017
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-92.9017 (269)
Wind Turbine electricity used in dwelling	-2183.7755	0.1416	-309.2783
Wind Turbine electricity exported	0.0000	0.0000	0.0000
Total			-309.2783 (269)
Total CO2, kg/year			-187.6211 (272)

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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	385.2407	1.5790	608.2895 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	785.0621	1.5470	1214.4827 (278)
Space and water heating			1822.7722 (279)
Pumps, fans and electric keep-hot	191.1295	1.5128	289.1407 (281)
Energy for lighting	81.2515	1.5338	124.6263 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-680.4091	1.5047	-1023.8373
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1023.8373 (283)
Wind Turbine electricity used in dwelling	-2183.7755	1.5238	-3327.5461
Wind Turbine electricity exported	0.0000	0.0000	0.0000
Total			-3327.5461 (283)
Total Primary energy kWh/year			-2114.8442 (286)