

Full SAP Calculation Printout



Property Reference	UNIT 40				Issued on Date	28/06/2023
Assessment Reference	UNIT 40			Prop Type Ref		
Property	Alexander House, UNIT 40, 205-207 King's Road, RG1 4LS					
SAP Rating	81 B	DER	6.07	TER	16.35	
Environmental	96 A	% DER < TER				62.87
CO ₂ Emissions (t/year)	0.25	DFEE	44.65	TFEE	43.61	
Compliance Check	See BREL	% DFEE < TFEE				-2.39
% DPER < TPER	25.84	DPER	64.02	TPER	86.32	
Assessor Details	Mr. Ondrej Gajdos				Assessor ID	W452-0001
Client						

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	43.2000 (1b)	x 2.5000 (2b)	= 108.0000 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	43.2000		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 108.0000 (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	4.0000 (17)
Number of sides sheltered	0.2000 (18)
	3 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1550 (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	0.1976	0.1938	0.1899	0.1705	0.1666	0.1473	0.1473	0.1434	0.1550	0.1666	0.1744	0.1821 (22b)
Mechanical extract ventilation - centralised												
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)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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
1 (Uw = 1.30)			6.5000	1.2357	8.0323		(27)
2 (Uw = 1.30)			6.5000	1.2357	8.0323		(27)
1			2.1000	1.0000	2.1000		(26)
top floor exposed new	25.2500	13.0000	12.2500	0.1800	2.2050	18.0000	220.5000 (29a)

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corridor new	25.2500	2.1000	23.1500	0.2400	5.5560	60.0000	1389.0000 (29a)
flat roof new	20.8000		20.8000	0.1300	2.7040	9.0000	187.2000 (30)
roof terrace new	22.4000		22.4000	0.1300	2.9120	9.0000	201.6000 (30)
Total net area of external elements Aum(A, m2)			93.7000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	31.5416			(33)
pw			21.5000	0.0000	0.0000	20.0000	430.0000 (32)
pf			43.2000			30.0000	1296.0000 (32d)
iw			56.0000			9.0000	504.0000 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	4228.3000 (34)	
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		97.8773 (35)	
List of Thermal Bridges			
K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	6.2000	0.0500	0.3100
E3 Sill	5.2000	0.0500	0.2600
E4 Jamb	14.2000	0.0500	0.7100
E7 Party floor between dwellings (in blocks of flats)	10.0000	0.0700	0.7000
E14 Flat roof	18.6000	0.0800	1.4880
E15 Flat roof with parapet	10.0000	0.1500	1.5000
E18 Party wall between dwellings	10.0000	0.0600	0.6000
E24 Eaves (insulation at ceiling level - inverted)	3.4000	0.2400	0.8160
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			6.3840 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =		37.9256 (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	17.8200	17.8200	17.8200	17.8200	17.8200	17.8200	17.8200	17.8200	17.8200	17.8200	17.8200	17.8200 (38)
Average = Sum(39)m / 12 =	55.7456	55.7456	55.7456	55.7456	55.7456	55.7456	55.7456	55.7456	55.7456	55.7456	55.7456	55.7456 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2904	1.2904	1.2904	1.2904	1.2904	1.2904	1.2904	1.2904	1.2904	1.2904	1.2904	1.2904 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

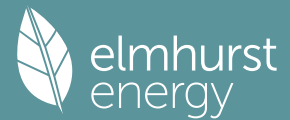
4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.4937 (42)
Hot water usage for mixer showers													
	49.2646	48.5243	47.4454	45.3813	43.8580	42.1592	41.1936	42.2643	43.4380	45.2619	47.3704	49.0759 (42a)	
Hot water usage for baths													
	21.3086	20.9922	20.5465	19.7248	19.1096	18.4273	18.0588	18.5013	18.9832	19.7132	20.5518	21.2366 (42b)	
Hot water usage for other uses													
	29.9274	28.8392	27.7509	26.6626	25.5744	24.4861	24.4861	25.5744	26.6626	27.7509	28.8392	29.9274 (42c)	
Average daily hot water use (litres/day)												92.3836 (43)	
Daily hot water use													
	100.5007	98.3556	95.7429	91.7687	88.5419	85.0726	83.7385	86.3400	89.0838	92.7260	96.7614	100.2399 (44)	
Energy content (annual)													
	159.1685	140.0571	147.1532	125.6268	119.1944	104.6067	101.2745	106.9070	109.8492	125.8283	137.8543	156.9515 (45)	
Distribution loss (46)m = 0.15 x (45)m													
	23.8753	21.0086	22.0730	18.8440	17.8792	15.6910	15.1912	16.0360	16.4774	18.8742	20.6782	23.5427 (46)	
Water storage loss:													
Store volume												150.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):												1.1500 (48)	
Temperature factor from Table 2b												0.5400 (49)	
Enter (49) or (54) in (55)												0.6210 (55)	
Total storage loss													
	19.2510	17.3880	19.2510	18.6300	19.2510	18.6300	19.2510	19.2510	18.6300	19.2510	18.6300	19.2510 (56)	
If cylinder contains dedicated solar storage													
	19.2510	17.3880	19.2510	18.6300	19.2510	18.6300	19.2510	19.2510	18.6300	19.2510	18.6300	19.2510 (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													
	201.6819	178.4563	189.6666	166.7688	161.7078	145.7487	143.7879	149.4204	150.9912	168.3417	178.9963	199.4649 (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													
	201.6819	178.4563	189.6666	166.7688	161.7078	145.7487	143.7879	149.4204	150.9912	168.3417	178.9963	199.4649 (64)	

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	89.6247	89.6247	89.6247	89.6247	89.6247	89.6247	89.6247	89.6247	89.6247	89.6247	89.6247	89.6247 (66)
	15.5242	13.7885	11.2135	8.4894	6.3459	5.3575	5.7889	7.5247	10.0996	12.8238	14.9672	15.9557 (67)

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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	193.5181	195.5262	190.4659	179.6929	166.0940	153.3129	144.7744	142.7663	147.8267	158.5996	172.1985	184.9796 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	45.4562	45.4562	45.4562	45.4562	45.4562	45.4562	45.4562	45.4562	45.4562	45.4562	45.4562	45.4562 (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)												
	-59.7498	-59.7498	-59.7498	-59.7498	-59.7498	-59.7498	-59.7498	-59.7498	-59.7498	-59.7498	-59.7498	-59.7498 (71)
Water heating gains (Table 5)												
	116.8471	115.0124	111.4774	103.7285	98.9823	94.0213	90.9738	93.4910	96.4423	101.9471	109.3752	115.8563 (72)
Total internal gains												
	401.2206	399.6582	388.4879	367.2419	346.7534	328.0228	316.8682	319.1131	329.6997	348.7016	371.8721	392.1227 (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					
West			6.5000	19.6403	0.6300	0.8000	0.7700	44.5887 (80)				
West			6.5000	19.6403	0.6300	0.8000	0.7700	44.5887 (80)				
Solar gains	89.1773	174.4498	287.2939	419.0010	513.5015	525.6602	500.4499	429.8791	334.1347	206.9993	111.1936	73.3351 (83)
Total gains	490.3979	574.1080	675.7818	786.2429	860.2549	853.6830	817.3182	748.9922	663.8344	555.7010	483.0658	465.4578 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n _{l,m} (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	21.0694	21.0694	21.0694	21.0694	21.0694	21.0694	21.0694	21.0694	21.0694	21.0694	21.0694	21.0694
alpha	2.4046	2.4046	2.4046	2.4046	2.4046	2.4046	2.4046	2.4046	2.4046	2.4046	2.4046	2.4046
util living area												
	0.8858	0.8426	0.7665	0.6505	0.5164	0.3865	0.2883	0.3248	0.5017	0.7211	0.8489	0.8968 (86)
Living												
	18.7372	19.1144	19.6770	20.2568	20.6620	20.8776	20.9560	20.9401	20.7649	20.1841	19.3376	18.6345
Non living												
	17.2779	17.7397	18.4193	19.0968	19.5438	19.7604	19.8262	19.8163	19.6648	19.0412	18.0286	17.1515
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												
	19.8425	19.1144	19.6770	20.2568	20.6620	20.8776	20.9560	20.9401	20.7649	20.1841	19.3376	18.9654 (87)
Th 2												
	19.8484	19.8484	19.8484	19.8484	19.8484	19.8484	19.8484	19.8484	19.8484	19.8484	19.8484	19.8484 (88)
util rest of house												
	0.8711	0.8233	0.7395	0.6128	0.4675	0.3251	0.2169	0.2493	0.4354	0.6794	0.8269	0.8833 (89)
MIT 2												
	18.8236	17.7397	18.4193	19.0968	19.5438	19.7604	19.8262	19.8163	19.6648	19.0412	18.0286	17.6375 (90)
Living area fraction												
									f _{LA} = Living area / (4) =			0.5463 (91)
MIT												
	19.3802	18.4907	19.1064	19.7305	20.1546	20.3707	20.4434	20.4302	20.2657	19.6656	18.7437	18.3629 (92)
Temperature adjustment												
												0.0000
adjusted MIT												
	19.3802	18.4907	19.1064	19.7305	20.1546	20.3707	20.4434	20.4302	20.2657	19.6656	18.7437	18.3629 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8643	0.7965	0.7200	0.6087	0.4810	0.3535	0.2543	0.2882	0.4604	0.6721	0.8018	0.8620 (94)
Useful gains	423.8720	457.3012	486.5428	478.5499	413.7487	301.7965	207.8667	215.8265	305.6165	373.4701	387.3224	401.2072 (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												
	840.6559	757.6207	702.7505	603.7536	471.3095	321.6933	214.2533	224.6664	343.7133	505.3671	649.0868	789.5211 (97)
Space heating kWh												
	310.0873	201.8147	160.8585	90.1466	42.8253	0.0000	0.0000	0.0000	0.0000	98.1314	188.4704	288.9056 (98a)
Space heating requirement - total per year (kWh/year)												
												1381.2396
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												
	310.0873	201.8147	160.8585	90.1466	42.8253	0.0000	0.0000	0.0000	0.0000	98.1314	188.4704	288.9056 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												
												1381.2396
Space heating per m2												
										(98c) / (4) =		31.9731 (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 %)												233.6929 (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												
	310.0873	201.8147	160.8585	90.1466	42.8253	0.0000	0.0000	0.0000	0.0000	98.1314	188.4704	288.9056 (98)
Space heating efficiency (main heating system 1)												

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Space heating fuel (main heating system)	233.6929	233.6929	233.6929	233.6929	233.6929	0.0000	0.0000	0.0000	0.0000	233.6929	233.6929	233.6929	(210)
Space heating efficiency (main heating system 2)	132.6901	86.3589	68.8333	38.5748	18.3254	0.0000	0.0000	0.0000	0.0000	41.9916	80.6487	123.6262	(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)
	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	201.6819	178.4563	189.6666	166.7688	161.7078	145.7487	143.7879	149.4204	150.9912	168.3417	178.9963	199.4649	(64)
Efficiency of water heater (217)m	191.5279	191.5279	191.5279	191.5279	191.5279	191.5279	191.5279	191.5279	191.5279	191.5279	191.5279	191.5279	(216)
Fuel for water heating, kWh/month	105.3016	93.1751	99.0282	87.0729	84.4304	76.0979	75.0741	78.0149	78.8351	87.8941	93.4571	104.1440	(217)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(219)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Lighting	13.5882	10.9010	9.8151	7.1910	5.5545	4.5381	5.0670	6.5863	8.5550	11.2246	12.6781	13.9659	(231)
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	(232)
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	(233a)
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	(234a)
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	(235a)
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	(235c)
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	(233b)
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	(234b)
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	(235b)
Annual totals kWh/year													(235d)
Space heating fuel - main system 1												591.0490	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												191.5279	(216)
Water heating fuel used												1062.5255	(217)
Space cooling fuel												0.0000	(219)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												109.6648	(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												1763.2393	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	591.0490	16.4900	97.4640 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1062.5255	16.4900	175.2104 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	109.6648	16.4900	18.0837 (250)
Additional standing charges			0.0000 (251)
Total energy cost			290.7582 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.1868 (257)
SAP value		80.7625
SAP rating (Section 12)		81 (258)
SAP band		B

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	591.0490	0.1556	91.9524 (261)

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Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1062.5255	0.1409	149.6814 (264)
Space and water heating			241.6338 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	109.6648	0.1443	15.8280 (268)
Total CO2, kg/year			257.4618 (272)
CO2 emissions per m2			5.9600 (273)
EI value			96.0884
EI rating			96 (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	43.2000 (1b)	x 2.5000 (2b)	= 108.0000 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	43.2000		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	108.0000 (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	4.0000 (17)
Infiltration rate	0.2000 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1550 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.1000	4.1000	3.8000	3.9000	3.4000	3.4000	3.3000	3.4000	3.8000	3.7000	4.0000 (22)
Wind factor	1.0750	1.0250	1.0250	0.9500	0.9750	0.8500	0.8500	0.8250	0.8500	0.9500	0.9250	1.0000 (22a)
Adj infilt rate	0.1666	0.1589	0.1589	0.1473	0.1511	0.1318	0.1318	0.1279	0.1318	0.1473	0.1434	0.1550 (22b)
Mechanical extract ventilation - centralised												
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)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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
1 (Uw = 1.30)			6.5000	1.2357	8.0323		(27)
2 (Uw = 1.30)			6.5000	1.2357	8.0323		(27)
1			2.1000	1.0000	2.1000		(26)
top floor exposed new	25.2500	13.0000	12.2500	0.1800	2.2050	18.0000	220.5000 (29a)
corridor new	25.2500	2.1000	23.1500	0.2400	5.5560	60.0000	1389.0000 (29a)
flat roof new	20.8000		20.8000	0.1300	2.7040	9.0000	187.2000 (30)
roof terrace new	22.4000		22.4000	0.1300	2.9120	9.0000	201.6000 (30)
Total net area of external elements Aum(A, m2)			93.7000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.5416		(33)
pw			21.5000	0.0000	0.0000	20.0000	430.0000 (32)
pf			43.2000			30.0000	1296.0000 (32d)
iw			56.0000			9.0000	504.0000 (32c)

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Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	4228.3000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		97.8773 (35)
List of Thermal Bridges		
K1 Element	Length	Psi-value
E2 Other lintels (including other steel lintels)	6.2000	0.0500
E3 Sill	5.2000	0.0500
E4 Jamb	14.2000	0.0500
E7 Party floor between dwellings (in blocks of flats)	10.0000	0.0700
E14 Flat roof	18.6000	0.0800
E15 Flat roof with parapet	10.0000	0.1500
E18 Party wall between dwellings	10.0000	0.0600
E24 Eaves (insulation at ceiling level - inverted)	3.4000	0.2400
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		0.8160
Point Thermal bridges		6.3840 (36)
Total fabric heat loss	(33) + (36) + (36a) =	37.9256 (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	17.8200	17.8200	17.8200	17.8200	17.8200	17.8200	17.8200	17.8200	17.8200	17.8200	17.8200	17.8200
Average = Sum(39)m / 12 =	55.7456	55.7456	55.7456	55.7456	55.7456	55.7456	55.7456	55.7456	55.7456	55.7456	55.7456	55.7456
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2904	1.2904	1.2904	1.2904	1.2904	1.2904	1.2904	1.2904	1.2904	1.2904	1.2904	1.2904
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

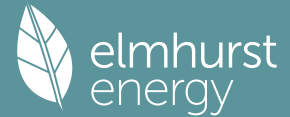
4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.4937 (42)
Hot water usage for mixer showers	49.2646	48.5243	47.4454	45.3813	43.8580	42.1592	41.1936	42.2643	43.4380	45.2619	47.3704	49.0759	49.0759 (42a)
Hot water usage for baths	21.3086	20.9922	20.5465	19.7248	19.1096	18.4273	18.0588	18.5013	18.9832	19.7132	20.5518	21.2366	21.2366 (42b)
Hot water usage for other uses	29.9274	28.8392	27.7509	26.6626	25.5744	24.4861	24.4861	25.5744	26.6626	27.7509	28.8392	29.9274	29.9274 (42c)
Average daily hot water use (litres/day)	23.8753	21.0086	22.0730	18.8440	17.8792	15.6910	15.1912	16.0360	16.4774	18.8742	20.6782	23.5427	92.3836 (43)
Daily hot water use	100.5007	98.3556	95.7429	91.7687	88.5419	85.0726	83.7385	86.3400	89.0838	92.7260	96.7614	100.2399	100.2399 (44)
Energy conte	159.1685	140.0571	147.1532	125.6268	119.1944	104.6067	101.2745	106.9070	109.8492	125.8283	137.8543	156.9515	156.9515 (45)
Energy content (annual)													Total = Sum(45)m = 1534.4716
Distribution loss (46)m = 0.15 x (45)m	23.8753	21.0086	22.0730	18.8440	17.8792	15.6910	15.1912	16.0360	16.4774	18.8742	20.6782	23.5427	23.5427 (46)
Water storage loss:													
Store volume													150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.1500 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.6210 (55)
Total storage loss	19.2510	17.3880	19.2510	18.6300	19.2510	18.6300	19.2510	19.2510	18.6300	19.2510	18.6300	19.2510	19.2510 (56)
If cylinder contains dedicated solar storage	19.2510	17.3880	19.2510	18.6300	19.2510	18.6300	19.2510	19.2510	18.6300	19.2510	18.6300	19.2510	19.2510 (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	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	0.0000 (61)
Total heat required for water heating calculated for each month	201.6819	178.4563	189.6666	166.7688	161.7078	145.7487	143.7879	149.4204	150.9912	168.3417	178.9963	199.4649	199.4649 (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	201.6819	178.4563	189.6666	166.7688	161.7078	145.7487	143.7879	149.4204	150.9912	168.3417	178.9963	199.4649	199.4649 (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)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month	86.9343	77.2883	82.9392	74.6845	73.6429	67.6953	67.6845	69.5573	69.4385	75.8486	78.7502	86.1971	86.1971 (65)

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

Metabolic gains (Table 5), Watts													
(66)m	89.6247	89.6247	89.6247	89.6247	89.6247	89.6247	89.6247	89.6247	89.6247	89.6247	89.6247	89.6247	89.6247 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.5242	13.7885	11.2135	8.4894	6.3459	5.3575	5.7889	7.5247	10.0996	12.8238	14.9672	15.9557	15.9557 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	193.5181	195.5262	190.4659	179.6929	166.0940	153.3129	144.7744	142.7663	147.8267	158.5996	172.1985	184.9796	184.9796 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	45.4562	45.4562	45.4562	45.4562	45.4562	45.4562	45.4562	45.4562	45.4562	45.4562	45.4562	45.4562	45.4562 (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	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-59.7498	-59.7498	-59.7498	-59.7498	-59.7498	-59.7498	-59.7498	-59.7498	-59.7498	-59.7498	-59.7498	-59.7498	-59.7498 (71)
Water heating gains (Table 5)													

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Total internal gains	116.8471	115.0124	111.4774	103.7285	98.9823	94.0213	90.9738	93.4910	96.4423	101.9471	109.3752	115.8563 (72)
	401.2206	399.6582	388.4879	367.2419	346.7534	328.0228	316.8682	319.1131	329.6997	348.7016	371.8721	392.1227 (73)

6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W			
West			6.5000	23.8018	0.6300	0.8000	0.7700	54.0364 (80)				
West			6.5000	23.8018	0.6300	0.8000	0.7700	54.0364 (80)				
Solar gains	108.0728	184.6599	301.3593	445.0487	530.4343	573.9977	541.2251	477.3095	373.2414	235.0507	132.7417	89.3857 (83)
Total gains	509.2934	584.3181	689.8472	812.2906	877.1877	902.0206	858.0933	796.4226	702.9411	583.7523	504.6138	481.5084 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)											
Utilisation factor for gains for living area, n _{l,m} (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	21.0694	21.0694	21.0694	21.0694	21.0694	21.0694	21.0694	21.0694	21.0694	21.0694	21.0694	21.0694
alpha	2.4046	2.4046	2.4046	2.4046	2.4046	2.4046	2.4046	2.4046	2.4046	2.4046	2.4046	2.4046
util living area	0.8677	0.8248	0.7388	0.6056	0.4583	0.3068	0.2102	0.2322	0.4304	0.6712	0.8205	0.8796 (86)
Living	18.9747	19.3097	19.8678	20.4219	20.7742	20.9403	20.9837	20.9790	20.8545	20.3721	19.5843	18.8910
Non living	17.5734	17.9805	18.6480	19.2833	19.6595	19.8127	19.8431	19.8411	19.7468	19.2533	18.3294	17.4720
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	19.9639	19.3097	19.8678	20.4219	20.7742	20.9403	20.9837	20.9790	20.8545	20.3721	19.5843	19.1860 (87)
Th 2	19.8484	19.8484	19.8484	19.8484	19.8484	19.8484	19.8484	19.8484	19.8484	19.8484	19.8484	19.8484 (88)
util rest of house	0.8504	0.8031	0.7084	0.5638	0.4048	0.2434	0.1385	0.1558	0.3598	0.6229	0.7941	0.8635 (89)
MIT 2	18.9414	17.9805	18.6480	19.2833	19.6595	19.8127	19.8431	19.8411	19.7468	19.2533	18.3294	17.9002 (90)
Living area fraction	f _{LA} = Living area / (4) =											
MIT	19.5000	18.7066	19.3144	19.9054	20.2685	20.4287	20.4662	20.4627	20.3519	19.8645	19.0149	18.6026 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.5000	18.7066	19.3144	19.9054	20.2685	20.4287	20.4662	20.4627	20.3519	19.8645	19.0149	18.6026 (93)

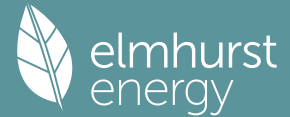
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8446	0.7780	0.6928	0.5660	0.4248	0.2758	0.1773	0.1970	0.3915	0.6236	0.7719	0.8425 (94)
Useful gains	430.1407	454.5976	477.9082	459.7204	372.6490	248.8140	152.1567	156.8997	275.2265	364.0403	389.5181	405.6903 (95)
Ext temp.	5.1000	5.7000	7.4000	9.9000	12.9000	15.8000	17.7000	17.6000	15.0000	11.5000	8.0000	5.1000 (96)
Heat loss rate W	802.7384	725.0619	664.1742	557.7548	410.7606	258.0284	154.2023	159.5845	298.3444	466.2842	614.0350	752.7137 (97)
Space heating kWh	277.2126	181.7520	138.5819	70.5848	28.3550	0.0000	0.0000	0.0000	0.0000	76.0694	161.6521	258.1854 (98a)
Space heating requirement - total per year (kWh/year)	1192.3933											
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	277.2126	181.7520	138.5819	70.5848	28.3550	0.0000	0.0000	0.0000	0.0000	76.0694	161.6521	258.1854 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	1192.3933											
Space heating per m2	(98c) / (4) = 27.6017 (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 %)	233.6929 (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	277.2126	181.7520	138.5819	70.5848	28.3550	0.0000	0.0000	0.0000	0.0000	76.0694	161.6521	258.1854 (98)
Space heating efficiency (main heating system 1)	233.6929	233.6929	233.6929	233.6929	233.6929	0.0000	0.0000	0.0000	0.0000	233.6929	233.6929	233.6929 (210)
Space heating fuel (main heating system)	118.6226	77.7739	59.3009	30.2041	12.1335	0.0000	0.0000	0.0000	0.0000	32.5510	69.1729	110.4806 (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)												

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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 requirement	201.6819	178.4563	189.6666	166.7688	161.7078	145.7487	143.7879	149.4204	150.9912	168.3417	178.9963	199.4649	(64)
Efficiency of water heater (217)m	191.5279	191.5279	191.5279	191.5279	191.5279	191.5279	191.5279	191.5279	191.5279	191.5279	191.5279	191.5279	(216)
Fuel for water heating, kWh/month	105.3016	93.1751	99.0282	87.0729	84.4304	76.0979	75.0741	78.0149	78.8351	87.8941	93.4571	104.1440	(217)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(219)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Lighting	13.5882	10.9010	9.8151	7.1910	5.5545	4.5381	5.0670	6.5863	8.5550	11.2246	12.6781	13.9659	(231)
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	(232)
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	(233a)
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	(234a)
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	(235a)
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	(235c)
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	(233b)
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	(234b)
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	(235b)
Annual totals kWh/year													(235d)
Space heating fuel - main system 1												510.2394	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												191.5279	
Water heating fuel used												1062.5255	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												109.6648	(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												1682.4297	(238)

10a. Fuel costs - using BEDF prices (521)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	510.2394	18.3900	93.8330 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1062.5255	18.3900	195.3984 (247)
Energy for instantaneous electric shower(s)	0.0000	18.3900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	109.6648	18.3900	20.1674 (250)
Additional standing charges			0.0000 (251)
Total energy cost			309.3988 (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	510.2394	0.1561	79.6535 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1062.5255	0.1409	149.6814 (264)
Space and water heating			229.3349 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	109.6648	0.1443	15.8280 (268)
Total CO2, kg/year			245.1629 (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	510.2394	1.5779	805.1046 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1062.5255	1.5209	1615.9915 (278)
Space and water heating			2421.0961 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)

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Energy for lighting 109.6648 1.5338 168.2076 (282)
Total Primary energy kWh/year 2589.3036 (286)

SAP 10 EPC IMPROVEMENTS

UNIT 40

Current energy efficiency rating: B 81
Current environmental impact rating: A 96

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

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

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

Potential energy efficiency rating: B 81
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 521 TEST (19 Jun 2023)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current £309	Potential £309	Saving £0
Electricity			
Space heating	£94	£94	£0
Water heating	£195	£195	£0
Lighting	£20	£20	£0
Total cost of fuels	£309	£309	£0
Total cost of uses	£309	£309	£0
Delivered energy	39 kWh/m²	39 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.2 tonnes	0.2 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	60 kWh/m²	60 kWh/m²	0 kWh/m²

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

1. Overall dwelling characteristics

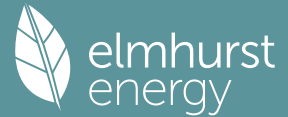
	Area (m²)	Storey height (m)	Volume (m³)
Ground floor	43.2000 (1b)	x 2.5000 (2b)	= 108.0000 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	43.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	108.0000 (5)

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

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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 4.0000 (17)
 Infiltration rate 0.2000 (18)
 Number of sides sheltered 3 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.7750 (20)
 Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1550 (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	0.1976	0.1938	0.1899	0.1705	0.1666	0.1473	0.1473	0.1434	0.1550	0.1666	0.1744	0.1821	(22b)
Mechanical extract ventilation - centralised													
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)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(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	
1 (Uw = 1.30)			6.5000	1.2357	8.0323			(27)
2 (Uw = 1.30)			6.5000	1.2357	8.0323			(27)
1			2.1000	1.0000	2.1000			(26)
top floor exposed new	25.2500	13.0000	12.2500	0.1800	2.2050	18.0000	220.5000	(29a)
corridor new	25.2500	2.1000	23.1500	0.2400	5.5560	60.0000	1389.0000	(29a)
flat roof new	20.8000		20.8000	0.1300	2.7040	9.0000	187.2000	(30)
roof terrace new	22.4000		22.4000	0.1300	2.9120	9.0000	201.6000	(30)
Total net area of external elements Aum(A, m2)			93.7000					(31)
Fabric heat loss, W/K = Sum (A x U)								(33)
pw			21.5000	0.0000	0.0000	20.0000	430.0000	(32)
pf			43.2000			30.0000	1296.0000	(32d)
iw			56.0000			9.0000	504.0000	(32c)
Heat capacity Cm = Sum(A x k)								(28)...(30) + (32) + (32a)...(32e) = 4228.3000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								97.8773 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	6.2000	0.0500	0.3100	
E3 Sill	5.2000	0.0500	0.2600	
E4 Jamb	14.2000	0.0500	0.7100	
E7 Party floor between dwellings (in blocks of flats)	10.0000	0.0700	0.7000	
E14 Flat roof	18.6000	0.0800	1.4880	
E15 Flat roof with parapet	10.0000	0.1500	1.5000	
E18 Party wall between dwellings	10.0000	0.0600	0.6000	
E24 Eaves (insulation at ceiling level - inverted)	3.4000	0.2400	0.8160	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				6.3840 (36)
Point Thermal bridges				0.0000 (36a) =
Total fabric heat loss				(33) + (36) + (36a) = 37.9256 (37)

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

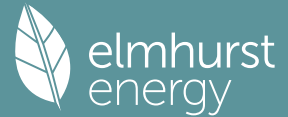
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	17.8200	17.8200	17.8200	17.8200	17.8200	17.8200	17.8200	17.8200	17.8200	17.8200	17.8200	17.8200	(38)
Heat transfer coeff	55.7456	55.7456	55.7456	55.7456	55.7456	55.7456	55.7456	55.7456	55.7456	55.7456	55.7456	55.7456	(39)
Average = Sum(39)m / 12 =													55.7456

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2904	1.2904	1.2904	1.2904	1.2904	1.2904	1.2904	1.2904	1.2904	1.2904	1.2904	1.2904	(40)
HLP (average)													1.2904
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.4937 (42)
Hot water usage for mixer showers													
49.2646	48.5243	47.4454	45.3813	43.8580	42.1592	41.1936	42.2643	43.4380	45.2619	47.3704	49.0759	49.0759	(42a)
Hot water usage for baths													
21.3086	20.9922	20.5465	19.7248	19.1096	18.4273	18.0588	18.5013	18.9832	19.7132	20.5518	21.2366	21.2366	(42b)
Hot water usage for other uses													
29.9274	28.8392	27.7509	26.6626	25.5744	24.4861	24.4861	25.5744	26.6626	27.7509	28.8392	29.9274	29.9274	(42c)
Average daily hot water use (litres/day)													92.3836 (43)
Daily hot water use													
100.5007	98.3556	95.7429	91.7687	88.5419	85.0726	83.7385	86.3400	89.0838	92.7260	96.7614	100.2399	100.2399	(44)
Energy conte	159.1685	140.0571	147.1532	125.6268	119.1944	104.6067	101.2745	106.9070	109.8492	125.8283	137.8543	156.9515	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m													
23.8753	21.0086	22.0730	18.8440	17.8792	15.6910	15.1912	16.0360	16.4774	18.8742	20.6782	23.5427	23.5427	(46)
Water storage loss:													
Store volume													150.0000 (47)

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a) If manufacturer declared loss factor is known (kWh/day):												1.1500 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6210 (55)
Total storage loss	19.2510	17.3880	19.2510	18.6300	19.2510	18.6300	19.2510	19.2510	18.6300	19.2510	18.6300	19.2510 (56)
If cylinder contains dedicated solar storage	19.2510	17.3880	19.2510	18.6300	19.2510	18.6300	19.2510	19.2510	18.6300	19.2510	18.6300	19.2510 (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	201.6819	178.4563	189.6666	166.7688	161.7078	145.7487	143.7879	149.4204	150.9912	168.3417	178.9963	199.4649 (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	201.6819	178.4563	189.6666	166.7688	161.7078	145.7487	143.7879	149.4204	150.9912	168.3417	178.9963	199.4649 (64)
	Total per year (kWh/year) = Sum(64)m =											2035.0326 (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	86.9343	77.2883	82.9392	74.6845	73.6429	67.6953	67.6845	69.5573	69.4385	75.8486	78.7502	86.1971 (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	89.6247	89.6247	89.6247	89.6247	89.6247	89.6247	89.6247	89.6247	89.6247	89.6247	89.6247	89.6247 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.5242	13.7885	11.2135	8.4894	6.3459	5.3575	5.7889	7.5247	10.0996	12.8238	14.9672	15.9557 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	193.5181	195.5262	190.4659	179.6929	166.0940	153.3129	144.7744	142.7663	147.8267	158.5996	172.1985	184.9796 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	45.4562	45.4562	45.4562	45.4562	45.4562	45.4562	45.4562	45.4562	45.4562	45.4562	45.4562	45.4562 (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)	-59.7498	-59.7498	-59.7498	-59.7498	-59.7498	-59.7498	-59.7498	-59.7498	-59.7498	-59.7498	-59.7498	-59.7498 (71)
Water heating gains (Table 5)	116.8471	115.0124	111.4774	103.7285	98.9823	94.0213	90.9738	93.4910	96.4423	101.9471	109.3752	115.8563 (72)
Total internal gains	401.2206	399.6582	388.4879	367.2419	346.7534	328.0228	316.8682	319.1131	329.6997	348.7016	371.8721	392.1227 (73)

6. Solar gains

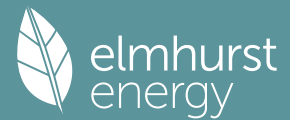
[Jan]			Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W			
West			6.5000	19.6403	0.6300	0.8000	0.7700	44.5887 (80)				
West			6.5000	19.6403	0.6300	0.8000	0.7700	44.5887 (80)				
Solar gains	89.1773	174.4498	287.2939	419.0010	513.5015	525.6602	500.4499	429.8791	334.1347	206.9993	111.1936	73.3351 (83)
Total gains	490.3979	574.1080	675.7818	786.2429	860.2549	853.6830	817.3182	748.9922	663.8344	555.7010	483.0658	465.4578 (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	21.0694	21.0694	21.0694	21.0694	21.0694	21.0694	21.0694	21.0694	21.0694	21.0694	21.0694	21.0694
alpha	2.4046	2.4046	2.4046	2.4046	2.4046	2.4046	2.4046	2.4046	2.4046	2.4046	2.4046	2.4046
util living area	0.8858	0.8426	0.7665	0.6505	0.5164	0.3865	0.2883	0.3248	0.5017	0.7211	0.8489	0.8968 (86)
Living	18.7372	19.1144	19.6770	20.2568	20.6620	20.8776	20.9560	20.9401	20.7649	20.1841	19.3376	18.6345
Non living	17.2779	17.7397	18.4193	19.0968	19.5438	19.7604	19.8262	19.8163	19.6648	19.0412	18.0286	17.1515
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	19.8425	19.1144	19.6770	20.2568	20.6620	20.8776	20.9560	20.9401	20.7649	20.1841	19.3376	18.9654 (87)
Th 2	19.8484	19.8484	19.8484	19.8484	19.8484	19.8484	19.8484	19.8484	19.8484	19.8484	19.8484	19.8484 (88)
util rest of house	0.8711	0.8233	0.7395	0.6128	0.4675	0.3251	0.2169	0.2493	0.4354	0.6794	0.8269	0.8833 (89)
MIT 2	18.8236	17.7397	18.4193	19.0968	19.5438	19.7604	19.8262	19.8163	19.6648	19.0412	18.0286	17.6375 (90)
Living area fraction	19.3802	18.4907	19.1064	19.7305	20.1546	20.3707	20.4434	20.4302	20.2657	19.6656	18.7437	0.5463 (91)
MIT	19.3802	18.4907	19.1064	19.7305	20.1546	20.3707	20.4434	20.4302	20.2657	19.6656	18.7437	18.3629 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3802	18.4907	19.1064	19.7305	20.1546	20.3707	20.4434	20.4302	20.2657	19.6656	18.7437	18.3629 (93)

8. Space heating requirement

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8643	0.7965	0.7200	0.6087	0.4810	0.3535	0.2543	0.2882	0.4604	0.6721	0.8018	0.8620	(94)
Useful gains	423.8720	457.3012	486.5428	478.5499	413.7487	301.7965	207.8667	215.8265	305.6165	373.4701	387.3224	401.2072	(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	840.6559	757.6207	702.7505	603.7536	471.3095	321.6933	214.2533	224.6664	343.7133	505.3671	649.0868	789.5211	(97)
Space heating kWh	310.0873	201.8147	160.8585	90.1466	42.8253	0.0000	0.0000	0.0000	0.0000	98.1314	188.4704	288.9056	(98a)
Space heating requirement - total per year (kWh/year)												1381.2396	
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	310.0873	201.8147	160.8585	90.1466	42.8253	0.0000	0.0000	0.0000	0.0000	98.1314	188.4704	288.9056	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1381.2396	
Space heating per m2										(98c) / (4) =		31.9731	(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 %)		233.6929	(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	310.0873	201.8147	160.8585	90.1466	42.8253	0.0000	0.0000	0.0000	0.0000	98.1314	188.4704	288.9056	(98)
Space heating efficiency (main heating system 1)	233.6929	233.6929	233.6929	233.6929	233.6929	0.0000	0.0000	0.0000	0.0000	233.6929	233.6929	233.6929	(210)
Space heating fuel (main heating system)	132.6901	86.3589	68.8333	38.5748	18.3254	0.0000	0.0000	0.0000	0.0000	41.9916	80.6487	123.6262	(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	201.6819	178.4563	189.6666	166.7688	161.7078	145.7487	143.7879	149.4204	150.9912	168.3417	178.9963	199.4649	(64)
Efficiency of water heater	191.5279	191.5279	191.5279	191.5279	191.5279	191.5279	191.5279	191.5279	191.5279	191.5279	191.5279	191.5279	(216)
Fuel for water heating, kWh/month	105.3016	93.1751	99.0282	87.0729	84.4304	76.0979	75.0741	78.0149	78.8351	87.8941	93.4571	104.1440	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	13.5882	10.9010	9.8151	7.1910	5.5545	4.5381	5.0670	6.5863	8.5550	11.2246	12.6781	13.9659	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												591.0490	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												191.5279	
Water heating fuel used												1062.5255	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												109.6648	(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												1763.2393	(238)

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10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	591.0490	16.4900	97.4640 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1062.5255	16.4900	175.2104 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	109.6648	16.4900	18.0837 (250)
Additional standing charges			0.0000 (251)
Total energy cost			290.7582 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.1868 (257)
SAP value		80.7625
SAP rating (Section 12)		81 (258)
SAP band		B

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	591.0490	0.1556	91.9524 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1062.5255	0.1409	149.6814 (264)
Space and water heating			241.6338 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	109.6648	0.1443	15.8280 (268)
Total CO2, kg/year			257.4618 (272)
CO2 emissions per m2			5.9600 (273)
EI value			96.0884
EI rating			96 (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

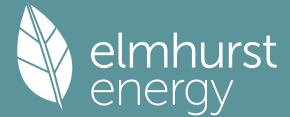
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	43.2000 (1b)	x 2.5000 (2b)	= 108.0000 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	43.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	108.0000 (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) =
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	4.0000 (17)
Number of sides sheltered	0.2000 (18)
	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)

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Infiltration rate adjusted to include shelter factor

$$(21) = (18) \times (20) = 0.1550 \quad (21)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.3000	4.1000	4.1000	3.8000	3.9000	3.4000	3.4000	3.3000	3.4000	3.8000	3.7000	4.0000	(22)
Wind factor	1.0750	1.0250	1.0250	0.9500	0.9750	0.8500	0.8500	0.8250	0.8500	0.9500	0.9250	1.0000	(22a)
Adj infiltr rate	0.1666	0.1589	0.1589	0.1473	0.1511	0.1318	0.1318	0.1279	0.1318	0.1473	0.1434	0.1550	(22b)
Mechanical extract ventilation - centralised													
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)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(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	
1 (Uw = 1.30)			6.5000	1.2357	8.0323			(27)
2 (Uw = 1.30)			6.5000	1.2357	8.0323			(27)
1			2.1000	1.0000	2.1000			(26)
top floor exposed new	25.2500	13.0000	12.2500	0.1800	2.2050	18.0000	220.5000	(29a)
corridor new	25.2500	2.1000	23.1500	0.2400	5.5560	60.0000	1389.0000	(29a)
flat roof new	20.8000		20.8000	0.1300	2.7040	9.0000	187.2000	(30)
roof terrace new	22.4000		22.4000	0.1300	2.9120	9.0000	201.6000	(30)
Total net area of external elements Aum(A, m2)			93.7000					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	31.5416		(33)
pw			21.5000	0.0000	0.0000	20.0000	430.0000	(32)
pf			43.2000			30.0000	1296.0000	(32d)
iw			56.0000			9.0000	504.0000	(32c)

Heat capacity Cm = Sum(A x k)

$$(28)...(30) + (32) + (32a)...(32e) = 4228.3000 \quad (34)$$

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

$$97.8773 \quad (35)$$

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	6.2000	0.0500	0.3100	
E3 Sill	5.2000	0.0500	0.2600	
E4 Jamb	14.2000	0.0500	0.7100	
E7 Party floor between dwellings (in blocks of flats)	10.0000	0.0700	0.7000	
E14 Flat roof	18.6000	0.0800	1.4880	
E15 Flat roof with parapet	10.0000	0.1500	1.5000	
E18 Party wall between dwellings	10.0000	0.0600	0.6000	
E24 Eaves (insulation at ceiling level - inverted)	3.4000	0.2400	0.8160	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				6.3840 (36)
Point Thermal bridges				0.0000 (36a)
Total fabric heat loss				(33) + (36) + (36a) = 37.9256 (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	17.8200	17.8200	17.8200	17.8200	17.8200	17.8200	17.8200	17.8200	17.8200	17.8200	17.8200	17.8200	(38)
Heat transfer coeff	55.7456	55.7456	55.7456	55.7456	55.7456	55.7456	55.7456	55.7456	55.7456	55.7456	55.7456	55.7456	(39)
Average = Sum(39)m / 12 =													55.7456

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2904	1.2904	1.2904	1.2904	1.2904	1.2904	1.2904	1.2904	1.2904	1.2904	1.2904	1.2904	(40)
HLP (average)													1.2904
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.4937 (42)
Hot water usage for mixer showers													
49.2646	48.5243	47.4454	45.3813	43.8580	42.1592	41.1936	42.2643	43.4380	45.2619	47.3704	49.0759	49.0759	(42a)
Hot water usage for baths													
21.3086	20.9922	20.5465	19.7248	19.1096	18.4273	18.0588	18.5013	18.9832	19.7132	20.5518	21.2366	21.2366	(42b)
Hot water usage for other uses													
29.9274	28.8392	27.7509	26.6626	25.5744	24.4861	24.4861	25.5744	26.6626	27.7509	28.8392	29.9274	29.9274	(42c)
Average daily hot water use (litres/day)													92.3836 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.5007	98.3556	95.7429	91.7687	88.5419	85.0726	83.7385	86.3400	89.0838	92.7260	96.7614	100.2399	(44)
Energy conte	159.1685	140.0571	147.1532	125.6268	119.1944	104.6067	101.2745	106.9070	109.8492	125.8283	137.8543	156.9515	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m													
23.8753	21.0086	22.0730	18.8440	17.8792	15.6910	15.1912	16.0360	16.4774	18.8742	20.6782	23.5427	23.5427	(46)
Water storage loss:													
Store volume													150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.1500 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.6210 (55)
Total storage loss													
19.2510	17.3880	19.2510	18.6300	19.2510	18.6300	19.2510	19.2510	18.6300	19.2510	18.6300	19.2510	19.2510	(56)
If cylinder contains dedicated solar storage													
19.2510	17.3880	19.2510	18.6300	19.2510	18.6300	19.2510	19.2510	18.6300	19.2510	18.6300	19.2510	19.2510	(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)

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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												
WWHRS	201.6819	178.4563	189.6666	166.7688	161.7078	145.7487	143.7879	149.4204	150.9912	168.3417	178.9963	199.4649 (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)
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	201.6819	178.4563	189.6666	166.7688	161.7078	145.7487	143.7879	149.4204	150.9912	168.3417	178.9963	199.4649 (64)
Total per year (kWh/year) = Sum(64)m =												2035.0326 (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												
	86.9343	77.2883	82.9392	74.6845	73.6429	67.6953	67.6845	69.5573	69.4385	75.8486	78.7502	86.1971 (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	89.6247	89.6247	89.6247	89.6247	89.6247	89.6247	89.6247	89.6247	89.6247	89.6247	89.6247	89.6247 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	15.5242	13.7885	11.2135	8.4894	6.3459	5.3575	5.7889	7.5247	10.0996	12.8238	14.9672	15.9557 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	193.5181	195.5262	190.4659	179.6929	166.0940	153.3129	144.7744	142.7663	147.8267	158.5996	172.1985	184.9796 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	45.4562	45.4562	45.4562	45.4562	45.4562	45.4562	45.4562	45.4562	45.4562	45.4562	45.4562	45.4562 (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)												
	-59.7498	-59.7498	-59.7498	-59.7498	-59.7498	-59.7498	-59.7498	-59.7498	-59.7498	-59.7498	-59.7498	-59.7498 (71)
Water heating gains (Table 5)												
	116.8471	115.0124	111.4774	103.7285	98.9823	94.0213	90.9738	93.4910	96.4423	101.9471	109.3752	115.8563 (72)
Total internal gains	401.2206	399.6582	388.4879	367.2419	346.7534	328.0228	316.8682	319.1131	329.6997	348.7016	371.8721	392.1227 (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				
West			6.5000	23.8018	0.6300	0.8000	0.7700	54.0364 (80)				
West			6.5000	23.8018	0.6300	0.8000	0.7700	54.0364 (80)				
Solar gains	108.0728	184.6599	301.3593	445.0487	530.4343	573.9977	541.2251	477.3095	373.2414	235.0507	132.7417	89.3857 (83)
Total gains	509.2934	584.3181	689.8472	812.2906	877.1877	902.0206	858.0933	796.4226	702.9411	583.7523	504.6138	481.5084 (84)

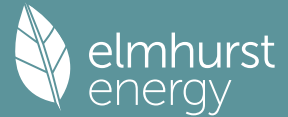
7. Mean internal temperature (heating season)

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	21.0694	21.0694	21.0694	21.0694	21.0694	21.0694	21.0694	21.0694	21.0694	21.0694	21.0694	21.0694
alpha	2.4046	2.4046	2.4046	2.4046	2.4046	2.4046	2.4046	2.4046	2.4046	2.4046	2.4046	2.4046
util living area	0.8677	0.8248	0.7388	0.6056	0.4583	0.3068	0.2102	0.2322	0.4304	0.6712	0.8205	0.8796 (86)
Living	18.9747	19.3097	19.8678	20.4219	20.7742	20.9403	20.9837	20.9790	20.8545	20.3721	19.5843	18.8910
Non living	17.5734	17.9805	18.6480	19.2833	19.6595	19.8127	19.8431	19.8411	19.7468	19.2533	18.3294	17.4720
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	19.9639	19.3097	19.8678	20.4219	20.7742	20.9403	20.9837	20.9790	20.8545	20.3721	19.5843	19.1860 (87)
Th 2	19.8484	19.8484	19.8484	19.8484	19.8484	19.8484	19.8484	19.8484	19.8484	19.8484	19.8484	19.8484 (88)
util rest of house	0.8504	0.8031	0.7084	0.5638	0.4048	0.2434	0.1385	0.1558	0.3598	0.6229	0.7941	0.8635 (89)
MIT 2	18.9414	17.9805	18.6480	19.2833	19.6595	19.8127	19.8431	19.8411	19.7468	19.2533	18.3294	17.9002 (90)
Living area fraction	19.5000	18.7066	19.3144	19.9054	20.2685	20.4287	20.4662	20.4627	20.3519	19.8645	19.0149	0.5463 (91)
MIT	19.5000	18.7066	19.3144	19.9054	20.2685	20.4287	20.4662	20.4627	20.3519	19.8645	19.0149	18.6026 (92)
Temperature adjustment												0.0000
adjusted MIT	19.5000	18.7066	19.3144	19.9054	20.2685	20.4287	20.4662	20.4627	20.3519	19.8645	19.0149	18.6026 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8446	0.7780	0.6928	0.5660	0.4248	0.2758	0.1773	0.1970	0.3915	0.6236	0.7719	0.8425 (94)
Useful gains	430.1407	454.5976	477.9082	459.7204	372.6490	248.8140	152.1567	156.8997	275.2265	364.0403	389.5181	405.6903 (95)
Ext temp.	5.1000	5.7000	7.4000	9.9000	12.9000	15.8000	17.7000	17.6000	15.0000	11.5000	8.0000	5.1000 (96)
Heat loss rate W	802.7384	725.0619	664.1742	557.7548	410.7606	258.0284	154.2023	159.5845	298.3444	466.2842	614.0350	752.7137 (97)

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Space heating kWh	277.2126	181.7520	138.5819	70.5848	28.3550	0.0000	0.0000	0.0000	0.0000	76.0694	161.6521	258.1854 (98a)
Space heating requirement - total per year (kWh/year)												1192.3933
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	277.2126	181.7520	138.5819	70.5848	28.3550	0.0000	0.0000	0.0000	0.0000	76.0694	161.6521	258.1854 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1192.3933
Space heating per m2										(98c) / (4) =		27.6017 (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 %)												233.6929 (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	277.2126	181.7520	138.5819	70.5848	28.3550	0.0000	0.0000	0.0000	0.0000	76.0694	161.6521	258.1854	(98)
Space heating efficiency (main heating system 1)	233.6929	233.6929	233.6929	233.6929	233.6929	0.0000	0.0000	0.0000	0.0000	233.6929	233.6929	233.6929	(210)
Space heating fuel (main heating system)	118.6226	77.7739	59.3009	30.2041	12.1335	0.0000	0.0000	0.0000	0.0000	32.5510	69.1729	110.4806	(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	201.6819	178.4563	189.6666	166.7688	161.7078	145.7487	143.7879	149.4204	150.9912	168.3417	178.9963	199.4649	(64)
Efficiency of water heater	191.5279	191.5279	191.5279	191.5279	191.5279	191.5279	191.5279	191.5279	191.5279	191.5279	191.5279	191.5279	(216)
Fuel for water heating, kWh/month	105.3016	93.1751	99.0282	87.0729	84.4304	76.0979	75.0741	78.0149	78.8351	87.8941	93.4571	104.1440	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	13.5882	10.9010	9.8151	7.1910	5.5545	4.5381	5.0670	6.5863	8.5550	11.2246	12.6781	13.9659	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												510.2394	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												191.5279	
Water heating fuel used												1062.5255	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:

Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	109.6648 (232)

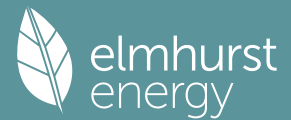
Energy saving/generation technologies (Appendices M ,N and Q)

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	1682.4297 (238)

10a. Fuel costs - using BEDF prices (521)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	510.2394	18.3900	93.8330 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1062.5255	18.3900	195.3984 (247)

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Energy for instantaneous electric shower(s)	0.0000	18.3900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	109.6648	18.3900	20.1674 (250)
Additional standing charges			0.0000 (251)
Total energy cost			309.3988 (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	510.2394	0.1561	79.6535 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1062.5255	0.1409	149.6814 (264)
Space and water heating			229.3349 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	109.6648	0.1443	15.8280 (268)
Total CO2, kg/year			245.1629 (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	510.2394	1.5779	805.1046 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1062.5255	1.5209	1615.9915 (278)
Space and water heating			2421.0961 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	109.6648	1.5338	168.2076 (282)
Total Primary energy kWh/year			2589.3036 (286)