

Full SAP Calculation Printout



Property Reference	UNIT 41				Issued on Date	28/06/2023
Assessment Reference	UNIT 41		Prop Type Ref			
Property	Alexander House, UNIT 41, 205-207 King's Road, RG1 4LS					
SAP Rating	80 C	DER	6.61	TER	18.57	
Environmental	96 A	% DER < TER				64.40
CO ₂ Emissions (t/year)	0.24	DFEE	50.41	TFEE	50.51	
Compliance Check	See BREL	% DFEE < TFEE				0.21
% DPER < TPER	29.22	DPER	69.59	TPER	98.33	
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	39.5000 (1b)	x 2.5000 (2b)	= 98.7500 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	39.5000		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 98.7500 (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)
	2 (19)

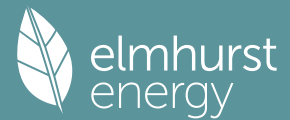
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1700 (21)

	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	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998 (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	33.5000	13.0000	20.5000	0.1800	3.6900	18.0000	369.0000 (29a)

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corridor new	26.2500	2.1000	24.1500	0.2400	5.7960	60.0000	1449.0000 (29a)
flat roof new	21.9000		21.9000	0.1300	2.8470	9.0000	197.1000 (30)
roof terrace new	17.6000		17.6000	0.1300	2.2880	9.0000	158.4000 (30)
Total net area of external elements Aum(A, m2)			99.2500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	32.7856			(33)
pw			10.7500	0.0000	0.0000	20.0000	215.0000 (32)
pf			39.5000			30.0000	1185.0000 (32d)
iw			49.0000			9.0000	441.0000 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 4014.5000 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 101.6329 (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)	12.6000	0.0700	0.8820				
E14 Flat roof	14.6000	0.0800	1.1680				
E15 Flat roof with parapet	13.4000	0.1500	2.0100				
E16 Corner (normal)	7.5000	0.0900	0.6750				
E17 Corner (inverted - internal area greater than external area)	2.5000	-0.0900	-0.2250				
E18 Party wall between dwellings	5.0000	0.0600	0.3000				
E24 Eaves (insulation at ceiling level - inverted)	3.3000	0.2400	0.7920				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			6.8820 (36)				
Point Thermal bridges			0.0000				
Total fabric heat loss			(33) + (36) + (36a) =	39.6676 (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	16.2937	16.2937	16.2937	16.2937	16.2937	16.2937	16.2937	16.2937	16.2937	16.2937	16.2937	16.2937	(38)
Average = Sum(39)m / 12 =	55.9614	55.9614	55.9614	55.9614	55.9614	55.9614	55.9614	55.9614	55.9614	55.9614	55.9614	55.9614	(39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.4167	1.4167	1.4167	1.4167	1.4167	1.4167	1.4167	1.4167	1.4167	1.4167	1.4167	1.4167	(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													1.3931 (42)
Hot water usage for mixer showers	47.5773	46.8623	45.8204	43.8269	42.3558	40.7152	39.7827	40.8167	41.9502	43.7117	45.7480	47.3950	(42a)
Hot water usage for baths	20.5830	20.2773	19.8469	19.0532	18.4588	17.7998	17.4439	17.8713	18.3367	19.0419	19.8520	20.5134	(42b)
Hot water usage for other uses	28.8968	27.8461	26.7953	25.7445	24.6937	23.6429	23.6429	24.6937	25.7445	26.7953	27.8461	28.8968	(42c)
Average daily hot water use (litres/day)	23.0572	20.2888	21.3167	18.1984	17.2666	15.1534	14.6707	15.4866	15.9128	18.2275	19.9696	22.7361	(46)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	97.0572	94.9857	92.4625	88.6246	85.5083	82.1579	80.8695	83.3817	86.0314	89.5488	93.4460	96.8053	(44)
Energy content (annual)	153.7148	135.2583	142.1115	121.3226	115.1106	101.0228	97.8046	103.2440	106.0853	121.5169	133.1309	151.5737	(45)
Distribution loss (46)m = 0.15 x (45)m	23.0572	20.2888	21.3167	18.1984	17.2666	15.1534	14.6707	15.4866	15.9128	18.2275	19.9696	22.7361	(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	196.2282	173.6575	184.6249	162.4646	157.6240	142.1648	140.3180	145.7574	147.2273	164.0303	174.2729	194.0871	(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	196.2282	173.6575	184.6249	162.4646	157.6240	142.1648	140.3180	145.7574	147.2273	164.0303	174.2729	194.0871	(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	85.1209	75.6928	81.2628	73.2534	72.2850	66.5037	66.5308	68.3393	68.1870	74.4151	77.1796	84.4090	(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	(66)
	83.5866	83.5866	83.5866	83.5866	83.5866	83.5866	83.5866	83.5866	83.5866	83.5866	83.5866	83.5866	

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Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	14.4012	12.7910	10.4024	7.8753	5.8868	4.9699	5.3702	6.9804	9.3690	11.8961	13.8845	14.8015 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	179.5194	181.3822	176.6879	166.6943	154.0791	142.2226	134.3017	132.4389	137.1332	147.1268	159.7420	171.5985 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	44.7518	44.7518	44.7518	44.7518	44.7518	44.7518	44.7518	44.7518	44.7518	44.7518	44.7518	44.7518 (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)	-55.7244	-55.7244	-55.7244	-55.7244	-55.7244	-55.7244	-55.7244	-55.7244	-55.7244	-55.7244	-55.7244	-55.7244 (71)
Water heating gains (Table 5)	114.4098	112.6380	109.2242	101.7408	97.1573	92.3662	89.4231	91.8540	94.7041	100.0203	107.1939	113.4529 (72)
Total internal gains	380.9444	379.4253	368.9284	348.9243	329.7372	312.1727	301.7089	303.8872	313.8203	331.6572	353.4345	372.4669 (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			
East			6.5000	19.6403	0.6300	0.8000		0.7700	44.5887 (76)			
East			6.5000	19.6403	0.6300	0.8000		0.7700	44.5887 (76)			
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	470.1217	553.8750	656.2223	767.9253	843.2387	837.8329	802.1588	733.7662	647.9550	538.6566	464.6281	445.8020 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	19.9269	19.9269	19.9269	19.9269	19.9269	19.9269	19.9269	19.9269	19.9269	19.9269	19.9269	19.9269
alpha	2.3285	2.3285	2.3285	2.3285	2.3285	2.3285	2.3285	2.3285	2.3285	2.3285	2.3285	2.3285
util living area	0.8883	0.8453	0.7697	0.6545	0.5211	0.3915	0.2931	0.3303	0.5081	0.7261	0.8521	0.8990 (86)
Living	18.5788	18.9729	19.5653	20.1824	20.6205	20.8589	20.9479	20.9296	20.7335	20.1061	19.2110	18.4738
Non living	17.0202	17.5021	18.2165	18.9354	19.4160	19.6530	19.7261	19.7151	19.5489	18.8797	17.8106	16.8911
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	19.7614	18.9729	19.5653	20.1824	20.6205	20.8589	20.9479	20.9296	20.7335	20.1061	19.2110	18.8272 (87)
Th 2	19.7505	19.7505	19.7505	19.7505	19.7505	19.7505	19.7505	19.7505	19.7505	19.7505	19.7505	19.7505 (88)
util rest of house	0.8728	0.8250	0.7410	0.6141	0.4683	0.3247	0.2147	0.2475	0.4362	0.6817	0.8290	0.8848 (89)
MIT 2	18.6620	17.5021	18.2165	18.9354	19.4160	19.6530	19.7261	19.7151	19.5489	18.8797	17.8106	17.4064 (90)
Living area fraction									fLA = Living area / (4) =			0.5899 (91)
MIT	19.3105	18.3697	19.0121	19.6710	20.1265	20.3643	20.4468	20.4315	20.2477	19.6031	18.6367	18.2445 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3105	18.3697	19.0121	19.6710	20.1265	20.3643	20.4468	20.4315	20.2477	19.6031	18.6367	18.2445 (93)

8. Space heating requirement

Utilisation	0.8667	0.7983	0.7219	0.6113	0.4848	0.3582	0.2591	0.2935	0.4660	0.6759	0.8042	0.8638 (94)
Useful gains	407.4575	442.1378	473.7295	469.4628	408.7835	300.1511	207.8145	215.3797	301.9675	364.0533	373.6346	385.0775 (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	840.0098	753.7816	700.1959	602.7591	471.5597	322.5802	215.2717	225.6080	344.0315	503.8267	645.6089	785.9482 (97)
Space heating kWh	321.8190	209.4246	168.4910	95.9733	46.7055	0.0000	0.0000	0.0000	0.0000	103.9914	195.8215	298.2478 (98a)
Space heating requirement - total per year (kWh/year)												1440.4741
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	321.8190	209.4246	168.4910	95.9733	46.7055	0.0000	0.0000	0.0000	0.0000	103.9914	195.8215	298.2478 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1440.4741
Space heating per m2										(98c) / (4) =		36.4677 (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 %)												233.8197 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement												

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321.8190	209.4246	168.4910	95.9733	46.7055	0.0000	0.0000	0.0000	0.0000	103.9914	195.8215	298.2478	(98)
Space heating efficiency (main heating system 1)												
233.8197	233.8197	233.8197	233.8197	233.8197	0.0000	0.0000	0.0000	0.0000	233.8197	233.8197	233.8197	(210)
Space heating fuel (main heating system)												
137.6355	89.5667	72.0602	41.0459	19.9750	0.0000	0.0000	0.0000	0.0000	44.4750	83.7489	127.5546	(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												
196.2282	173.6575	184.6249	162.4646	157.6240	142.1648	140.3180	145.7574	147.2273	164.0303	174.2729	194.0871	(64)
Efficiency of water heater												
(217)m	191.5179	191.5179	191.5179	191.5179	191.5179	191.5179	191.5179	191.5179	191.5179	191.5179	191.5179	(216)
Fuel for water heating, kWh/month												
102.4595	90.6743	96.4008	84.8300	82.3025	74.2305	73.2663	76.1064	76.8739	85.6475	90.9956	101.3415	(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												
Lighting	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
12.6053	10.1124	9.1051	6.6708	5.1527	4.2098	4.7005	6.1099	7.9361	10.4126	11.7610	12.9556	(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											616.0619	(211)
Space heating fuel - main system 2											0.0000	(213)
Space heating fuel - secondary											0.0000	(215)
Efficiency of water heater											191.5179	
Water heating fuel used											1035.1289	(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)											101.7319	(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											1752.9227	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	616.0619	16.4900	101.5886 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1035.1289	16.4900	170.6928 (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	101.7319	16.4900	16.7756 (250)
Additional standing charges			0.0000 (251)
Total energy cost			289.0569 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600 (256)
Energy cost factor (ECF)	1.2315 (257)
SAP value	80.0376
SAP rating (Section 12)	80 (258)
SAP band	C

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

Energy	Emission factor	Emissions
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Space heating - main system 1	kWh/year	kg CO2/kWh	kg CO2/year
Total CO2 associated with community systems	616.0619	0.1555	95.7828 (261)
Water heating (other fuel)	1035.1289	0.1409	0.0000 (373)
Space and water heating			145.8026 (264)
Pumps, fans and electric keep-hot	0.0000	0.0000	241.5854 (265)
Energy for lighting	101.7319	0.1443	0.0000 (267)
Total CO2, kg/year			14.6831 (268)
CO2 emissions per m2			256.2684 (272)
EI value			6.4900 (273)
EI rating			95.9361
EI band			96 (274)
			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	39.5000 (1b)	x 2.5000 (2b)	= 98.7500 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	39.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	98.7500 (5)

2. Ventilation rate

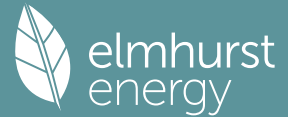
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number 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	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1700 (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	0.1827	0.1742	0.1742	0.1615	0.1658	0.1445	0.1445	0.1403	0.1445	0.1615	0.1573	0.1700 (22b)
Mechanical extract ventilation - centralised												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
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	33.5000	13.0000	20.5000	0.1800	3.6900	18.0000	369.0000 (29a)
corridor new	26.2500	2.1000	24.1500	0.2400	5.7960	60.0000	1449.0000 (29a)
flat roof new	21.9000		21.9000	0.1300	2.8470	9.0000	197.1000 (30)
roof terrace new	17.6000		17.6000	0.1300	2.2880	9.0000	158.4000 (30)
Total net area of external elements Aum(A, m2)			99.2500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.7856		(33)
pw			10.7500	0.0000	0.0000	20.0000	215.0000 (32)

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pf 39.5000 30.0000 1185.0000 (32d)
iw 49.0000 9.0000 441.0000 (32c)

Heat capacity $C_m = \text{Sum}(A \times k)$ (28)...(30) + (32) + (32a)...(32e) = 4014.5000 (34)
Thermal mass parameter (TMP = C_m / TFA) in kJ/m²K 101.6329 (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)	12.6000	0.0700	0.8820
E14 Flat roof	14.6000	0.0800	1.1680
E15 Flat roof with parapet	13.4000	0.1500	2.0100
E16 Corner (normal)	7.5000	0.0900	0.6750
E17 Corner (inverted - internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	5.0000	0.0600	0.3000
E24 Eaves (insulation at ceiling level - inverted)	3.3000	0.2400	0.7920
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			6.8820 (36)
Point Thermal bridges			0.0000 (36a) =
Total fabric heat loss			39.6676 (37) (33) + (36) + (36a) =

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	16.2937	16.2937	16.2937	16.2937	16.2937	16.2937	16.2937	16.2937	16.2937	16.2937	16.2937	16.2937	(38)
Heat transfer coeff	55.9614	55.9614	55.9614	55.9614	55.9614	55.9614	55.9614	55.9614	55.9614	55.9614	55.9614	55.9614	(39)
Average = Sum(39)m / 12 =												55.9614	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4167	1.4167	1.4167	1.4167	1.4167	1.4167	1.4167	1.4167	1.4167	1.4167	1.4167	1.4167	(40)
HLP (average)												1.4167	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

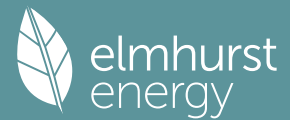
4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.3931 (42)
Hot water usage for mixer showers	47.5773	46.8623	45.8204	43.8269	42.3558	40.7152	39.7827	40.8167	41.9502	43.7117	45.7480	47.3950	(42a)
Hot water usage for baths	20.5830	20.2773	19.8469	19.0532	18.4588	17.7998	17.4439	17.8713	18.3367	19.0419	19.8520	20.5134	(42b)
Hot water usage for other uses	28.8968	27.8461	26.7953	25.7445	24.6937	23.6429	23.6429	24.6937	25.7445	26.7953	27.8461	28.8968	(42c)
Average daily hot water use (litres/day)												89.2182	(43)
Daily hot water use	97.0572	94.9857	92.4625	88.6246	85.5083	82.1579	80.8695	83.3817	86.0314	89.5488	93.4460	96.8053	(44)
Energy content (annual)	153.7148	135.2583	142.1115	121.3226	115.1106	101.0228	97.8046	103.2440	106.0853	121.5169	133.1309	151.5737	(45)
Distribution loss (46)m = 0.15 x (45)m	23.0572	20.2888	21.3167	18.1984	17.2666	15.1534	14.6707	15.4866	15.9128	18.2275	19.9696	22.7361	(46)
Water storage loss:												150.0000	(47)
Store volume												1.1500	(48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400	(49)
Temperature factor from Table 2b												0.6210	(55)
Enter (49) or (54) in (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	196.2282	173.6575	184.6249	162.4646	157.6240	142.1648	140.3180	145.7574	147.2273	164.0303	174.2729	194.0871	(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	196.2282	173.6575	184.6249	162.4646	157.6240	142.1648	140.3180	145.7574	147.2273	164.0303	174.2729	194.0871	(64)
Total per year (kWh/year) = Sum(64)m =												1982.4570	(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	85.1209	75.6928	81.2628	73.2534	72.2850	66.5037	66.5308	68.3393	68.1870	74.4151	77.1796	84.4090	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	83.5866	83.5866	83.5866	83.5866	83.5866	83.5866	83.5866	83.5866	83.5866	83.5866	83.5866	83.5866	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	14.4012	12.7910	10.4024	7.8753	5.8868	4.9699	5.3702	6.9804	9.3690	11.8961	13.8845	14.8015	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	179.5194	181.3822	176.6879	166.6943	154.0791	142.2226	134.3017	132.4389	137.1332	147.1268	159.7420	171.5985	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	44.7518	44.7518	44.7518	44.7518	44.7518	44.7518	44.7518	44.7518	44.7518	44.7518	44.7518	44.7518	(69)

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Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-55.7244	-55.7244	-55.7244	-55.7244	-55.7244	-55.7244	-55.7244	-55.7244	-55.7244	-55.7244	-55.7244	-55.7244	-55.7244 (71)
Water heating gains (Table 5)	114.4098	112.6380	109.2242	101.7408	97.1573	92.3662	89.4231	91.8540	94.7041	100.0203	107.1939	113.4529	(72)
Total internal gains	380.9444	379.4253	368.9284	348.9243	329.7372	312.1727	301.7089	303.8872	313.8203	331.6572	353.4345	372.4669	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific FF or Table 6c	Access factor Table 6d	Gains W
East	6.5000	23.8018	0.6300	0.8000	0.7700	54.0364 (76)
East	6.5000	23.8018	0.6300	0.8000	0.7700	54.0364 (76)

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	489.0172	564.0852	670.2877	793.9729	860.1715	886.1704	842.9340	781.1967	687.0617	566.7079	486.1761	461.8526	(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	19.9269	19.9269	19.9269	19.9269	19.9269	19.9269	19.9269	19.9269	19.9269	19.9269	19.9269	19.9269	
alpha	2.3285	2.3285	2.3285	2.3285	2.3285	2.3285	2.3285	2.3285	2.3285	2.3285	2.3285	2.3285	
util living area	0.8706	0.8280	0.7426	0.6101	0.4633	0.3115	0.2141	0.2366	0.4367	0.6769	0.8243	0.8823	(86)
Living	18.8265	19.1773	19.7667	20.3595	20.7436	20.9298	20.9802	20.9746	20.8328	20.3067	19.4696	18.7410	
Non living	17.3284	17.7541	18.4577	19.1346	19.5418	19.7108	19.7448	19.7426	19.6384	19.1052	18.1258	17.2249	
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	19.8881	19.1773	19.7667	20.3595	20.7436	20.9298	20.9802	20.9746	20.8328	20.3067	19.4696	19.0570	(87)
Th 2	19.7505	19.7505	19.7505	19.7505	19.7505	19.7505	19.7505	19.7505	19.7505	19.7505	19.7505	19.7505	(88)
util rest of house	0.8524	0.8050	0.7102	0.5652	0.4053	0.2420	0.1350	0.1524	0.3598	0.6253	0.7965	0.8653	(89)
MIT 2	18.7849	17.7541	18.4577	19.1346	19.5418	19.7108	19.7448	19.7426	19.6384	19.1052	18.1258	17.6800	(90)
Living area fraction									fLA = Living area / (4) =			0.5899	(91)
MIT	19.4357	18.5937	19.2299	19.8571	20.2507	20.4299	20.4735	20.4694	20.3429	19.8139	18.9185	18.4923	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4357	18.5937	19.2299	19.8571	20.2507	20.4299	20.4735	20.4694	20.3429	19.8139	18.9185	18.4923	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8473	0.7801	0.6952	0.5693	0.4292	0.2804	0.1812	0.2014	0.3974	0.6281	0.7747	0.8447	(94)
Useful gains	414.3451	440.0245	465.9878	451.9807	369.2151	248.4511	152.7380	157.3512	273.0345	355.9520	376.6503	390.1192	(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	802.2436	721.5469	662.0155	557.2139	411.3573	259.0932	155.2095	160.5732	298.9981	465.2599	611.0118	749.4497	(97)
Space heating kWh	288.5965	189.1831	145.8447	75.7679	31.3538	0.0000	0.0000	0.0000	0.0000	81.3251	168.7403	267.3418	(98a)
Space heating requirement - total per year (kWh/year)												1248.1531	
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	288.5965	189.1831	145.8447	75.7679	31.3538	0.0000	0.0000	0.0000	0.0000	81.3251	168.7403	267.3418	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1248.1531	
Space heating per m2										(98c) / (4) =		31.5988	(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 %)													233.8197 (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	288.5965	189.1831	145.8447	75.7679	31.3538	0.0000	0.0000	0.0000	0.0000	81.3251	168.7403	267.3418	(98)
Space heating efficiency (main heating system 1)	233.8197	233.8197	233.8197	233.8197	233.8197	0.0000	0.0000	0.0000	0.0000	233.8197	233.8197	233.8197	(210)
Space heating fuel (main heating system)	123.4269	80.9098	62.3748	32.4044	13.4094	0.0000	0.0000	0.0000	0.0000	34.7811	72.1668	114.3367	(211)
Space heating efficiency (main heating system 2)													

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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 (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	196.2282	173.6575	184.6249	162.4646	157.6240	142.1648	140.3180	145.7574	147.2273	164.0303	174.2729	194.0871 (64)
Efficiency of water heater	191.5179	191.5179	191.5179	191.5179	191.5179	191.5179	191.5179	191.5179	191.5179	191.5179	191.5179	191.5179 (216)
Fuel for water heating, kWh/month	102.4595	90.6743	96.4008	84.8300	82.3025	74.2305	73.2663	76.1064	76.8739	85.6475	90.9956	101.3415 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	12.6053	10.1124	9.1051	6.6708	5.1527	4.2098	4.7005	6.1099	7.9361	10.4126	11.7610	12.9556 (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												533.8100 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												191.5179
Water heating fuel used												1035.1289 (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)												101.7319 (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												1670.6708 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	533.8100	18.3900	98.1677 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1035.1289	18.3900	190.3602 (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	101.7319	18.3900	18.7085 (250)
Additional standing charges			0.0000 (251)
Total energy cost			307.2364 (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	533.8100	0.1560	83.2757 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1035.1289	0.1409	145.8026 (264)
Space and water heating			229.0782 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	101.7319	0.1443	14.6831 (268)
Total CO2, kg/year			243.7613 (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	533.8100	1.5775	842.0843 (275)

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Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1035.1289	1.5208	1574.2517 (278)
Space and water heating			2416.3360 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	101.7319	1.5338	156.0398 (282)
Total Primary energy kWh/year			2572.3757 (286)

SAP 10 EPC IMPROVEMENTS

UNIT 41

Current energy efficiency rating:	C 80
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 (none)	Typical annual savings	Energy efficiency	Environmental impact

	Total Savings	£0	0.00 kg/m²
Potential energy efficiency rating:		C 80	
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	Potential	Saving
Electricity	£307	£307	£0
Space heating	£98	£98	£0
Water heating	£190	£190	£0
Lighting	£19	£19	£0
Total cost of fuels	£307	£307	£0
Total cost of uses	£307	£307	£0
Delivered energy	42 kWh/m²	42 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	65 kWh/m²	65 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

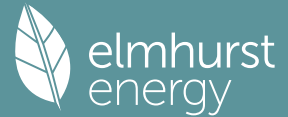
1. Overall dwelling characteristics

	Area (m²)	Storey height (m)	Volume (m³)
Ground floor	39.5000 (1b)	x 2.5000 (2b)	= 98.7500 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	39.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 98.7500 (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)

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Number of passive vents
Number of flueless gas fires

0 * 10 = 0.0000 (7b)
0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =
Pressure test
Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Air changes per hour
0.0000 / (5) = 0.0000 (8)
Yes
Blower Door
4.0000 (17)
0.2000 (18)
2 (19)

Shelter factor
Infiltration rate adjusted to include shelter factor

(20) = 1 - [0.075 x (19)] = 0.8500 (20)
(21) = (18) x (20) = 0.1700 (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	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(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	33.5000	13.0000	20.5000	0.1800	3.6900	18.0000	369.0000	(29a)
corridor new	26.2500	2.1000	24.1500	0.2400	5.7960	60.0000	1449.0000	(29a)
flat roof new	21.9000		21.9000	0.1300	2.8470	9.0000	197.1000	(30)
roof terrace new	17.6000		17.6000	0.1300	2.2880	9.0000	158.4000	(30)
Total net area of external elements Aum(A, m2)			99.2500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.7856			(33)
pw			10.7500	0.0000	0.0000	20.0000	215.0000	(32)
pf			39.5000			30.0000	1185.0000	(32d)
iw			49.0000			9.0000	441.0000	(32c)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
(28)...(30) + (32) + (32a)...(32e) = 4014.5000 (34)
101.6329 (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)	12.6000	0.0700	0.8820	
E14 Flat roof	14.6000	0.0800	1.1680	
E15 Flat roof with parapet	13.4000	0.1500	2.0100	
E16 Corner (normal)	7.5000	0.0900	0.6750	
E17 Corner (inverted - internal area greater than external area)	2.5000	-0.0900	-0.2250	
E18 Party wall between dwellings	5.0000	0.0600	0.3000	
E24 Eaves (insulation at ceiling level - inverted)	3.3000	0.2400	0.7920	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			6.8820	(36)
Point Thermal Bridges			0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	39.6676	(37)

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

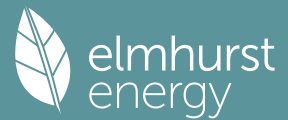
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.2937	16.2937	16.2937	16.2937	16.2937	16.2937	16.2937	16.2937	16.2937	16.2937	16.2937	16.2937	(38)
Heat transfer coeff	55.9614	55.9614	55.9614	55.9614	55.9614	55.9614	55.9614	55.9614	55.9614	55.9614	55.9614	55.9614	(39)
Average = Sum(39)m / 12 =												55.9614	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4167	1.4167	1.4167	1.4167	1.4167	1.4167	1.4167	1.4167	1.4167	1.4167	1.4167	1.4167	(40)
HLP (average)												1.4167	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.3931 (42)
Hot water usage for mixer showers	47.5773	46.8623	45.8204	43.8269	42.3558	40.7152	39.7827	40.8167	41.9502	43.7117	45.7480	47.3950	(42a)
Hot water usage for baths	20.5830	20.2773	19.8469	19.0532	18.4588	17.7998	17.4439	17.8713	18.3367	19.0419	19.8520	20.5134	(42b)
Hot water usage for other uses	28.8968	27.8461	26.7953	25.7445	24.6937	23.6429	23.6429	24.6937	25.7445	26.7953	27.8461	28.8968	(42c)
Average daily hot water use (litres/day)												89.2182	(43)
Daily hot water use	97.0572	94.9857	92.4625	88.6246	85.5083	82.1579	80.8695	83.3817	86.0314	89.5488	93.4460	96.8053	(44)

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Energy conte	153.7148	135.2583	142.1115	121.3226	115.1106	101.0228	97.8046	103.2440	106.0853	121.5169	133.1309	151.5737 (45)
Energy content (annual)										Total = Sum(45)m =		1481.8960
Distribution loss (46)m = 0.15 x (45)m												
	23.0572	20.2888	21.3167	18.1984	17.2666	15.1534	14.6707	15.4866	15.9128	18.2275	19.9696	22.7361 (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												
	196.2282	173.6575	184.6249	162.4646	157.6240	142.1648	140.3180	145.7574	147.2273	164.0303	174.2729	194.0871 (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												
	196.2282	173.6575	184.6249	162.4646	157.6240	142.1648	140.3180	145.7574	147.2273	164.0303	174.2729	194.0871 (64)
								Total per year (kWh/year) = Sum(64)m =				1982.4570 (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												
	85.1209	75.6928	81.2628	73.2534	72.2850	66.5037	66.5308	68.3393	68.1870	74.4151	77.1796	84.4090 (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	83.5866	83.5866	83.5866	83.5866	83.5866	83.5866	83.5866	83.5866	83.5866	83.5866	83.5866	83.5866 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	14.4012	12.7910	10.4024	7.8753	5.8868	4.9699	5.3702	6.9804	9.3690	11.8961	13.8845	14.8015 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	179.5194	181.3822	176.6879	166.6943	154.0791	142.2226	134.3017	132.4389	137.1332	147.1268	159.7420	171.5985 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	44.7518	44.7518	44.7518	44.7518	44.7518	44.7518	44.7518	44.7518	44.7518	44.7518	44.7518	44.7518 (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)												
	-55.7244	-55.7244	-55.7244	-55.7244	-55.7244	-55.7244	-55.7244	-55.7244	-55.7244	-55.7244	-55.7244	-55.7244 (71)
Water heating gains (Table 5)												
	114.4098	112.6380	109.2242	101.7408	97.1573	92.3662	89.4231	91.8540	94.7041	100.0203	107.1939	113.4529 (72)
Total internal gains												
	380.9444	379.4253	368.9284	348.9243	329.7372	312.1727	301.7089	303.8872	313.8203	331.6572	353.4345	372.4669 (73)

6. Solar gains

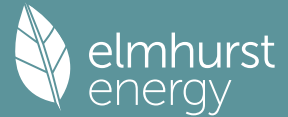
[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East	6.5000	19.6403	0.6300	0.8000	0.7700	44.5887 (76)
East	6.5000	19.6403	0.6300	0.8000	0.7700	44.5887 (76)

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	470.1217	553.8750	656.2223	767.9253	843.2387	837.8329	802.1588	733.7662	647.9550	538.6566	464.6281	445.8020 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n1,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	19.9269	19.9269	19.9269	19.9269	19.9269	19.9269	19.9269	19.9269	19.9269	19.9269	19.9269	19.9269
alpha	2.3285	2.3285	2.3285	2.3285	2.3285	2.3285	2.3285	2.3285	2.3285	2.3285	2.3285	2.3285
util living area	0.8883	0.8453	0.7697	0.6545	0.5211	0.3915	0.2931	0.3303	0.5081	0.7261	0.8521	0.8990 (86)
Living	18.5788	18.9729	19.5653	20.1824	20.6205	20.8589	20.9479	20.9296	20.7335	20.1061	19.2110	18.4738
Non living	17.0202	17.5021	18.2165	18.9354	19.4160	19.6530	19.7261	19.7151	19.5489	18.8797	17.8106	16.8911
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	19.7614	18.9729	19.5653	20.1824	20.6205	20.8589	20.9479	20.9296	20.7335	20.1061	19.2110	18.8272 (87)
Th 2	19.7505	19.7505	19.7505	19.7505	19.7505	19.7505	19.7505	19.7505	19.7505	19.7505	19.7505	19.7505 (88)
util rest of house	0.8728	0.8250	0.7410	0.6141	0.4683	0.3247	0.2147	0.2475	0.4362	0.6817	0.8290	0.8848 (89)
MIT 2	18.6620	17.5021	18.2165	18.9354	19.4160	19.6530	19.7261	19.7151	19.5489	18.8797	17.8106	17.4064 (90)
Living area fraction	fLA = Living area / (4) =											0.5899 (91)
MIT	19.3105	18.3697	19.0121	19.6710	20.1265	20.3643	20.4468	20.4315	20.2477	19.6031	18.6367	18.2445 (92)
Temperature adjustment												0.0000

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adjusted MIT 19.3105 18.3697 19.0121 19.6710 20.1265 20.3643 20.4468 20.4315 20.2477 19.6031 18.6367 18.2445 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8667	0.7983	0.7219	0.6113	0.4848	0.3582	0.2591	0.2935	0.4660	0.6759	0.8042	0.8638	(94)
Useful gains	407.4575	442.1378	473.7295	469.4628	408.7835	300.1511	207.8145	215.3797	301.9675	364.0533	373.6346	385.0775	(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	840.0098	753.7816	700.1959	602.7591	471.5597	322.5802	215.2717	225.6080	344.0315	503.8267	645.6089	785.9482	(97)
Space heating kWh	321.8190	209.4246	168.4910	95.9733	46.7055	0.0000	0.0000	0.0000	0.0000	103.9914	195.8215	298.2478	(98a)
Space heating requirement - total per year (kWh/year)												1440.4741	
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	321.8190	209.4246	168.4910	95.9733	46.7055	0.0000	0.0000	0.0000	0.0000	103.9914	195.8215	298.2478	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1440.4741	
Space heating per m2										(98c) / (4) =		36.4677	(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 %)													233.8197 (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	321.8190	209.4246	168.4910	95.9733	46.7055	0.0000	0.0000	0.0000	0.0000	103.9914	195.8215	298.2478	(98)
Space heating efficiency (main heating system 1)	233.8197	233.8197	233.8197	233.8197	233.8197	0.0000	0.0000	0.0000	0.0000	233.8197	233.8197	233.8197	(210)
Space heating fuel (main heating system)	137.6355	89.5667	72.0602	41.0459	19.9750	0.0000	0.0000	0.0000	0.0000	44.4750	83.7489	127.5546	(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	196.2282	173.6575	184.6249	162.4646	157.6240	142.1648	140.3180	145.7574	147.2273	164.0303	174.2729	194.0871	(64)
Efficiency of water heater	191.5179	191.5179	191.5179	191.5179	191.5179	191.5179	191.5179	191.5179	191.5179	191.5179	191.5179	191.5179	(216)
Fuel for water heating, kWh/month	102.4595	90.6743	96.4008	84.8300	82.3025	74.2305	73.2663	76.1064	76.8739	85.6475	90.9956	101.3415	(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	12.6053	10.1124	9.1051	6.6708	5.1527	4.2098	4.7005	6.1099	7.9361	10.4126	11.7610	12.9556	(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												616.0619	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												191.5179	
Water heating fuel used												1035.1289	(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)												101.7319	(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													

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Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	1752.9227 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	616.0619	16.4900	101.5886 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1035.1289	16.4900	170.6928 (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	101.7319	16.4900	16.7756 (250)
Additional standing charges			0.0000 (251)
Total energy cost			289.0569 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] = 1.2315 (257)$
SAP value	80.0376
SAP rating (Section 12)	80 (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	616.0619	0.1555	95.7828 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1035.1289	0.1409	145.8026 (264)
Space and water heating			241.5854 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	101.7319	0.1443	14.6831 (268)
Total CO2, kg/year			256.2684 (272)
CO2 emissions per m2			6.4900 (273)
EI value			95.9361
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	39.5000 (1b)	x 2.5000 (2b)	= 98.7500 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	39.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 98.7500 (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)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)
Pressure test	Yes

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Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Blower Door
4.0000 (17)
0.2000 (18)
2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1700 (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	0.1827	0.1742	0.1742	0.1615	0.1658	0.1445	0.1445	0.1403	0.1445	0.1615	0.1573	0.1700	(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	33.5000	13.0000	20.5000	0.1800	3.6900	18.0000	369.0000	(29a)
corridor new	26.2500	2.1000	24.1500	0.2400	5.7960	60.0000	1449.0000	(29a)
flat roof new	21.9000		21.9000	0.1300	2.8470	9.0000	197.1000	(30)
roof terrace new	17.6000		17.6000	0.1300	2.2880	9.0000	158.4000	(30)
Total net area of external elements Aum(A, m2)			99.2500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.7856			(33)
pw			10.7500	0.0000	0.0000	20.0000	215.0000	(32)
pf			39.5000			30.0000	1185.0000	(32d)
iw			49.0000			9.0000	441.0000	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 4014.5000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 101.6329 (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)	12.6000	0.0700	0.8820	
E14 Flat roof	14.6000	0.0800	1.1680	
E15 Flat roof with parapet	13.4000	0.1500	2.0100	
E16 Corner (normal)	7.5000	0.0900	0.6750	
E17 Corner (inverted - internal area greater than external area)	2.5000	-0.0900	-0.2250	
E18 Party wall between dwellings	5.0000	0.0600	0.3000	
E24 Eaves (insulation at ceiling level - inverted)	3.3000	0.2400	0.7920	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			6.8820	(36)
Point Thermal bridges			0.0000	(36a) =
Total fabric heat loss		(33) + (36) + (36a) =	39.6676	(37)

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

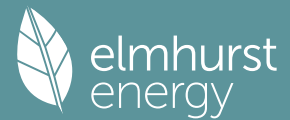
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.2937	16.2937	16.2937	16.2937	16.2937	16.2937	16.2937	16.2937	16.2937	16.2937	16.2937	16.2937	(38)
Heat transfer coeff	55.9614	55.9614	55.9614	55.9614	55.9614	55.9614	55.9614	55.9614	55.9614	55.9614	55.9614	55.9614	(39)
Average = Sum(39)m / 12 =												55.9614	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4167	1.4167	1.4167	1.4167	1.4167	1.4167	1.4167	1.4167	1.4167	1.4167	1.4167	1.4167	(40)
HLP (average)												1.4167	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.3931 (42)
Hot water usage for mixer showers													
47.5773	46.8623	45.8204	43.8269	42.3558	40.7152	39.7827	40.8167	41.9502	43.7117	45.7480	47.3950	47.3950	(42a)
Hot water usage for baths													
20.5830	20.2773	19.8469	19.0532	18.4588	17.7998	17.4439	17.8713	18.3367	19.0419	19.8520	20.5134	20.5134	(42b)
Hot water usage for other uses													
28.8968	27.8461	26.7953	25.7445	24.6937	23.6429	23.6429	24.6937	25.7445	26.7953	27.8461	28.8968	28.8968	(42c)
Average daily hot water use (litres/day)												89.2182	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.0572	94.9857	92.4625	88.6246	85.5083	82.1579	80.8695	83.3817	86.0314	89.5488	93.4460	96.8053	(44)
Energy conte	153.7148	135.2583	142.1115	121.3226	115.1106	101.0228	97.8046	103.2440	106.0853	121.5169	133.1309	151.5737	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m													
23.0572	20.2888	21.3167	18.1984	17.2666	15.1534	14.6707	15.4866	15.9128	18.2275	19.9696	22.7361	22.7361	(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	196.2282	173.6575	184.6249	162.4646	157.6240	142.1648	140.3180	145.7574	147.2273	164.0303	174.2729	194.0871 (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	196.2282	173.6575	184.6249	162.4646	157.6240	142.1648	140.3180	145.7574	147.2273	164.0303	174.2729	194.0871 (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	85.1209	75.6928	81.2628	73.2534	72.2850	66.5037	66.5308	68.3393	68.1870	74.4151	77.1796	84.4090 (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	83.5866	83.5866	83.5866	83.5866	83.5866	83.5866	83.5866	83.5866	83.5866	83.5866	83.5866	83.5866 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	14.4012	12.7910	10.4024	7.8753	5.8868	4.9699	5.3702	6.9804	9.3690	11.8961	13.8845	14.8015 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	179.5194	181.3822	176.6879	166.6943	154.0791	142.2226	134.3017	132.4389	137.1332	147.1268	159.7420	171.5985 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	44.7518	44.7518	44.7518	44.7518	44.7518	44.7518	44.7518	44.7518	44.7518	44.7518	44.7518	44.7518 (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)	-55.7244	-55.7244	-55.7244	-55.7244	-55.7244	-55.7244	-55.7244	-55.7244	-55.7244	-55.7244	-55.7244	-55.7244 (71)
Water heating gains (Table 5)	114.4098	112.6380	109.2242	101.7408	97.1573	92.3662	89.4231	91.8540	94.7041	100.0203	107.1939	113.4529 (72)
Total internal gains	380.9444	379.4253	368.9284	348.9243	329.7372	312.1727	301.7089	303.8872	313.8203	331.6572	353.4345	372.4669 (73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
East			6.5000		23.8018		0.6300		0.8000		0.7700		54.0364 (76)	
East			6.5000		23.8018		0.6300		0.8000		0.7700		54.0364 (76)	
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			489.0172	564.0852	670.2877	793.9729	860.1715	886.1704	842.9340	781.1967	687.0617	566.7079	486.1761	461.8526 (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	19.9269	19.9269	19.9269	19.9269	19.9269	19.9269	19.9269	19.9269	19.9269	19.9269	19.9269	19.9269
alpha	2.3285	2.3285	2.3285	2.3285	2.3285	2.3285	2.3285	2.3285	2.3285	2.3285	2.3285	2.3285
util living area	0.8706	0.8280	0.7426	0.6101	0.4633	0.3115	0.2141	0.2366	0.4367	0.6769	0.8243	0.8823 (86)
Living	18.8265	19.1773	19.7667	20.3595	20.7436	20.9298	20.9802	20.9746	20.8328	20.3067	19.4696	18.7410
Non living	17.3284	17.7541	18.4577	19.1346	19.5418	19.7108	19.7448	19.7426	19.6384	19.1052	18.1258	17.2249
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	19.8881	19.1773	19.7667	20.3595	20.7436	20.9298	20.9802	20.9746	20.8328	20.3067	19.4696	19.0570 (87)
Th 2	19.7505	19.7505	19.7505	19.7505	19.7505	19.7505	19.7505	19.7505	19.7505	19.7505	19.7505	19.7505 (88)
util rest of house	0.8524	0.8050	0.7102	0.5652	0.4053	0.2420	0.1350	0.1524	0.3598	0.6253	0.7965	0.8653 (89)
MIT 2	18.7849	17.7541	18.4577	19.1346	19.5418	19.7108	19.7448	19.7426	19.6384	19.1052	18.1258	17.6800 (90)
Living area fraction	19.4357	18.5937	19.2299	19.8571	20.2507	20.4299	20.4735	20.4694	20.3429	19.8139	18.9185	0.5899 (91)
MIT	19.4357	18.5937	19.2299	19.8571	20.2507	20.4299	20.4735	20.4694	20.3429	19.8139	18.9185	18.4923 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4357	18.5937	19.2299	19.8571	20.2507	20.4299	20.4735	20.4694	20.3429	19.8139	18.9185	18.4923 (93)

8. Space heating requirement

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8473	0.7801	0.6952	0.5693	0.4292	0.2804	0.1812	0.2014	0.3974	0.6281	0.7747	0.8447	(94)
Useful gains	414.3451	440.0245	465.9878	451.9807	369.2151	248.4511	152.7380	157.3512	273.0345	355.9520	376.6503	390.1192	(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	802.2436	721.5469	662.0155	557.2139	411.3573	259.0932	155.2095	160.5732	298.9981	465.2599	611.0118	749.4497	(97)
Space heating kWh	288.5965	189.1831	145.8447	75.7679	31.3538	0.0000	0.0000	0.0000	0.0000	81.3251	168.7403	267.3418	(98a)
Space heating requirement - total per year (kWh/year)												1248.1531	
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	288.5965	189.1831	145.8447	75.7679	31.3538	0.0000	0.0000	0.0000	0.0000	81.3251	168.7403	267.3418	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1248.1531	
Space heating per m2										(98c) / (4) =		31.5988	(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 %)		233.8197	(206)
Efficiency of main space heating system 2 (in %)		0.0000	(207)
Efficiency of secondary/supplementary heating system, %		0.0000	(208)

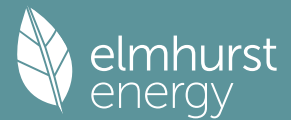
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	288.5965	189.1831	145.8447	75.7679	31.3538	0.0000	0.0000	0.0000	0.0000	81.3251	168.7403	267.3418	(98)
Space heating efficiency (main heating system 1)	233.8197	233.8197	233.8197	233.8197	233.8197	0.0000	0.0000	0.0000	0.0000	233.8197	233.8197	233.8197	(210)
Space heating fuel (main heating system)	123.4269	80.9098	62.3748	32.4044	13.4094	0.0000	0.0000	0.0000	0.0000	34.7811	72.1668	114.3367	(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	196.2282	173.6575	184.6249	162.4646	157.6240	142.1648	140.3180	145.7574	147.2273	164.0303	174.2729	194.0871	(64)
Efficiency of water heater												191.5179	(216)
(217)m	191.5179	191.5179	191.5179	191.5179	191.5179	191.5179	191.5179	191.5179	191.5179	191.5179	191.5179	191.5179	(217)
Fuel for water heating, kWh/month	102.4595	90.6743	96.4008	84.8300	82.3025	74.2305	73.2663	76.1064	76.8739	85.6475	90.9956	101.3415	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	12.6053	10.1124	9.1051	6.6708	5.1527	4.2098	4.7005	6.1099	7.9361	10.4126	11.7610	12.9556	(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												533.8100	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												191.5179	
Water heating fuel used												1035.1289	(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)												101.7319	(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												1670.6708	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	533.8100	18.3900	98.1677 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1035.1289	18.3900	190.3602 (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	101.7319	18.3900	18.7085 (250)
Additional standing charges			0.0000 (251)
Total energy cost			307.2364 (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	533.8100	0.1560	83.2757 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1035.1289	0.1409	145.8026 (264)
Space and water heating			229.0782 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	101.7319	0.1443	14.6831 (268)
Total CO2, kg/year			243.7613 (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	533.8100	1.5775	842.0843 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1035.1289	1.5208	1574.2517 (278)
Space and water heating			2416.3360 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	101.7319	1.5338	156.0398 (282)
Total Primary energy kWh/year			2572.3757 (286)