

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property and Energy
Services Ltd.

Property Reference	3260-3	Issued on Date	08/05/2019
Assessment Reference	3260-3	Prop Type Ref	
Property	3, Aldworth Rise, Reading, RG1 7NA		

SAP Rating	83 B	DER	19.85	TER	18.38
Environmental	85 B	% DER<TER	-8.01		
CO ₂ Emissions (t/year)	1.33	DFEE	50.72	TFEE	55.55
General Requirements Compliance	Fail	% DFEE<TFEE	8.69		

Assessor Details	Mr. Ian Lloyd, Property and Energy Services Limited, Tel: 01367240212, ianl@propertyandenergy.co.uk	Assessor ID	H044-0001
Client	Keen Partnership, Keen		

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.2500 (1b)	x 2.4200 (2b)	= 109.5050 (1b) - (3b)
First floor	36.0900 (1c)	x 2.5500 (2c)	= 92.0295 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 201.5345 (5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour					
Number of chimneys		0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues		0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans								4 * 10 =	40.0000 (7a)				
Number of passive vents								0 * 10 =	0.0000 (7b)				
Number of flueless gas fires								0 * 40 =	0.0000 (7c)				
Air changes per hour													
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =							40.0000 / (5) =	0.1985 (8)				
Pressure test								Yes					
Measured/design AP50								5.0000					
Infiltration rate								0.4485 (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) =	0.3812 (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	0.4098	0.3907	0.3907	0.3621	0.3717	0.3240	0.3240	0.3145	0.3240	0.3621	0.3526	0.3812	(22b)
Effective ac	0.5840	0.5763	0.5763	0.5656	0.5691	0.5525	0.5525	0.5495	0.5525	0.5656	0.5622	0.5727	(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					
Door -1			2.3000	1.0000	2.3000		(26)					
W-1.4 (Uw = 1.40)			17.4300	1.3258	23.1080		(27)					
Velux (Uw = 1.50)			0.5400	1.4151	0.7642		(27a)					
Ground floor			45.2500	0.1200	5.4300		(28a)					
Cavity wall	89.5500	19.7300	69.8200	0.2200	15.3604		(29a)					
Ceiling	10.0600		10.0600	0.1600	1.6096		(30)					
Skelling	34.8700	0.5400	34.3300	0.1600	5.4928		(30)					
Total net area of external elements Aum(A, m2)			179.7300				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		54.0649		(33)					
Party Wall			47.5400	0.0000	0.0000		(32)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.9788 (36)					
Total fabric heat loss							(33) + (36) = 64.0437 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 38.8375	Feb 38.3301	Mar 38.3301	Apr 37.6143	May 37.8469	Jun 36.7445	Jul 36.7445	Aug 36.5422	Sep 36.7445	Oct 37.6143	Nov 37.3878	Dec 38.0855 (38)

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Heat transfer coeff	102.8811	102.3738	102.3738	101.6580	101.8905	100.7882	100.7882	100.5858	100.7882	101.6580	101.4315	102.1291 (39)
Average = Sum(39)m / 12 =												101.6122 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2648	1.2586	1.2586	1.2498	1.2526	1.2391	1.2391	1.2366	1.2391	1.2498	1.2470	1.2556 (40)
Days in month												1.2492 (40)
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4878 (42)
Average daily hot water use (litres/day)												93.2851 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.6136	98.8822	95.1508	91.4194	87.6880	83.9566	83.9566	87.6880	91.4194	95.1508	98.8822	102.6136 (44)
Energy conte	152.1731	133.0915	137.3385	119.7351	114.8886	99.1402	91.8679	105.4198	106.6788	124.3239	135.7093	147.3715 (45)
Energy content (annual)										Total = Sum(45)m =		1467.7382 (45)
Distribution loss (46)m = 0.15 x (45)m	22.8260	19.9637	20.6008	17.9603	17.2333	14.8710	13.7802	15.8130	16.0018	18.6486	20.3564	22.1057 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7560 (55)
Total storage loss	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (56)
If cylinder contains dedicated solar storage	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (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)
Total heat required for water heating calculated for each month	198.8715	175.2707	184.0369	164.9271	161.5870	144.3322	138.5663	152.1182	151.8708	171.0223	180.9013	194.0699 (62)
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 (63)
Output from w/h	198.8715	175.2707	184.0369	164.9271	161.5870	144.3322	138.5663	152.1182	151.8708	171.0223	180.9013	194.0699 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	87.9563	77.9963	83.0238	75.9655	75.5592	69.1177	67.9048	72.4108	71.6243	78.6964	81.2769	86.3597 (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	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.5305	43.9925	35.7771	27.0856	20.2468	17.0932	18.4698	24.0077	32.2231	40.9147	47.7535	50.9071 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	331.6691	335.1108	326.4378	307.9742	284.6671	262.7618	248.1277	244.6860	253.3589	271.8226	295.1296	317.0350 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118 (71)
Water heating gains (Table 5)	118.2208	116.0659	111.5911	105.5076	101.5581	95.9968	91.2699	97.3263	99.4782	105.7748	112.8846	116.0749 (72)
Total internal gains	604.5908	600.3397	578.9765	545.7379	511.6424	481.0222	463.0378	471.1905	490.2307	523.6825	560.9382	589.1874 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					5.1300	12.7650	0.6300	0.7000	0.7700		20.0130 (74)	
East					3.9100	23.8018	0.6300	0.7000	0.7700		28.4418 (76)	
West					8.3900	23.8018	0.6300	0.7000	0.7700		61.0299 (80)	
North					0.5400	21.1256	0.6300	0.7000	1.0000		4.5278 (82)	
Solar gains	114.0125	194.4463	321.7114	489.9048	601.2950	659.8612	618.3851	532.0247	402.8002	248.2476	139.8162	94.5260 (83)
Total gains	718.6033	794.7860	900.6879	1035.6427	1112.9374	1140.8834	1081.4229	1003.2152	893.0309	771.9300	700.7544	683.7134 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	54.9042	55.1764	55.1764	55.5649	55.4380	56.0444	56.0444	56.1571	56.0444	55.5649	55.6889	55.3085
util living area	4.6603	4.6784	4.6784	4.7043	4.6959	4.7363	4.7363	4.7438	4.7363	4.7043	4.7126	4.6872
	0.9878	0.9789	0.9497	0.8581	0.6840	0.4531	0.3068	0.3395	0.6385	0.9030	0.9755	0.9899 (86)
MIT	19.9527	20.1075	20.3922	20.7282	20.9274	20.9918	20.9990	20.9984	20.9608	20.6953	20.2795	19.9272 (87)
Th 2	19.8685	19.8734	19.8734	19.8804	19.8781	19.8888	19.8888	19.8908	19.8888	19.8804	19.8826	19.8758 (88)

Regs Region: England

Elmhurst Energy Systems
SAP2012 Calculator (Design
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util rest of house	0.9837	0.9720	0.9333	0.8161	0.6083	0.3594	0.2039	0.2295	0.5365	0.8627	0.9660	0.9865 (89)
MIT 2	18.9496	19.1053	19.3793	19.6883	19.8396	19.8864	19.8887	19.8906	19.8733	19.6695	19.2831	18.9304 (90)
Living area fraction									fLA = Living area / (4) =			0.1962 (91)
MIT	19.1464	19.3019	19.5781	19.8923	20.0531	20.1033	20.1066	20.1080	20.0867	19.8708	19.4786	19.1259 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.9964	19.1519	19.4281	19.7423	19.9031	19.9533	19.9566	19.9580	19.9367	19.7208	19.3286	18.9759 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9794	0.9662	0.9251	0.8102	0.6101	0.3649	0.2102	0.2362	0.5411	0.8558	0.9597	0.9827	(94)
Useful gains	703.8173	767.9206	833.2669	839.0621	679.0470	416.3033	227.3264	236.9880	483.2590	660.5804	672.4949	671.9085	(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	1429.6769	1377.1243	1231.3581	1000.5518	713.5453	418.6063	227.4379	237.1816	497.5614	835.7080	1149.0793	1417.1385	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	540.0396	409.3849	296.1799	116.2726	25.6667	0.0000	0.0000	0.0000	0.0000	130.2949	343.1408	554.4511	(98)
Space heating												2415.4304	(98)
RHI space heating demand												2415	(98)

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.2500 (1b)	x 2.4200 (2b)	= 109.5050 (1b) - (3b)
First floor	36.0900 (1c)	x 2.5500 (2c)	= 92.0295 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.3400		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 201.5345 (5)
Dwelling volume			

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1985 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4485 (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) =	0.3812 (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												
Effective ac	0.4860	0.4765	0.4670	0.4193	0.4098	0.3621	0.3621	0.3526	0.3812	0.4098	0.4289	0.4479 (22b)
	0.6181	0.6135	0.6090	0.5879	0.5840	0.5656	0.5656	0.5622	0.5727	0.5840	0.5920	0.6003 (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
Door -1			2.3000	1.0000	2.3000		(26)
W-1.4 (Uw = 1.40)			17.4300	1.3258	23.1080		(27)
Velux (Uw = 1.50)			0.5400	1.4151	0.7642		(27a)
Ground floor			45.2500	0.1200	5.4300		(28a)
Cavity wall	89.5500	19.7300	69.8200	0.2200	15.3604		(29a)
Ceiling	10.0600		10.0600	0.1600	1.6096		(30)
Skelling	34.8700	0.5400	34.3300	0.1600	5.4928		(30)
Total net area of external elements Aum(A, m ²)			179.7300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.0649		(33)
Party Wall			47.5400	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.9788 (36)
Total fabric heat loss						(33) + (36) =	64.0437 (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	41.1087	40.8036	40.5046	39.1002	38.8375	37.6143	37.6143	37.3878	38.0855	38.8375	39.3690	39.9248 (38)
Heat transfer coeff												
Average = Sum(39)m / 12 =	105.1523	104.8473	104.5483	103.1439	102.8811	101.6580	101.6580	101.4315	102.1291	102.8811	103.4127	103.9684 (39)
												103.1426 (39)
HLP	1.2928	1.2890	1.2853	1.2681	1.2648	1.2498	1.2498	1.2470	1.2556	1.2648	1.2714	1.2782 (40)
HLP (average)												1.2680 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4878 (42)
Average daily hot water use (litres/day)												93.2851 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	102.6136	98.8822	95.1508	91.4194	87.6880	83.9566	83.9566	87.6880	91.4194	95.1508	98.8822	102.6136 (44)
Energy conte	152.1731	133.0915	137.3385	119.7351	114.8886	99.1402	91.8679	105.4198	106.6788	124.3239	135.7093	147.3715 (45)
Energy content (annual)												Total = Sum(45)m = 1467.7382 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.8260	19.9637	20.6008	17.9603	17.2333	14.8710	13.7802	15.8130	16.0018	18.6486	20.3564	22.1057 (46)
Water storage loss:												

Regs Region: England

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System) version 4.10r08

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Store volume													150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.4000 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.7560 (55)
Total storage loss													
	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(56)
If cylinder contains dedicated solar storage													
	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(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)
Total heat required for water heating calculated for each month													
	198.8715	175.2707	184.0369	164.9271	161.5870	144.3322	138.5663	152.1182	151.8708	171.0223	180.9013	194.0699	(62)
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	(63)
Solar input (sum of months) = Sum(63)m =													(63)
Output from w/h													
	198.8715	175.2707	184.0369	164.9271	161.5870	144.3322	138.5663	152.1182	151.8708	171.0223	180.9013	194.0699	(64)
Heat gains from water heating, kWh/month													
	87.9563	77.9963	83.0238	75.9655	75.5592	69.1177	67.9048	72.4108	71.6243	78.6964	81.2769	86.3597	(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	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	49.5305	43.9925	35.7771	27.0856	20.2468	17.0932	18.4698	24.0077	32.2231	40.9147	47.7535	50.9071	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	331.6691	335.1108	326.4378	307.9742	284.6671	262.7618	248.1277	244.6860	253.3589	271.8226	295.1296	317.0350	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	(71)
Water heating gains (Table 5)													
	118.2208	116.0659	111.5911	105.5076	101.5581	95.9968	91.2699	97.3263	99.4782	105.7748	112.8846	116.0749	(72)
Total internal gains													
	604.5908	600.3397	578.9765	545.7379	511.6424	481.0222	463.0378	471.1905	490.2307	523.6825	560.9382	589.1874	(73)

6. Solar gains

[Jan]				Area	Solar flux	g			FF	Access		Gains
				m2	Table 6a	Specific data				factor		W
					W/m2	or Table 6b				or Table 6c		
										Table 6d		
North				5.1300	10.6334		0.6300		0.7000		0.7700	16.6710 (74)
East				3.9100	19.6403		0.6300		0.7000		0.7700	23.4691 (76)
West				8.3900	19.6403		0.6300		0.7000		0.7700	50.3595 (80)
North				0.5400	17.5997		0.6300		0.7000		1.0000	3.7721 (82)
Solar gains	94.2716	183.6067	305.5334	458.4207	578.2535	600.4055	568.0555	476.0595	358.8221	218.2308	117.2752	77.7660 (83)
Total gains	698.8624	783.9463	884.5100	1004.1586	1089.8959	1081.4277	1031.0933	947.2500	849.0528	741.9133	678.2133	666.9534 (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	53.7184	53.8747	54.0287	54.7644	54.9042	55.5649	55.5649	55.6889	55.3085	54.9042	54.6220	54.3301	
alpha	4.5812	4.5916	4.6019	4.6510	4.6603	4.7043	4.7043	4.7126	4.6872	4.6603	4.6415	4.6220	
util living area	0.9911	0.9840	0.9633	0.8995	0.7659	0.5784	0.4289	0.4835	0.7398	0.9363	0.9836	0.9927 (86)	
MIT	19.8033	19.9677	20.2519	20.6103	20.8619	20.9715	20.9943	20.9903	20.9133	20.5756	20.1298	19.7763 (87)	
Th 2	19.8465	19.8495	19.8523	19.8659	19.8685	19.8804	19.8804	19.8826	19.8758	19.8685	19.8633	19.8580 (88)	
util rest of house	0.9882	0.9788	0.9514	0.8682	0.7029	0.4869	0.3223	0.3707	0.6507	0.9091	0.9774	0.9904 (89)	
MIT 2	18.7841	18.9485	19.2275	19.5729	19.7844	19.8688	19.8791	19.8802	19.8335	19.5529	19.1211	18.7665 (90)	
Living area fraction									fLA = Living area / (4) =			0.1962 (91)	
MIT	18.9840	19.1485	19.4285	19.7765	19.9958	20.0852	20.0979	20.0980	20.0453	19.7536	19.3190	18.9646 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	18.8340	18.9985	19.2785	19.6265	19.8458	19.9352	19.9479	19.9480	19.8953	19.6036	19.1690	18.8146 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9847	0.9737	0.9438	0.8604	0.7015	0.4916	0.3289	0.3774	0.6525	0.9011	0.9722	0.9874 (94)
Useful gains	688.2026	763.3384	834.7658	864.0274	764.5219	531.6328	339.1011	357.5353	553.9651	668.5308	659.3503	658.5479 (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	1528.2886	1478.1868	1335.9733	1106.3710	838.0520	542.3620	340.3432	359.8773	591.8725	926.2956	1248.0917	1519.4597 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	625.0240	480.3781	372.8984	174.4874	54.7064	0.0000	0.0000	0.0000	0.0000	191.7770	423.8938	640.5184 (98)
Space heating												2963.6835 (98)
Space heating per m2										(98) / (4) =		36.4357 (99)

Regs Region: England

Elmhurst Energy Systems
SAP2012 Calculator (Design
System) version 4.10R08

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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 %)												89.8000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3300.3157 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	625.0240	480.3781	372.8984	174.4874	54.7064	0.0000	0.0000	0.0000	0.0000	191.7770	423.8938	640.5184 (98)
Space heating efficiency (main heating system 1)	89.8000	89.8000	89.8000	89.8000	89.8000	0.0000	0.0000	0.0000	0.0000	89.8000	89.8000	89.8000 (210)
Space heating fuel (main heating system)	696.0178	534.9423	415.2543	194.3067	60.9202	0.0000	0.0000	0.0000	0.0000	213.5601	472.0421	713.2721 (211)
Water heating 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 (215)
Water heating requirement	198.8715	175.2707	184.0369	164.9271	161.5870	144.3322	138.5663	152.1182	151.8708	171.0223	180.9013	194.0699 (64)
Efficiency of water heater (217)m	86.9606	86.6660	85.9577	84.2614	81.5579	79.1000	79.1000	79.1000	79.1000	84.4170	86.3079	79.1000 (216)
Fuel for water heating, kWh/month	228.6915	202.2369	214.1018	195.7326	198.1255	182.4680	175.1787	192.3112	191.9985	202.5922	209.6000	222.9114 (219)
Water heating fuel used												2415.9483 (219)
Annual totals kWh/year												2415.9483 (219)
Space heating fuel - main system												3300.3157 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												75.0000 (231)
Electricity for lighting (calculated in Appendix L)												349.8893 (232)
Total delivered energy for all uses												6141.1533 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3300.3157	3.4800	114.8510 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2415.9483	3.4800	84.0750 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	349.8893	13.1900	46.1504 (250)
Additional standing charges			120.0000 (251)
Total energy cost			374.9689 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200 (256)	
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] = 1.2465 (257)	
SAP value	82.6109	
SAP rating (Section 12)	83 (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	3300.3157	0.2160	712.8682 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2415.9483	0.2160	521.8448 (264)
Space and water heating			1234.7130 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	349.8893	0.5190	181.5926 (268)
Total kg/year			1455.2306 (272)
CO2 emissions per m2			17.8900 (273)
EI value			84.5654
EI rating			85 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.8980 = 3.875$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.8980 = 0.2405$, stars = 4
Water heating energy efficiency	$3.48 / 0.8330 = 4.178$, stars = 4
Water heating environmental impact	$0.216 / 0.8330 = 0.2593$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.2500 (1b)	x 2.4200 (2b)	= 109.5050 (1b) - (3b)
First floor	36.0900 (1c)	x 2.5500 (2c)	= 92.0295 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 201.5345 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1985 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4485 (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) =				0.3812 (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	0.4098	0.3907	0.3907	0.3621	0.3717	0.3240	0.3240	0.3145	0.3240	0.3621	0.3526	0.3812 (22b)
Effective ac	0.5840	0.5763	0.5763	0.5656	0.5691	0.5525	0.5525	0.5495	0.5525	0.5656	0.5622	0.5727 (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
Door -1			2.3000	1.0000	2.3000		(26)
W-1.4 (Uw = 1.40)			17.4300	1.3258	23.1080		(27)
Velux (Uw = 1.50)			0.5400	1.4151	0.7642		(27a)
Ground floor			45.2500	0.1200	5.4300		(28a)
Cavity wall	89.5500	19.7300	69.8200	0.2200	15.3604		(29a)
Ceiling	10.0600		10.0600	0.1600	1.6096		(30)
Skelling	34.8700	0.5400	34.3300	0.1600	5.4928		(30)
Total net area of external elements Aum(A, m ²)			179.7300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.0649		(33)
Party Wall			47.5400	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.9788 (36)
Total fabric heat loss						(33) + (36) =	64.0437 (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	38.8375	38.3301	38.3301	37.6143	37.8469	36.7445	36.7445	36.5422	36.7445	37.6143	37.3878	38.0855 (38)
Heat transfer coeff	102.8811	102.3738	102.3738	101.6580	101.8905	100.7882	100.7882	100.5858	100.7882	101.6580	101.4315	102.1291 (39)
Average = Sum(39)m / 12 =												101.6122 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2648	1.2586	1.2586	1.2498	1.2526	1.2391	1.2391	1.2366	1.2391	1.2498	1.2470	1.2556 (40)
HLP (average)												1.2492 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4878 (42)
Average daily hot water use (litres/day)												93.2851 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	102.6136	98.8822	95.1508	91.4194	87.6880	83.9566	83.9566	87.6880	91.4194	95.1508	98.8822	102.6136 (44)
Energy content (annual)	152.1731	133.0915	137.3385	119.7351	114.8886	99.1402	91.8679	105.4198	106.6788	124.3239	135.7093	147.3715 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1467.7382 (45)
Water storage loss:	22.8260	19.9637	20.6008	17.9603	17.2333	14.8710	13.7802	15.8130	16.0018	18.6486	20.3564	22.1057 (46)



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store volume														150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):														1.4000	(48)
Temperature factor from Table 2b														0.5400	(49)
Enter (49) or (54) in (55)														0.7560	(55)
Total storage loss															
	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	22.6800	23.4360	(56)
If cylinder contains dedicated solar storage															
	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	22.6800	23.4360	(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	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month															
	198.8715	175.2707	184.0369	164.9271	161.5870	144.3322	138.5663	152.1182	151.8708	171.0223	180.9013	194.0699	194.0699	(62)	
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	(63)	
								Solar input (sum of months) = Sum(63)m =						0.0000	(63)
Output from w/h															
	198.8715	175.2707	184.0369	164.9271	161.5870	144.3322	138.5663	152.1182	151.8708	171.0223	180.9013	194.0699	194.0699	(64)	
								Total per year (kWh/year) = Sum(64)m =						2017.5742	(64)
Heat gains from water heating, kWh/month															
	87.9563	77.9963	83.0238	75.9655	75.5592	69.1177	67.9048	72.4108	71.6243	78.6964	81.2769	86.3597	86.3597	(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	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.5305	43.9925	35.7771	27.0856	20.2468	17.0932	18.4698	24.0077	32.2231	40.9147	47.7535	50.9071 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	331.6691	335.1108	326.4378	307.9742	284.6671	262.7618	248.1277	244.6860	253.3589	271.8226	295.1296	317.0350 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118 (71)
Water heating gains (Table 5)	118.2208	116.0659	111.5911	105.5076	101.5581	95.9968	91.2699	97.3263	99.4782	105.7748	112.8846	116.0749 (72)
Total internal gains	604.5908	600.3397	578.9765	545.7379	511.6424	481.0222	463.0378	471.1905	490.2307	523.6825	560.9382	589.1874 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				5.1300	12.7650	0.6300	0.7000	0.7700	20.0130 (74)			
East				3.9100	23.8018	0.6300	0.7000	0.7700	28.4418 (76)			
West				8.3900	23.8018	0.6300	0.7000	0.7700	61.0299 (80)			
North				0.5400	21.1256	0.6300	0.7000	1.0000	4.5278 (82)			
Solar gains	114.0125	194.4463	321.7114	489.9048	601.2950	659.8612	618.3851	532.0247	402.8002	248.2476	139.8162	94.5260 (83)
Total gains	718.6033	794.7860	900.6879	1035.6427	1112.9374	1140.8834	1081.4229	1003.2152	893.0309	771.9300	700.7544	683.7134 (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	54.9042	55.1764	55.1764	55.5649	55.4380	56.0444	56.0444	56.1571	56.0444	55.5649	55.6889	55.3085
alpha	4.6603	4.6784	4.6784	4.7043	4.6959	4.7363	4.7363	4.7438	4.7363	4.7043	4.7126	4.6872
util living area	0.9878	0.9789	0.9497	0.8581	0.6840	0.4531	0.3068	0.3395	0.6385	0.9030	0.9755	0.9899 (86)
MIT	19.9527	20.1075	20.3922	20.7282	20.9274	20.9918	20.9990	20.9984	20.9608	20.6953	20.2795	19.9272 (87)
Th 2	19.8685	19.8734	19.8734	19.8804	19.8781	19.8888	19.8888	19.8908	19.8888	19.8804	19.8826	19.8758 (88)
util rest of house	0.9837	0.9720	0.9333	0.8161	0.6083	0.3594	0.2039	0.2295	0.5365	0.8627	0.9660	0.9865 (89)
MIT 2	18.9496	19.1053	19.3793	19.6883	19.8396	19.8864	19.8887	19.8906	19.8733	19.6695	19.2831	18.9304 (90)
Living area fraction									fLA = Living area / (4) =			0.1962 (91)
MIT	19.1464	19.3019	19.5781	19.8923	20.0531	20.1033	20.1066	20.1080	20.0867	19.8708	19.4786	19.1259 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.9964	19.1519	19.4281	19.7423	19.9031	19.9533	19.9566	19.9580	19.9367	19.7208	19.3286	18.9759 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9794	0.9662	0.9251	0.8102	0.6101	0.3649	0.2102	0.2362	0.5411	0.8558	0.9597	0.9827 (94)
Useful gains	703.8173	767.9206	833.2669	839.0621	679.0470	416.3033	227.3264	236.9880	483.2590	660.5804	672.4949	671.9085 (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	1429.6769	1377.1243	1231.3581	1000.5518	713.5453	418.6063	227.4379	237.1816	497.5614	835.7080	1149.0793	1417.1385 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	540.0396	409.3849	296.1799	116.2726	25.6667	0.0000	0.0000	0.0000	0.0000	130.2949	343.1408	554.4511 (98)
Space heating												2415.4304 (98)
Space heating per m2												29.6955 (99)
										(98) / (4) =		

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

8c. Space cooling requirement

Not applicable

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 %)													89.8000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2689.7889 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	540.0396	409.3849	296.1799	116.2726	25.6667	0.0000	0.0000	0.0000	0.0000	130.2949	343.1408	554.4511	(98)
Space heating efficiency (main heating system 1)	89.8000	89.8000	89.8000	89.8000	89.8000	0.0000	0.0000	0.0000	0.0000	89.8000	89.8000	89.8000	(210)
Space heating fuel (main heating system)	601.3804	455.8852	329.8217	129.4795	28.5821	0.0000	0.0000	0.0000	0.0000	145.0945	382.1167	617.4289	(211)
Water heating 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	(215)
Water heating requirement	198.8715	175.2707	184.0369	164.9271	161.5870	144.3322	138.5663	152.1182	151.8708	171.0223	180.9013	194.0699	(64)
Efficiency of water heater (217)m	86.6455	86.3003	85.3741	83.1991	80.4133	79.1000	79.1000	79.1000	79.1000	83.3970	85.7937	79.1000	(216)
Fuel for water heating, kWh/month	229.5232	203.0940	215.5653	198.2318	200.9456	182.4680	175.1787	192.3112	191.9985	205.0702	210.8560	223.6930	(219)
Water heating fuel used												2428.9354	(219)
Annual totals kWh/year													
Space heating fuel - main system												2689.7889	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												349.8893	(232)
Total delivered energy for all uses												5543.6136	(238)

10a. Fuel costs - using BEDF prices (442)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2689.7889	3.9200	105.4397 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2428.9354	3.9200	95.2143 (247)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	349.8893	16.9600	59.3412 (250)
Additional standing charges			88.0000 (251)
Total energy cost			360.7152 (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	2689.7889	0.2160	580.9944 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2428.9354	0.2160	524.6500 (264)
Space and water heating			1105.6444 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	349.8893	0.5190	181.5926 (268)
Total kg/year			1326.1620 (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	2689.7889	1.2200	3281.5424 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2428.9354	1.2200	2963.3012 (264)
Space and water heating			6244.8436 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	349.8893	3.0700	1074.1603 (268)
Primary energy kWh/year			7549.2539 (272)
Primary energy kWh/m2/year			92.8111 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 83
Current environmental impact rating: B 85

FULL SAP CALCULATION PRINTOUT

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(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Recommended
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Recommended
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.7	-£ 41	-249 kg (18.8%)
U Solar photovoltaic panels	+ 10.6	-£ 317	-971 kg (90.2%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£41	3.06 kg/m ²	B 84 B 87
Solar photovoltaic panels	£317	11.94 kg/m ²	A 95 A 97
Total Savings	£359	15.00 kg/m ²	

Potential energy efficiency rating: A 95
Potential environmental impact rating: A 97

Fuel prices for cost data on this page from database revision number 442 TEST (29 Apr 2019)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£72	£81	-£8
Mains gas	£289	£239	£50
Space heating	£206	£207	-£1
Water heating	£95	£52	£43
Lighting	£59	£59	£0
Generated (PV)	-£0	-£317	£317
Total cost of fuels	£361	£3	£359
Total cost of uses	£360	£1	£359
Delivered energy	68 kWh/m ²	30 kWh/m ²	38 kWh/m ²
Carbon dioxide emissions	1.3 tonnes	0.1 tonnes	1.2 tonnes
CO2 emissions per m ²	16 kg/m ²	1 kg/m ²	15 kg/m ²
Primary energy	93 kWh/m ²	5 kWh/m ²	88 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property and Energy
Services Ltd.

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.2500 (1b)	x 2.4200 (2b)	= 109.5050 (1b) - (3b)
First floor	36.0900 (1c)	x 2.5500 (2c)	= 92.0295 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 201.5345 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1985 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4485 (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) =	0.3812 (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	0.4860	0.4765	0.4670	0.4193	0.4098	0.3621	0.3621	0.3526	0.3812	0.4098	0.4289	0.4479 (22b)
Effective ac	0.6181	0.6135	0.6090	0.5879	0.5840	0.5656	0.5656	0.5622	0.5727	0.5840	0.5920	0.6003 (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
Door -1			2.3000	1.0000	2.3000		(26)
W-1.4 (Uw = 1.40)			17.4300	1.3258	23.1080		(27)
Velux (Uw = 1.50)			0.5400	1.4151	0.7642		(27a)
Ground floor			45.2500	0.1200	5.4300		(28a)
Cavity wall	89.5500	19.7300	69.8200	0.2200	15.3604		(29a)
Ceiling	10.0600		10.0600	0.1600	1.6096		(30)
Skelling	34.8700	0.5400	34.3300	0.1600	5.4928		(30)
Total net area of external elements Aum(A, m ²)			179.7300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.0649		(33)
Party Wall			47.5400	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.9788 (36)
Total fabric heat loss						(33) + (36) =	64.0437 (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	41.1087	40.8036	40.5046	39.1002	38.8375	37.6143	37.6143	37.3878	38.0855	38.8375	39.3690	39.9248 (38)
Heat transfer coeff	105.1523	104.8473	104.5483	103.1439	102.8811	101.6580	101.6580	101.4315	102.1291	102.8811	103.4127	103.9684 (39)
Average = Sum(39)m / 12 =												103.1426 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2928	1.2890	1.2853	1.2681	1.2648	1.2498	1.2498	1.2470	1.2556	1.2648	1.2714	1.2782 (40)
HLP (average)												1.2680 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4878 (42)
Average daily hot water use (litres/day)												93.2851 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.6136	98.8822	95.1508	91.4194	87.6880	83.9566	83.9566	87.6880	91.4194	95.1508	98.8822	102.6136 (44)
Energy conte	152.1731	133.0915	137.3385	119.7351	114.8886	99.1402	91.8679	105.4198	106.6788	124.3239	135.7093	147.3715 (45)
Energy content (annual)												Total = Sum(45)m = 1467.7382 (45)
Distribution loss (46)m = 0.15 x (45)m	22.8260	19.9637	20.6008	17.9603	17.2333	14.8710	13.7802	15.8130	16.0018	18.6486	20.3564	22.1057 (46)
Water storage loss:												

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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9853	0.9745	0.9455	0.8654	0.7109	0.5006	0.3357	0.3855	0.6603	0.9043	0.9732	0.9879	(94)
Useful gains	681.3667	756.8360	827.9127	856.1859	759.7815	530.6845	338.9676	357.2825	551.8020	662.8916	652.8963	651.6311	(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	1527.4663	1477.4011	1335.1388	1105.4259	837.4907	542.2461	340.3238	359.8420	591.6121	925.6131	1247.3192	1518.6366	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	629.4981	484.2198	377.3762	179.4528	57.8156	0.0000	0.0000	0.0000	0.0000	195.4648	427.9845	645.0521	(98)
Space heating												2996.8639	(98)
Space heating per m2												36.8437	(99)

(98) / (4) =

8c. Space cooling requirement

Not applicable

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 %)													89.8000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3337.2649 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	629.4981	484.2198	377.3762	179.4528	57.8156	0.0000	0.0000	0.0000	0.0000	195.4648	427.9845	645.0521	(98)
Space heating efficiency (main heating system 1)	89.8000	89.8000	89.8000	89.8000	89.8000	0.0000	0.0000	0.0000	0.0000	89.8000	89.8000	89.8000	(210)
Space heating fuel (main heating system)	701.0002	539.2202	420.2408	199.8361	64.3826	0.0000	0.0000	0.0000	0.0000	217.6668	476.5975	718.3208	(211)
Water heating 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	(215)
Water heating													
Water heating requirement	166.3848	126.2880	102.8945	53.8410	21.2345	6.4207	1.5829	30.8578	59.7103	108.0650	143.8591	165.7697	(64)
Efficiency of water heater	87.3303	87.3556	87.2708	87.0814	86.6514	79.1000	79.1000	79.1000	79.1000	85.6739	86.8446	87.3833	(216)
(217)m	87.3303	87.3556	87.2708	87.0814	86.6514	79.1000	79.1000	79.1000	79.1000	85.6739	86.8446	87.3833	(217)
Fuel for water heating, kWh/month	190.5235	144.5677	117.9026	61.8284	24.5057	8.1172	2.0011	39.0111	75.4871	126.1352	165.6511	189.7040	(219)
Water heating fuel used												1145.4347	(219)
Annual totals kWh/year													
Space heating fuel - main system												3337.2649	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												349.8893	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =										-1727.2394		-1727.2394	(233)
Total delivered energy for all uses												3230.3496	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3337.2649	3.4800	116.1368	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1145.4347	3.4800	39.8611	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	349.8893	13.1900	46.1504	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			110.8130	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200 (256)
Energy cost factor (ECF)			0.3684 (257)
SAP value			94.8611
SAP rating (Section 12)			95 (258)
SAP band			A

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

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	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3337.2649	0.2160	720.8492 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1145.4347	0.2160	247.4139 (264)
Space and water heating			968.2631 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	349.8893	0.5190	181.5926 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			318.2934 (272)
CO2 emissions per m2			3.9100 (273)
EI value			96.6241
EI rating			97 (274)
EI band			A

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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.2500 (1b)	x 2.4200 (2b)	= 109.5050 (1b) - (3b)
First floor	36.0900 (1c)	x 2.5500 (2c)	= 92.0295 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 201.5345 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1985 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4485 (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) =	0.3812 (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												
Effective ac	0.4098	0.3907	0.3907	0.3621	0.3717	0.3240	0.3240	0.3145	0.3240	0.3621	0.3526	0.3812 (22b)
	0.5840	0.5763	0.5763	0.5656	0.5691	0.5525	0.5525	0.5495	0.5525	0.5656	0.5622	0.5727 (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
Door -1			2.3000	1.0000	2.3000		(26)
W-1.4 (Uw = 1.40)			17.4300	1.3258	23.1080		(27)
Velux (Uw = 1.50)			0.5400	1.4151	0.7642		(27a)
Ground floor			45.2500	0.1200	5.4300		(28a)
Cavity wall	89.5500	19.7300	69.8200	0.2200	15.3604		(29a)
Ceiling	10.0600		10.0600	0.1600	1.6096		(30)
Skelling	34.8700	0.5400	34.3300	0.1600	5.4928		(30)
Total net area of external elements Aum(A, m ²)			179.7300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.0649		(33)
Party Wall			47.5400	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.9788 (36)
Total fabric heat loss						(33) + (36) =	64.0437 (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	38.8375	38.3301	38.3301	37.6143	37.8469	36.7445	36.7445	36.5422	36.7445	37.6143	37.3878	38.0855 (38)
Heat transfer coeff	102.8811	102.3738	102.3738	101.6580	101.8905	100.7882	100.7882	100.5858	100.7882	101.6580	101.4315	102.1291 (39)
Average = Sum(39)m / 12 =												101.6122 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2648	1.2586	1.2586	1.2498	1.2526	1.2391	1.2391	1.2366	1.2391	1.2498	1.2470	1.2556 (40)
HLP (average)												1.2492 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4878 (42)
Average daily hot water use (litres/day)												93.2851 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.6136	98.8822	95.1508	91.4194	87.6880	83.9566	83.9566	87.6880	91.4194	95.1508	98.8822	102.6136 (44)
Energy conte	152.1731	133.0915	137.3385	119.7351	114.8886	99.1402	91.8679	105.4198	106.6788	124.3239	135.7093	147.3715 (45)
Energy content (annual)												Total = Sum(45)m = 1467.7382 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.8260	19.9637	20.6008	17.9603	17.2333	14.8710	13.7802	15.8130	16.0018	18.6486	20.3564	22.1057 (46)
Water storage loss:												

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9802	0.9672	0.9273	0.8160	0.6196	0.3717	0.2144	0.2411	0.5483	0.8597	0.9611	0.9834	(94)
Useful gains	697.1516	761.6456	826.9861	833.0001	676.5074	416.0869	227.3134	236.9654	482.3498	656.0501	666.4051	665.1430	(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	1428.8857	1376.3775	1230.6040	999.8336	713.2460	418.5777	227.4353	237.1774	497.4500	835.1651	1148.3575	1416.3417	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	544.4102	413.0998	300.2917	120.1201	27.3335	0.0000	0.0000	0.0000	0.0000	133.2616	347.0057	558.8918	(98)
Space heating												2444.4145	(98)
Space heating per m2											(98) / (4) =	30.0518	(99)

8c. Space cooling requirement

Not applicable

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 %)													89.8000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2722.0652 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	544.4102	413.0998	300.2917	120.1201	27.3335	0.0000	0.0000	0.0000	0.0000	133.2616	347.0057	558.8918	(98)
Space heating efficiency (main heating system 1)	89.8000	89.8000	89.8000	89.8000	89.8000	0.0000	0.0000	0.0000	0.0000	89.8000	89.8000	89.8000	(210)
Space heating fuel (main heating system)	606.2475	460.0221	334.4005	133.7641	30.4382	0.0000	0.0000	0.0000	0.0000	148.3982	386.4206	622.3739	(211)
Water heating 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	(215)
Water heating													
Water heating requirement	162.9897	126.6989	104.0299	53.7715	24.1407	2.5289	0.0000	26.0047	55.7070	104.5896	140.3356	162.7949	(64)
Efficiency of water heater	87.0858	87.0366	86.7797	86.1945	84.4429	79.1000	79.1000	79.1000	79.1000	84.7583	86.4332	79.1000	(216)
(217)m	87.0858	87.0366	86.7797	86.1945	84.4429	79.1000	79.1000	79.1000	79.1000	84.7583	86.4332	79.1000	(217)
Fuel for water heating, kWh/month	187.1600	145.5697	119.8782	62.3839	28.5882	3.1971	0.0000	32.8757	70.4260	123.3974	162.3632	186.8178	(219)
Water heating fuel used												1122.6572	(219)
Annual totals kWh/year													
Space heating fuel - main system												2722.0652	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												349.8893	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1170 * 0.80) =										-1871.3360		-1871.3360	(233)
Total delivered energy for all uses												2448.2757	(238)

10a. Fuel costs - using BEDF prices (442)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2722.0652	3.9200	106.7050 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1122.6572	3.9200	44.0082 (247)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Pump for solar water heating	50.0000	16.9600	8.4800 (249)
Energy for lighting	349.8893	16.9600	59.3412 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	-1871.3360	16.9600	-317.3786 (252)
Total energy cost			1.8758 (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	2722.0652	0.2160	587.9661 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1122.6572	0.2160	242.4940 (264)
Space and water heating			830.4600 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	349.8893	0.5190	181.5926 (268)
Energy saving/generation technologies			

Regs Region: England

Elmhurst Energy Systems
SAP2012 Calculator (Design
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PV Unit	-1871.3360	0.5190	-971.2234 (269)
Total kg/year			105.7042 (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	2722.0652	1.2200	3320.9195 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1122.6572	1.2200	1369.6418 (264)
Space and water heating			4690.5613 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	349.8893	3.0700	1074.1603 (268)
Energy saving/generation technologies			
PV Unit	-1871.3360	3.0700	-5745.0015 (269)
Primary energy kWh/year			403.4701 (272)
Primary energy kWh/m2/year			4.9603 (273)