

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property and Energy
Services Ltd.

Property Reference	3260-1	Issued on Date	08/05/2019
Assessment Reference	3260-1	Prop Type Ref	
Property	1, Aldworth Rise, Reading, RG1 7NA		

SAP Rating	88 B	DER	13.34	TER	17.66
Environmental	90 B	% DER<TER	24.46		
CO ₂ Emissions (t/year)	0.78	DFEE	46.91	TTEE	51.95
General Requirements Compliance	Pass	% DFEE<TFEE	9.71		

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		secondary		other		total	m3 per hour				
	heating		heating									
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)				
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =								Air changes per hour				
Pressure test								40.0000 / (5) =	0.1985 (8)			
Measured/design AP50								Yes	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)			
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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)			18.9700	1.3258	25.1496			(27)				
Velux (Uw = 1.50)			0.5400	1.4151	0.7642			(27a)				
Ground floor			45.2500	0.0900	4.0725			(28a)				
Cavity wall	89.5500	21.2700	68.2800	0.2200	15.0216			(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) =		54.4103			(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) = 64.3890 (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	103.2265	102.7191	102.7191	102.0033	102.2359	101.1335	101.1335	100.9312	101.1335	102.0033	101.7768	102.4745 (39)
Average = Sum(39)m / 12 =												101.9575 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2691	1.2628	1.2628	1.2540	1.2569	1.2433	1.2433	1.2409	1.2433	1.2540	1.2513	1.2598 (40)
Days in month												1.2535 (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 (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 (64)
								Total per year (kWh/year) = Sum(64)m =				2017.5742 (64)
												2018 (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												
	49.5273	43.9897	35.7748	27.0839	20.2455	17.0921	18.4686	24.0062	32.2211	40.9121	47.7504	50.9038 (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												
	604.5876	600.3369	578.9742	545.7361	511.6411	481.0211	463.0366	471.1890	490.2287	523.6799	560.9351	589.1842 (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					6.7800	23.8018		0.6300	0.7000	0.7700		49.3186 (76)
South					3.8000	54.2217		0.6300	0.7000	0.7700		62.9693 (78)
West					8.3900	23.8018		0.6300	0.7000	0.7700		61.0299 (80)
South					0.5400	47.8082		0.6300	0.7000	1.0000		10.2465 (82)

Solar gains	183.5643	295.1945	447.3121	622.5778	719.4215	770.4065	729.5527	657.7741	539.4573	364.8805	221.4235	154.6336 (83)
Total gains	788.1520	895.5313	1026.2863	1168.3140	1231.0626	1251.4276	1192.5893	1128.9631	1029.6859	888.5603	782.3586	743.8177 (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	54.7205	54.9908	54.9908	55.3767	55.2508	55.8530	55.8530	55.9650	55.8530	55.3767	55.5000	55.1221
alpha	4.6480	4.6661	4.6661	4.6918	4.6834	4.7235	4.7235	4.7310	4.7235	4.6918	4.7000	4.6748
util living area												
	0.9825	0.9675	0.9238	0.8111	0.6343	0.4161	0.2794	0.3032	0.5684	0.8580	0.9636	0.9859 (86)
MIT	20.0203	20.2022	20.4921	20.7909	20.9464	20.9942	20.9993	20.9990	20.9755	20.7659	20.3547	19.9858 (87)
Th 2	19.8651	19.8701	19.8701	19.8770	19.8748	19.8855	19.8855	19.8875	19.8855	19.8770	19.8792	19.8724 (88)

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util rest of house	0.9769	0.9574	0.9012	0.7631	0.5595	0.3290	0.1853	0.2044	0.4719	0.8078	0.9502	0.9813 (89)
MIT 2	19.0128	19.1933	19.4672	19.7340	19.8472	19.8838	19.8854	19.8873	19.8763	19.7221	19.3513	18.9851 (90)
Living area fraction									fLA = Living area / (4) =			0.1962 (91)
MIT	19.2105	19.3913	19.6683	19.9414	20.0629	20.1017	20.1040	20.1055	20.0919	19.9269	19.5482	19.1815 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.0605	19.2413	19.5183	19.7914	19.9129	19.9517	19.9540	19.9555	19.9419	19.7769	19.3982	19.0315 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9716	0.9503	0.8928	0.7590	0.5621	0.3342	0.1911	0.2105	0.4770	0.8026	0.9428	0.9767	(94)
Useful gains	765.8040	850.9814	916.2179	886.7549	692.0044	418.2664	227.8784	237.6220	491.1966	713.1553	737.6265	726.4794	(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	1441.0947	1390.9474	1244.7842	1008.9559	716.9667	419.8738	227.9527	237.7402	499.7965	844.2737	1160.0731	1427.6185	(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	502.4163	362.8571	244.4534	87.9847	18.5719	0.0000	0.0000	0.0000	0.0000	97.5521	304.1615	521.6475	(98)
Space heating												2139.6446	(98)
RHI space heating demand												2140	(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		(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												
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)			18.9700	1.3258	25.1496		(27)
Velux (Uw = 1.50)			0.5400	1.4151	0.7642		(27a)
Ground floor			45.2500	0.0900	4.0725		(28a)
Cavity wall	89.5500	21.2700	68.2800	0.2200	15.0216		(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) =	54.4103		(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) =	64.3890 (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	105.4977	105.1926	104.8937	103.4893	103.2265	102.0033	102.0033	101.7768	102.4745	103.2265	103.7581	104.3138 (39)
Average = Sum(39)m / 12 =												103.4880 (39)
HLP	1.2970	1.2932	1.2896	1.2723	1.2691	1.2540	1.2540	1.2513	1.2598	1.2691	1.2756	1.2824 (40)
HLP (average)												1.2723 (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

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.10r08



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CALCULATION OF ENERGY RATINGS 09 Jan 2014

											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 =											0.0000	(64)
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	(63)
	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	(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	49.5273	43.9897	35.7748	27.0839	20.2455	17.0921	18.4686	24.0062	32.2211	40.9121	47.7504	50.9038 (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	604.5876	600.3369	578.9742	545.7361	511.6411	481.0211	463.0366	471.1890	490.2287	523.6799	560.9351	589.1842 (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					6.7800	19.6403	0.6300	0.7000	0.7700	40.6957 (76)		
South					3.8000	46.7521	0.6300	0.7000	0.7700	54.2945 (78)		
West					8.3900	19.6403	0.6300	0.7000	0.7700	50.3595 (80)		
South					0.5400	39.9063	0.6300	0.7000	1.0000	8.5530 (82)		
Solar gains	153.9027	283.0628	431.7245	591.2364	700.4893	708.7419	678.0190	596.7965	488.2320	325.8965	188.4172	128.9246 (83)
Total gains	758.4904	883.3997	1010.6987	1136.9726	1212.1304	1189.7631	1141.0557	1067.9855	978.4607	849.5764	749.3523	718.1087 (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	53.5425	53.6978	53.8508	54.5816	54.7205	55.3767	55.3767	55.5000	55.1221	54.7205	54.4402	54.1502
alpha	4.5695	4.5799	4.5901	4.6388	4.6480	4.6918	4.6918	4.7000	4.6748	4.6480	4.6293	4.6100
util living area	0.9878	0.9751	0.9428	0.8599	0.7159	0.5334	0.3903	0.4332	0.6705	0.9041	0.9762	0.9903 (86)
MIT	19.8613	20.0635	20.3603	20.6899	20.8957	20.9793	20.9961	20.9938	20.9422	20.6548	20.1978	19.8260 (87)
Th 2	19.8432	19.8461	19.8490	19.8626	19.8651	19.8770	19.8770	19.8792	19.8724	19.8651	19.8600	19.8546 (88)
util rest of house	0.9839	0.9674	0.9257	0.8218	0.6504	0.4464	0.2923	0.3303	0.5804	0.8679	0.9676	0.9872 (89)
MIT 2	18.8385	19.0387	19.3258	19.6365	19.8036	19.8688	19.8762	19.8777	19.8457	19.6176	19.1839	18.8128 (90)
Living area fraction									fLA = Living area / (4) =			0.1962 (91)
MIT	19.0392	19.2397	19.5288	19.8432	20.0179	20.0867	20.0959	20.0967	20.0609	19.8211	19.3829	19.0116 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.8892	19.0897	19.3788	19.6932	19.8679	19.9367	19.9459	19.9467	19.9109	19.6711	19.2329	18.8616 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9796	0.9610	0.9171	0.8153	0.6506	0.4511	0.2984	0.3366	0.5837	0.8605	0.9613	0.9835 (94)
Useful gains	743.0261	848.9167	926.9557	926.9528	788.6386	536.7412	340.4631	359.5094	571.1464	731.0444	720.3153	706.2640 (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	1539.1238	1492.6573	1350.9063	1116.9796	843.1452	544.3650	341.2947	360.9719	595.4656	936.3818	1258.8830	1529.4052 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	592.2967	432.5937	315.4192	136.8193	40.5529	0.0000	0.0000	0.0000	0.0000	152.7710	387.7687	612.4170 (98)
Space heating												2670.6386 (98)
Space heating per m2												32.8330 (99)
										(98) / (4) =		

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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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													2973.9851 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	592.2967	432.5937	315.4192	136.8193	40.5529	0.0000	0.0000	0.0000	0.0000	152.7710	387.7687	612.4170	(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)	659.5731	481.7302	351.2464	152.3600	45.1591	0.0000	0.0000	0.0000	0.0000	170.1236	431.8137	681.9789	(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	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	86.8470	86.4289	85.5365	83.6176	81.0371	79.1000	79.1000	79.1000	79.1000	83.8118	86.0952	79.1000	(216)
Fuel for water heating, kWh/month	228.9906	202.7918	215.1560	197.2396	199.3987	182.4680	175.1787	192.3112	191.9985	204.0552	210.1178	223.1482	(219)
Water heating fuel used												2422.8543	(219)
Annual totals kWh/year													
Space heating fuel - main system												2973.9851	(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)												349.8671	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.00 * 1080 * 1.00) =										-863.6197		-863.6197	(233)
Total delivered energy for all uses												4958.0869	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2973.9851	3.4800	103.4947 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2422.8543	3.4800	84.3153 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	349.8671	13.1900	46.1475 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-863.6197	13.1900	-113.9114 (252)
Total energy cost			249.9385 (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] =	0.8309 (257)
SAP value	88.4091	
SAP rating (Section 12)	88	(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	2973.9851	0.2160	642.3808 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2422.8543	0.2160	523.3365 (264)
Space and water heating			1165.7173 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	349.8671	0.5190	181.5810 (268)
Energy saving/generation technologies			
PV Unit	-863.6197	0.5190	-448.2186 (269)
Total kg/year			938.0047 (272)
CO2 emissions per m2			11.5300 (273)
EI value			90.0512
EI rating			90
EI band			B

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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 $3.48 / 0.8306 = 4.190$, stars = 4
Water heating environmental impact $0.216 / 0.8306 = 0.2600$, stars = 4

FULL SAP CALCULATION PRINTOUT

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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)			18.9700	1.3258	25.1496		(27)
Velux (Uw = 1.50)			0.5400	1.4151	0.7642		(27a)
Ground floor			45.2500	0.0900	4.0725		(28a)
Cavity wall	89.5500	21.2700	68.2800	0.2200	15.0216		(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) =	54.4103		(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) =	64.3890 (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	103.2265	102.7191	102.7191	102.0033	102.2359	101.1335	101.1335	100.9312	101.1335	102.0033	101.7768	102.4745 (39)
Average = Sum(39)m / 12 =												101.9575 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2691	1.2628	1.2628	1.2540	1.2569	1.2433	1.2433	1.2409	1.2433	1.2540	1.2513	1.2598 (40)
HLP (average)												1.2535 (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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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	(64)
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	(63)	
								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	49.5273	43.9897	35.7748	27.0839	20.2455	17.0921	18.4686	24.0062	32.2211	40.9121	47.7504	50.9038 (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	604.5876	600.3369	578.9742	545.7361	511.6411	481.0211	463.0366	471.1890	490.2287	523.6799	560.9351	589.1842 (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				6.7800	23.8018	0.6300	0.7000	0.7700	49.3186 (76)			
South				3.8000	54.2217	0.6300	0.7000	0.7700	62.9693 (78)			
West				8.3900	23.8018	0.6300	0.7000	0.7700	61.0299 (80)			
South				0.5400	47.8082	0.6300	0.7000	1.0000	10.2465 (82)			
Solar gains	183.5643	295.1945	447.3121	622.5778	719.4215	770.4065	729.5527	657.7741	539.4573	364.8805	221.4235	154.6336 (83)
Total gains	788.1520	895.5313	1026.2863	1168.3140	1231.0626	1251.4276	1192.5893	1128.9631	1029.6859	888.5603	782.3586	743.8177 (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	54.7205	54.9908	54.9908	55.3767	55.2508	55.8530	55.8530	55.9650	55.8530	55.3767	55.5000	55.1221
alpha	4.6480	4.6661	4.6661	4.6918	4.6834	4.7235	4.7235	4.7310	4.7235	4.6918	4.7000	4.6748
util living area	0.9825	0.9675	0.9238	0.8111	0.6343	0.4161	0.2794	0.3032	0.5684	0.8580	0.9636	0.9859 (86)
MIT	20.0203	20.2022	20.4921	20.7909	20.9464	20.9942	20.9993	20.9990	20.9755	20.7659	20.3547	19.9858 (87)
Th 2	19.8651	19.8701	19.8701	19.8770	19.8748	19.8855	19.8855	19.8875	19.8855	19.8770	19.8792	19.8724 (88)
util rest of house	0.9769	0.9574	0.9012	0.7631	0.5595	0.3290	0.1853	0.2044	0.4719	0.8078	0.9502	0.9813 (89)
MIT 2	19.0128	19.1933	19.4672	19.7340	19.8472	19.8838	19.8854	19.8873	19.8763	19.7221	19.3513	18.9851 (90)
Living area fraction	19.2105	19.3913	19.6683	19.9414	20.0629	20.1017	20.1040	20.1055	20.0919	19.9269	19.5482	0.1962 (91)
MIT	19.2105	19.3913	19.6683	19.9414	20.0629	20.1017	20.1040	20.1055	20.0919	19.9269	19.5482	19.1815 (92)
Temperature adjustment	19.0605	19.2413	19.5183	19.7914	19.9129	19.9517	19.9540	19.9555	19.9419	19.7769	19.3982	-0.1500
adjusted MIT	19.0605	19.2413	19.5183	19.7914	19.9129	19.9517	19.9540	19.9555	19.9419	19.7769	19.3982	19.0315 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9716	0.9503	0.8928	0.7590	0.5621	0.3342	0.1911	0.2105	0.4770	0.8026	0.9428	0.9767 (94)
Useful gains	765.8040	850.9814	916.2179	886.7549	692.0044	418.2664	227.8784	237.6220	491.1966	713.1553	737.6265	726.4794 (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	1441.0947	1390.9474	1244.7842	1008.9559	716.9667	419.8738	227.9527	237.7402	499.7965	844.2737	1160.0731	1427.6185 (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	502.4163	362.8571	244.4534	87.9847	18.5719	0.0000	0.0000	0.0000	0.0000	97.5521	304.1615	521.6475 (98)
Space heating												2139.6446 (98)
Space heating per m2												26.3049 (99)
										(98) / (4) =		

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property and Energy
Services Ltd.

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													2382.6777 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	502.4163	362.8571	244.4534	87.9847	18.5719	0.0000	0.0000	0.0000	0.0000	97.5521	304.1615	521.6475	(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)	559.4836	404.0725	272.2198	97.9785	20.6814	0.0000	0.0000	0.0000	0.0000	108.6326	338.7099	580.8992	(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	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	86.4825	86.0105	84.8692	82.5206	80.0837	79.1000	79.1000	79.1000	79.1000	82.6783	85.4873	79.1000	(216)
Fuel for water heating, kWh/month	229.9557	203.7783	216.8478	199.8616	201.7728	182.4680	175.1787	192.3112	191.9985	206.8528	211.6119	224.0404	(219)
Water heating fuel used												2436.6778	(219)
Annual totals kWh/year													
Space heating fuel - main system												2382.6777	(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)												349.8671	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.00 * 1170 * 1.00) =										-935.6680		-935.6680	(233)
Total delivered energy for all uses												4308.5546	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2382.6777	3.9200	93.4010 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2436.6778	3.9200	95.5178 (247)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	349.8671	16.9600	59.3375 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	-935.6680	16.9600	-158.6893 (252)
Total energy cost			190.2869 (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	2382.6777	0.2160	514.6584 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2436.6778	0.2160	526.3224 (264)
Space and water heating			1040.9808 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	349.8671	0.5190	181.5810 (268)
Energy saving/generation technologies			
PV Unit	-935.6680	0.5190	-485.6117 (269)
Total kg/year			775.8751 (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	2382.6777	1.2200	2906.8668 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2436.6778	1.2200	2972.7469 (264)
Space and water heating			5879.6137 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	349.8671	3.0700	1074.0920 (268)
Energy saving/generation technologies			
PV Unit	-935.6680	3.0700	-2872.5007 (269)
Primary energy kWh/year			4311.4549 (272)
Primary energy kWh/m2/year			53.0053 (273)

Regs Region: England

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 88
Current environmental impact rating: B 90

(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	Already installed
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	-£ 42	-251 kg (32.3%)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
Solar water heating	£42	3.08 kg/m²	B 90	A 93
Total Savings	£42	3.08 kg/m²		
Potential energy efficiency rating:			B 90	
Potential environmental impact rating:				A 93

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	£277	£227	£50
Space heating	£194	£195	-£1
Water heating	£96	£53	£43
Lighting	£59	£59	£0
Generated (PV)	-£159	-£159	£0
Total cost of fuels	£190	£149	£42
Total cost of uses	£190	£148	£42
Delivered energy	53 kWh/m²	38 kWh/m²	15 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.5 tonnes	0.3 tonnes
CO2 emissions per m²	10 kg/m²	6 kg/m²	3 kg/m²
Primary energy	53 kWh/m²	36 kWh/m²	17 kWh/m²

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												
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)			18.9700	1.3258	25.1496		(27)
Velux (Uw = 1.50)			0.5400	1.4151	0.7642		(27a)
Ground floor			45.2500	0.0900	4.0725		(28a)
Cavity wall	89.5500	21.2700	68.2800	0.2200	15.0216		(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) =	54.4103		(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) =	64.3890 (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	105.4977	105.1926	104.8937	103.4893	103.2265	102.0033	102.0033	101.7768	102.4745	103.2265	103.7581	104.3138 (39)
Average = Sum(39)m / 12 =												103.4880 (39)
HLP	1.2970	1.2932	1.2896	1.2723	1.2691	1.2540	1.2540	1.2513	1.2598	1.2691	1.2756	1.2824 (40)
HLP (average)												1.2723 (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:												

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9803	0.9620	0.9192	0.8205	0.6593	0.4588	0.3040	0.3430	0.5904	0.8640	0.9625	0.9841	(94)
Useful gains	736.3466	842.7734	920.8733	920.6834	785.2208	536.1108	340.3815	359.3667	569.8316	726.3874	714.1697	699.4689	(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	1538.3155	1491.9092	1350.1622	1116.2277	842.7423	544.2874	341.2827	360.9517	595.3070	935.8182	1258.1421	1528.5922	(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	596.6649	436.2193	319.3910	140.7919	42.7960	0.0000	0.0000	0.0000	0.0000	155.8165	391.6602	616.8677	(98)
Space heating												2700.2074	(98)
Space heating per m2												33.1966	(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													3006.9125 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	596.6649	436.2193	319.3910	140.7919	42.7960	0.0000	0.0000	0.0000	0.0000	155.8165	391.6602	616.8677	(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)	664.4375	485.7676	355.6692	156.7839	47.6570	0.0000	0.0000	0.0000	0.0000	173.5150	436.1472	686.9351	(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	87.2271	87.1532	86.9346	86.5609	85.9445	79.1000	79.1000	79.1000	79.1000	85.0865	86.6512	79.1000	(216)
(217)m	87.2271	87.1532	86.9346	86.5609	85.9445	79.1000	79.1000	79.1000	79.1000	85.0865	86.6512	79.1000	(217)
Fuel for water heating, kWh/month	190.7490	144.9035	118.3586	62.2002	24.7072	8.1172	2.0011	39.0111	75.4871	127.0060	166.0209	189.8878	(219)
Water heating fuel used												1148.4497	(219)
Annual totals kWh/year													
Space heating fuel - main system												3006.9125	(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)												349.8671	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.00 * 1080 * 1.00) =										-863.6197		-863.6197	(233)
Total delivered energy for all uses												3766.6096	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3006.9125	3.4800	104.6406	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1148.4497	3.4800	39.9661	(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	349.8671	13.1900	46.1475	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-863.6197	13.1900	-113.9114	(252)
Total energy cost			213.3301	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200 (256)
Energy cost factor (ECF)			0.7092 (257)
SAP value			90.1068
SAP rating (Section 12)			90 (258)
SAP band			B

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3006.9125	0.2160	649.4931 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1148.4497	0.2160	248.0651 (264)
Space and water heating			897.5582 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	349.8671	0.5190	181.5810 (268)
Energy saving/generation technologies			
PV Unit	-863.6197	0.5190	-448.2186 (269)
Total kg/year			695.7956 (272)
CO2 emissions per m2			8.5500 (273)
EI value			92.6202
EI rating			93 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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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	m3 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)			18.9700	1.3258	25.1496		(27)
Velux (Uw = 1.50)			0.5400	1.4151	0.7642		(27a)
Ground floor			45.2500	0.0900	4.0725		(28a)
Cavity wall	89.5500	21.2700	68.2800	0.2200	15.0216		(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) =	54.4103		(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) =	64.3890 (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	103.2265	102.7191	102.7191	102.0033	102.2359	101.1335	101.1335	100.9312	101.1335	102.0033	101.7768	102.4745 (39)
Average = Sum(39)m / 12 =												101.9575 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2691	1.2628	1.2628	1.2540	1.2569	1.2433	1.2433	1.2409	1.2433	1.2540	1.2513	1.2598 (40)
HLP (average)												1.2535 (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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store volume													190.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6390	(48)
Temperature factor from Table 2b													0.5400	(49)
Enter (49) or (54) in (55)													0.8850	(55)
Total storage loss														
	27.4363	24.7811	27.4363	26.5512	27.4363	26.5512	27.4363	27.4363	26.5512	27.4363	26.5512	27.4363	(56)	
If cylinder contains dedicated solar storage														
	16.6062	14.9991	16.6062	16.0705	16.6062	16.0705	16.6062	16.6062	16.0705	16.6062	16.0705	16.6062	(57)	
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)	
Total heat required for water heating calculated for each month														
	192.0416	169.1018	175.8114	151.5639	141.9629	125.1159	118.7096	133.1919	139.8584	162.7967	174.2917	187.2400	(62)	
Aperture area of solar collector														
Zero-loss collector efficiency													3.0000	(H1)
Collector heat loss coefficient													0.7000	(H2)
Collector 2nd order heat loss coefficient													1.8000	(H3)
Collector effective heat loss coefficient													0.0050	(H3a)
Collector performance ratio													1.8063	(H3b)
Annual solar radiation per m2													2.5804	(H4)
Overshading factor													1169.5850	(H5)
Solar energy available													0.8000	(H6)
Adjustment factor for showers													1964.9028	(H7)
Solar-to-load ratio													1.0000	(H7a)
Utilisation factor													1.3387	(H8)
Collector performance factor													0.5262	(H9)
Dedicated solar storage volume													0.8793	(H10)
Effective solar volume													75.0000	(H11)
Daily hot water demand													109.5000	(H13)
Volume ratio Veff/V													93.2851	(H14)
Solar storage volume factor													1.1738	(H15)
Solar input													1.0000	(H16)
Solar input	-29.0519	-42.4030	-71.7814	-97.7925	-117.8222	-122.5870	-119.7506	-107.1872	-84.1514	-58.2071	-33.9561	-909.1356	(H17)	
													-24.4452	(63)
													-909.1356	(63)
Output from w/h														
	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)	
													963.5913	(64)
Heat gains from water heating, kWh/month														
	82.4924	73.0612	76.4433	65.2750	59.8599	53.7447	52.0194	57.2698	62.0144	72.1160	75.9893	80.8959	(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	49.5273	43.9897	35.7748	27.0839	20.2455	17.0921	18.4686	24.0062	32.2211	40.9121	47.7504	50.9038 (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)	110.8769	108.7220	102.7464	90.6597	80.4568	74.6454	69.9185	76.9755	86.1311	96.9300	105.5407	108.7310 (72)
Total internal gains	597.2437	592.9930	570.1295	530.8882	490.5399	459.6698	441.6853	450.8381	476.8816	514.8351	553.5912	581.8403 (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	6.7800	23.8018	0.6300	0.7000	0.7700	49.3186 (76)
South	3.8000	54.2217	0.6300	0.7000	0.7700	62.9693 (78)
West	8.3900	23.8018	0.6300	0.7000	0.7700	61.0299 (80)
South	0.5400	47.8082	0.6300	0.7000	1.0000	10.2465 (82)

Solar gains	183.5643	295.1945	447.3121	622.5778	719.4215	770.4065	729.5527	657.7741	539.4573	364.8805	221.4235	154.6336 (83)
Total gains	780.8081	888.1874	1017.4416	1153.4661	1209.9614	1230.0762	1171.2379	1108.6122	1016.3388	879.7156	775.0147	736.4738 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n11,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	54.7205	54.9908	54.9908	55.3767	55.2508	55.8530	55.8530	55.9650	55.8530	55.3767	55.5000	55.1221
alpha	4.6480	4.6661	4.6661	4.6918	4.6834	4.7235	4.7235	4.7310	4.7235	4.6918	4.7000	4.6748
util living area	0.9832	0.9684	0.9258	0.8166	0.6430	0.4231	0.2844	0.3087	0.5748	0.8617	0.9648	0.9865 (86)
MIT	20.0127	20.1951	20.4852	20.7843	20.9433	20.9938	20.9993	20.9990	20.9744	20.7609	20.3477	19.9780 (87)
Th 2	19.8651	19.8701	19.8701	19.8770	19.8748	19.8855	19.8855	19.8875	19.8855	19.8770	19.8792	19.8724 (88)
util rest of house	0.9777	0.9586	0.9036	0.7691	0.5679	0.3346	0.1887	0.2082	0.4777	0.8121	0.9518	0.9820 (89)
MIT 2	19.0054	19.1866	19.4610	19.7290	19.8454	19.8837	19.8854	19.8873	19.8758	19.7183	19.3448	18.9775 (90)
Living area fraction									fLA = Living area / (4) =			0.1962 (91)
MIT	19.2031	19.3845	19.6620	19.9361	20.0608	20.1015	20.1040	20.1054	20.0913	19.9229	19.5416	19.1738 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.0531	19.2345	19.5120	19.7861	19.9108	19.9515	19.9540	19.9554	19.9413	19.7729	19.3916	19.0238 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9725	0.9515	0.8952	0.7648	0.5705	0.3399	0.1946	0.2143	0.4828	0.8067	0.9445	0.9775	(94)
Useful gains	759.3686	845.1409	910.8072	882.1561	690.2525	418.1270	227.8705	237.6097	490.6952	709.6938	731.9829	719.8979	(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	1440.3256	1390.2471	1244.1333	1008.4149	716.7602	419.8553	227.9511	237.7379	499.7344	843.8607	1159.3996	1426.8384	(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	506.6320	366.3114	247.9946	90.9063	19.7217	0.0000	0.0000	0.0000	0.0000	99.8202	307.7400	525.9638	(98)
Space heating												2165.0901	(98)
Space heating per m2												26.6178	(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													2411.0134 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	506.6320	366.3114	247.9946	90.9063	19.7217	0.0000	0.0000	0.0000	0.0000	99.8202	307.7400	525.9638	(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)	564.1782	407.9192	276.1632	101.2320	21.9618	0.0000	0.0000	0.0000	0.0000	111.1583	342.6949	585.7058	(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	86.9375	86.7831	86.3482	85.5014	83.5776	79.1000	79.1000	79.1000	79.1000	83.9869	86.1501	79.1000	(216)
(217)m	86.9375	86.7831	86.3482	85.5014	83.5776	79.1000	79.1000	79.1000	79.1000	83.9869	86.1501	79.1000	(217)
Fuel for water heating, kWh/month	187.4792	145.9948	120.4772	62.8896	28.8841	3.1971	0.0000	32.8757	70.4260	124.5308	162.8966	187.0823	(219)
Water heating fuel used												1126.7335	(219)
Annual totals kWh/year													
Space heating fuel - main system												2411.0134	(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)												349.8671	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.00 * 1170 * 1.00) =										-935.6680		-935.6680	(233)
Total delivered energy for all uses												3076.9461	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2411.0134	3.9200	94.5117	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1126.7335	3.9200	44.1680	(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	349.8671	16.9600	59.3375	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	-935.6680	16.9600	-158.6893	(252)
Total energy cost			148.5278	(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	2411.0134	0.2160	520.7789	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1126.7335	0.2160	243.3744	(264)
Space and water heating			764.1533	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	349.8671	0.5190	181.5810	(268)
Energy saving/generation technologies				

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PV Unit	-935.6680	0.5190	-485.6117 (269)
Total kg/year			524.9977 (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	2411.0134	1.2200	2941.4364 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1126.7335	1.2200	1374.6149 (264)
Space and water heating			4316.0513 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	349.8671	3.0700	1074.0920 (268)
Energy saving/generation technologies			
PV Unit	-935.6680	3.0700	-2872.5007 (269)
Primary energy kWh/year			2901.3926 (272)
Primary energy kWh/m2/year			35.6699 (273)