

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property and Energy
Services Ltd.

Property Reference	3260-2	Issued on Date	08/05/2019
Assessment Reference	3260-2	Prop Type Ref	
Property	2, Aldworth Rise, Reading, RG1 7NA		
SAP Rating	84 B	DER	16.71
Environmental	87 B	% DER<TER	1.63
CO ₂ Emissions (t/year)	1.09	DFEE	43.30
General Requirements Compliance	Pass	% DFEE<TFEE	10.15
Assessor Details	Mr. Ian Lloyd, Property and Energy Services Limited, Tel: 01367240212, ianl@propertyandenergy.co.uk		Assessor ID
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	45.2400 (1b)	x 2.4200 (2b)	= 109.4808 (1b) - (3b)
First floor	35.9600 (1c)	x 2.5500 (2c)	= 91.6980 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 201.1788 (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)				
Air changes per hour												
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						40.0000 / (5) =	0.1988 (8)				
Pressure test							Yes					
Measured/design AP50							5.0000					
Infiltration rate							0.4488	(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) =	0.3815 (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	0.4101	0.3910	0.3910	0.3624	0.3720	0.3243	0.3243	0.3147	0.3243	0.3624	0.3529	0.3815 (22b)
Effective ac	0.5841	0.5765	0.5765	0.5657	0.5692	0.5526	0.5526	0.5495	0.5526	0.5657	0.5623	0.5728 (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			2.5500	1.0000	2.5500		(26)					
W-1.4 (Uw = 1.40)			16.8000	1.3258	22.2727		(27)					
Ground floor			45.2400	0.1200	5.4288		(28a)					
Cavity wall	44.7300	19.3500	25.3800	0.2200	5.5836		(29a)					
Ceiling	16.8100		16.8100	0.1600	2.6896		(30)					
Skelling	31.5900		31.5900	0.1600	5.0544		(30)					
Total net area of external elements Aum(A, m2)			138.3700				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		43.5791		(33)					
Party Wall			99.8900	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) = 53.5579 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 38.7777	Feb 38.2704	Mar 38.2704	Apr 37.5548	May 37.7873	Jun 36.6851	Jul 36.6851	Aug 36.4828	Sep 36.6851	Oct 37.5548	Nov 37.3283	Dec 38.0258 (38)
Heat transfer coeff												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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CALCULATION OF HEAT DEMAND 09 Jan 2014

Average = Sum(39)m / 12 =	92.3356	91.8283	91.8283	91.1126	91.3451	90.2430	90.2430	90.0407	90.2430	91.1126	90.8862	91.5837 (39)
												91.0668 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1371	1.1309	1.1309	1.1221	1.1249	1.1114	1.1114	1.1089	1.1114	1.1221	1.1193	1.1279 (40)
Days in month												1.1215 (40)
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4852 (42)
Average daily hot water use (litres/day)												93.2243 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	102.5468	98.8178	95.0888	91.3599	87.6309	83.9019	83.9019	87.6309	91.3599	95.0888	98.8178	102.5468 (44)
Energy content (annual)	152.0739	133.0048	137.2491	119.6571	114.8138	99.0756	91.8081	105.3511	106.6093	124.2429	135.6208	147.2755 (45)
Distribution loss (46)m = 0.15 x (45)m	22.8111	19.9507	20.5874	17.9486	17.2221	14.8613	13.7712	15.8027	15.9914	18.6364	20.3431	22.0913 (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	198.7723	175.1840	183.9475	164.8491	161.5122	144.2676	138.5065	152.0495	151.8013	170.9413	180.8128	193.9739 (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 (63)
Output from w/h	198.7723	175.1840	183.9475	164.8491	161.5122	144.2676	138.5065	152.0495	151.8013	170.9413	180.8128	193.9739 (64)
RHI water heating demand												2016.6179 (64)
Heat gains from water heating, kWh/month	87.9233	77.9675	82.9940	75.9396	75.5343	69.0962	67.8849	72.3880	71.6012	78.6695	81.2475	86.3278 (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	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.6547	44.1029	35.8669	27.1535	20.2976	17.1361	18.5161	24.0680	32.3040	41.0173	47.8733	51.0348 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	331.2391	334.6764	326.0147	307.5749	284.2981	262.4211	247.8060	244.3688	253.0305	271.4702	294.7470	316.6240 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966 (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)	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094 (71)
Water heating gains (Table 5)	118.1765	116.0230	111.5511	105.4716	101.5246	95.9670	91.2432	97.2957	99.4461	105.7386	112.8438	116.0320 (72)
Total internal gains	604.1717	599.9036	578.5340	545.3015	511.2216	480.6256	462.6666	470.8337	489.8819	523.3274	560.5655	588.7921 (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	8.4100				23.8018	0.6300	0.7000	0.7700	61.1754 (76)			
West	8.3900				23.8018	0.6300	0.7000	0.7700	61.0299 (80)			
Solar gains	122.2054	208.8077	340.7678	503.2473	599.7988	649.0590	612.0006	539.7269	422.0498	265.7881	150.1002	101.0746 (83)
Total gains	726.3771	808.7113	919.3019	1048.5488	1111.0204	1129.6845	1074.6673	1010.5607	911.9318	789.1155	710.6657	689.8668 (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	61.0695	61.4069	61.4069	61.8892	61.7317	62.4856	62.4856	62.6260	62.4856	61.8892	62.0434	61.5709
alpha	5.0713	5.0938	5.0938	5.1259	5.1154	5.1657	5.1657	5.1751	5.1657	5.1259	5.1362	5.1047
util living area	0.9856	0.9736	0.9344	0.8213	0.6356	0.4128	0.2768	0.3025	0.5767	0.8729	0.9694	0.9883 (86)
MIT	20.1279	20.2832	20.5476	20.8254	20.9608	20.9966	20.9997	20.9995	20.9819	20.7945	20.4270	20.1007 (87)
Th 2	19.9706	19.9757	19.9757	19.9828	19.9805	19.9916	19.9916	19.9936	19.9916	19.9828	19.9851	19.9781 (88)
util rest of house	0.9810	0.9655	0.9150	0.7769	0.5663	0.3341	0.1924	0.2132	0.4873	0.8279	0.9582	0.9845 (89)
MIT 2	19.2048	19.3604	19.6117	19.8619	19.9600	19.9905	19.9915	19.9935	19.9845	19.8439	19.5102	19.1845 (90)

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CALCULATION OF HEAT DEMAND 09 Jan 2014

Living area fraction									fLA = Living area / (4) =			0.2064 (91)
MIT	19.3954	19.5509	19.8048	20.0607	20.1666	20.1982	20.1996	20.2012	20.1904	20.0401	19.6994	19.3736 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.2454	19.4009	19.6548	19.9107	20.0166	20.0482	20.0496	20.0512	20.0404	19.8901	19.5494	19.2236 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9767	0.9597	0.9077	0.7734	0.5688	0.3385	0.1973	0.2183	0.4918	0.8232	0.9521	0.9807 (94)
Useful gains	709.4477	776.0907	834.4843	810.9627	632.0005	382.4143	211.9967	220.6384	448.5007	649.5883	676.5952	676.5729 (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												
Month fracti	1306.1198	1258.1270	1125.3406	912.1050	650.0682	383.3686	212.0356	220.7040	454.8601	764.4424	1049.6831	1293.4888 (97)
Space heating kWh	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	443.9241	323.9284	216.3971	72.8225	13.4424	0.0000	0.0000	0.0000	0.0000	85.4514	268.6233	458.9854 (98)
RHI space heating demand												1883.5746 (98)
												1884 (98)

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Property and Energy
Services Ltd.

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	45.2400 (1b)	x 2.4200 (2b)	= 109.4808 (1b) - (3b)
First floor	35.9600 (1c)	x 2.5500 (2c)	= 91.6980 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 201.1788 (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) = 0.1988 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4488 (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) =	0.3815 (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	0.4864	0.4769	0.4673	0.4197	0.4101	0.3624	0.3624	0.3529	0.3815	0.4101	0.4292	0.4483 (22b)
Effective ac	0.6183	0.6137	0.6092	0.5881	0.5841	0.5657	0.5657	0.5623	0.5728	0.5841	0.5921	0.6005 (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			2.5500	1.0000	2.5500		(26)
W-1.4 (Uw = 1.40)			16.8000	1.3258	22.2727		(27)
Ground floor			45.2400	0.1200	5.4288		(28a)
Cavity wall	44.7300	19.3500	25.3800	0.2200	5.5836		(29a)
Ceiling	16.8100		16.8100	0.1600	2.6896		(30)
Skeiling	31.5900		31.5900	0.1600	5.0544		(30)
Total net area of external elements Aum(A, m ²)			138.3700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		43.5791		(33)
Party Wall			99.8900	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) =	53.5579 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	41.0484	40.7434	40.4445	39.0404	38.7777	37.5548	37.5548	37.3283	38.0258	38.7777	39.3091	39.8647 (38)
Heat transfer coeff	94.6063	94.3013	94.0024	92.5983	92.3356	91.1126	91.1126	90.8862	91.5837	92.3356	92.8670	93.4226 (39)
Average = Sum(39)m / 12 =												92.5970 (39)
HLP	1.1651	1.1613	1.1577	1.1404	1.1371	1.1221	1.1221	1.1193	1.1279	1.1371	1.1437	1.1505 (40)
HLP (average)												1.1404 (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												2.4852 (42)
Average daily hot water use (litres/day)												93.2243 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.5468	98.8178	95.0888	91.3599	87.6309	83.9019	83.9019	87.6309	91.3599	95.0888	98.8178	102.5468 (44)
Energy conte	152.0739	133.0048	137.2491	119.6571	114.8138	99.0756	91.8081	105.3511	106.6093	124.2429	135.6208	147.2755 (45)
Energy content (annual)											Total = Sum(45)m =	1466.7819 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	22.8111	19.9507	20.5874	17.9486	17.2221	14.8613	13.7712	15.8027	15.9914	18.6364	20.3431	22.0913 (46)
Water storage loss:												
Store volume												150.0000 (47)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.10r08

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

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	198.7723	175.1840	183.9475	164.8491	161.5122	144.2676	138.5065	152.0495	151.8013	170.9413	180.8128	193.9739 (62)
WWHRS	-47.1860	-41.5162	-42.3734	-34.8733	-32.3856	-26.7201	-22.6205	-27.3861	-28.1821	-34.8317	-40.3382	-45.6052 eq. (G10)
Total of WWHRS savings												-424.0185
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	151.5863	133.6678	141.5740	129.9757	129.1265	117.5475	115.8859	124.6634	123.6192	136.1096	140.4746	148.3687 (64)
Heat gains from water heating, kWh/month	87.9233	77.9675	82.9940	75.9396	75.5343	69.0962	67.8849	72.3880	71.6012	78.6695	81.2475	86.3278 (65)
Total per year (kWh/year) = Sum(64)m = 1592.5995 (64)												

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	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.6547	44.1029	35.8669	27.1535	20.2976	17.1361	18.5161	24.0680	32.3040	41.0173	47.8733	51.0348 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	331.2391	334.6764	326.0147	307.5749	284.2981	262.4211	247.8060	244.3688	253.0305	271.4702	294.7470	316.6240 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966 (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)	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094 (71)
Water heating gains (Table 5)	118.1765	116.0230	111.5511	105.4716	101.5246	95.9670	91.2432	97.2957	99.4461	105.7386	112.8438	116.0320 (72)
Total internal gains	604.1717	599.9036	578.5340	545.3015	511.2216	480.6256	462.6666	470.8337	489.8819	523.3274	560.5655	588.7921 (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	8.4100				19.6403		0.6300		0.7000		0.7700		50.4795 (76)
West	8.3900				19.6403		0.6300		0.7000		0.7700		50.3595 (80)
Solar gains	100.8390	197.2624	324.8631	473.7935	580.6517	594.4003	565.8934	486.0940	377.8292	234.0685	125.7343	82.9251 (83)	
Total gains	705.0107	797.1660	903.3971	1019.0949	1091.8733	1075.0259	1028.5600	956.9278	867.7112	757.3959	686.2998	671.7172 (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	59.6038	59.7965	59.9867	60.8963	61.0695	61.8892	61.8892	62.0434	61.5709	61.0695	60.7201	60.3589
alpha	4.9736	4.9864	4.9991	5.0598	5.0713	5.1259	5.1259	5.1362	5.1047	5.0713	5.0480	5.0239
util living area	0.9899	0.9805	0.9529	0.8719	0.7217	0.5314	0.3879	0.4334	0.6824	0.9169	0.9803	0.9919 (86)
MIT	19.9826	20.1497	20.4199	20.7313	20.9181	20.9862	20.9977	20.9961	20.9538	20.6918	20.2843	19.9554 (87)
Th 2	19.9480	19.9510	19.9540	19.9680	19.9706	19.9828	19.9828	19.9851	19.9781	19.9706	19.9653	19.9598 (88)
util rest of house	0.9868	0.9745	0.9387	0.8373	0.6607	0.4517	0.2992	0.3396	0.5986	0.8855	0.9731	0.9894 (89)
MIT 2	19.0429	19.2095	19.4728	19.7692	19.9216	19.9772	19.9823	19.9841	19.9562	19.7451	19.3552	19.0256 (90)
Living area fraction	19.2369	19.4035	19.6683	19.9678	20.1273	20.1855	20.1919	20.1930	20.1621	19.9405	19.5470	19.2175 (92)
MIT	19.0869	19.2535	19.5183	19.8178	19.9773	20.0355	20.0419	20.0430	20.0121	19.7905	19.3970	-0.1500
Temperature adjustment												19.0675 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9833	0.9694	0.9315	0.8316	0.6611	0.4560	0.3044	0.3450	0.6016	0.8789	0.9680	0.9864 (94)
Ext temp.	693.2380	772.7554	841.5148	847.4963	721.8564	490.1720	313.1062	330.1673	522.0284	665.6766	664.3408	662.5848 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	1398.9299	1353.5580	1223.7469	1010.9695	764.2872	495.2425	313.6010	331.0979	541.4524	848.6097	1141.9831	1388.9644 (97)
Space heating kWh	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	525.0348	390.2993	284.3807	117.7007	31.5686	0.0000	0.0000	0.0000	0.0000	136.1022	343.9024	540.4265 (98)
Space heating per m2												2369.4151 (98)
(98) / (4) = 29.1800 (99)												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property and Energy
Services Ltd.

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													2638.5469	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	525.0348	390.2993	284.3807	117.7007	31.5686	0.0000	0.0000	0.0000	0.0000	136.1022	343.9024	540.4265	(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)	584.6712	434.6318	316.6823	131.0698	35.1543	0.0000	0.0000	0.0000	0.0000	151.5615	382.9648	601.8112	(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	151.5863	133.6678	141.5740	129.9757	129.1265	117.5475	115.8859	124.6634	123.6192	136.1096	140.4746	148.3687	(64)	
Efficiency of water heater (217)m	87.1586	86.8045	85.9363	83.8478	80.9959	79.1000	79.1000	79.1000	79.1000	84.1109	86.4101	87.2575	(216)	
Fuel for water heating, kWh/month	173.9201	153.9873	164.7430	155.0139	159.4235	148.6062	146.5056	157.6023	156.2822	161.8216	162.5674	170.0354	(219)	
Water heating fuel used												1910.5084	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2638.5469	(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)													350.7672	(232)
Total delivered energy for all uses													4974.8224	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2638.5469	3.4800	91.8214 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1910.5084	3.4800	66.4857 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	350.7672	13.1900	46.2662 (250)
Additional standing charges			120.0000 (251)
Total energy cost			334.4658 (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] =	1.1131 (257)
SAP value		84.4720
SAP rating (Section 12)		84 (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	2638.5469	0.2160	569.9261 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1910.5084	0.2160	412.6698 (264)
Space and water heating			982.5959 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	350.7672	0.5190	182.0482 (268)
Total kg/year			1203.5691 (272)
CO2 emissions per m2			14.8200 (273)
EI value			87.2204
EI rating			87 (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	$3.48 / 0.8324 = 4.181$, stars = 5
Water heating environmental impact	$0.216 / 0.8324 = 0.2595$, stars = 5

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property and Energy
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CALCULATION OF ENERGY RATINGS 09 Jan 2014

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	45.2400 (1b)	x 2.4200 (2b)	= 109.4808 (1b) - (3b)
First floor	35.9600 (1c)	x 2.5500 (2c)	= 91.6980 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 201.1788 (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) = 0.1988 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4488 (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) =		0.3815 (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	0.4101	0.3910	0.3910	0.3624	0.3720	0.3243	0.3243	0.3147	0.3243	0.3624	0.3529	0.3815 (22b)
Effective ac	0.5841	0.5765	0.5765	0.5657	0.5692	0.5526	0.5526	0.5495	0.5526	0.5657	0.5623	0.5728 (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			2.5500	1.0000	2.5500		(26)
W-1.4 (Uw = 1.40)			16.8000	1.3258	22.2727		(27)
Ground floor			45.2400	0.1200	5.4288		(28a)
Cavity wall	44.7300	19.3500	25.3800	0.2200	5.5836		(29a)
Ceiling	16.8100		16.8100	0.1600	2.6896		(30)
Skeiling	31.5900		31.5900	0.1600	5.0544		(30)
Total net area of external elements Aum(A, m ²)			138.3700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		43.5791		(33)
Party Wall			99.8900	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) =	53.5579 (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	38.7777	38.2704	38.2704	37.5548	37.7873	36.6851	36.6851	36.4828	36.6851	37.5548	37.3283	38.0258 (38)
Heat transfer coeff	92.3356	91.8283	91.8283	91.1126	91.3451	90.2430	90.2430	90.0407	90.2430	91.1126	90.8862	91.5837 (39)
Average = Sum(39)m / 12 =												91.0668 (39)
HLP	1.1371	1.1309	1.1309	1.1221	1.1249	1.1114	1.1114	1.1089	1.1114	1.1221	1.1193	1.1279 (40)
HLP (average)												1.1215 (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												2.4852 (42)
Average daily hot water use (litres/day)												93.2243 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.5468	98.8178	95.0888	91.3599	87.6309	83.9019	83.9019	87.6309	91.3599	95.0888	98.8178	102.5468 (44)
Energy conte	152.0739	133.0048	137.2491	119.6571	114.8138	99.0756	91.8081	105.3511	106.6093	124.2429	135.6208	147.2755 (45)
Energy content (annual)											Total = Sum(45)m =	1466.7819 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	22.8111	19.9507	20.5874	17.9486	17.2221	14.8613	13.7712	15.8027	15.9914	18.6364	20.3431	22.0913 (46)
Water storage loss:												
Store volume												150.0000 (47)

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
Services Ltd.

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

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	198.7723	175.1840	183.9475	164.8491	161.5122	144.2676	138.5065	152.0495	151.8013	170.9413	180.8128	193.9739 (62)
WWHRS	-47.1860	-41.5162	-42.3734	-34.8733	-32.3856	-26.7201	-22.6205	-27.3861	-28.1821	-34.8317	-40.3382	-45.6052 eq. (G10)
Total of WWHRS savings												-424.0185
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	151.5863	133.6678	141.5740	129.9757	129.1265	117.5475	115.8859	124.6634	123.6192	136.1096	140.4746	148.3687 (64)
Heat gains from water heating, kWh/month	87.9233	77.9675	82.9940	75.9396	75.5343	69.0962	67.8849	72.3880	71.6012	78.6695	81.2475	86.3278 (65)
Total per year (kWh/year) = Sum(64)m = 1592.5995 (64)												

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	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.6547	44.1029	35.8669	27.1535	20.2976	17.1361	18.5161	24.0680	32.3040	41.0173	47.8733	51.0348 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	331.2391	334.6764	326.0147	307.5749	284.2981	262.4211	247.8060	244.3688	253.0305	271.4702	294.7470	316.6240 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966 (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)	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094 (71)
Water heating gains (Table 5)	118.1765	116.0230	111.5511	105.4716	101.5246	95.9670	91.2432	97.2957	99.4461	105.7386	112.8438	116.0320 (72)
Total internal gains	604.1717	599.9036	578.5340	545.3015	511.2216	480.6256	462.6666	470.8337	489.8819	523.3274	560.5655	588.7921 (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					8.4100	23.8018	0.6300	0.7000			0.7700			61.1754 (76)
West					8.3900	23.8018	0.6300	0.7000			0.7700			61.0299 (80)
Solar gains	122.2054	208.8077	340.7678	503.2473	599.7988	649.0590	612.0006	539.7269	422.0498	265.7881	150.1002			101.0746 (83)
Total gains	726.3771	808.7113	919.3019	1048.5488	1111.0204	1129.6845	1074.6673	1010.5607	911.9318	789.1155	710.6657			689.8668 (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	61.0695	61.4069	61.4069	61.8892	61.7317	62.4856	62.4856	62.6260	62.4856	61.8892	62.0434	61.5709
alpha	5.0713	5.0938	5.0938	5.1259	5.1154	5.1657	5.1657	5.1751	5.1657	5.1259	5.1362	5.1047
util living area	0.9856	0.9736	0.9344	0.8213	0.6356	0.4128	0.2768	0.3025	0.5767	0.8729	0.9694	0.9883 (86)
MIT	20.1279	20.2832	20.5476	20.8254	20.9608	20.9966	20.9997	20.9995	20.9819	20.7945	20.4270	20.1007 (87)
Th 2	19.9706	19.9757	19.9757	19.9828	19.9805	19.9916	19.9916	19.9936	19.9916	19.9828	19.9851	19.9781 (88)
util rest of house	0.9810	0.9655	0.9150	0.7769	0.5663	0.3341	0.1924	0.2132	0.4873	0.8279	0.9582	0.9845 (89)
MIT 2	19.2048	19.3604	19.6117	19.8619	19.9600	19.9905	19.9915	19.9935	19.9845	19.8439	19.5102	19.1845 (90)
Living area fraction	19.3954	19.5509	19.8048	20.0607	20.1666	20.1982	20.1996	20.2012	20.1904	20.0401	19.6994	19.3736 (92)
MIT	19.3954	19.5509	19.8048	20.0607	20.1666	20.1982	20.1996	20.2012	20.1904	20.0401	19.6994	19.3736 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.2454	19.4009	19.6548	19.9107	20.0166	20.0482	20.0496	20.0512	20.0404	19.8901	19.5494	19.2236 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9767	0.9597	0.9077	0.7734	0.5688	0.3385	0.1973	0.2183	0.4918	0.8232	0.9521	0.9807 (94)
Ext temp.	709.4477	776.0907	834.4843	810.9627	632.0005	382.4143	211.9967	220.6384	448.5007	649.5883	676.5952	676.5729 (95)
Heat loss rate W	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)
Month fracti	1306.1198	1258.1270	1125.3406	912.1050	650.0682	383.3686	212.0356	220.7040	454.8601	764.4424	1049.6831	1293.4888 (97)
Space heating kWh	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	443.9241	323.9284	216.3971	72.8225	13.4424	0.0000	0.0000	0.0000	0.0000	85.4514	268.6233	458.9854 (98)
Space heating per m ²												1883.5746 (98)
										(98) / (4) =		23.1967 (99)

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													2097.5218	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	443.9241	323.9284	216.3971	72.8225	13.4424	0.0000	0.0000	0.0000	0.0000	85.4514	268.6233	458.9854	(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)	494.3475	360.7220	240.9768	81.0941	14.9693	0.0000	0.0000	0.0000	0.0000	95.1575	299.1351	511.1196	(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	151.5863	133.6678	141.5740	129.9757	129.1265	117.5475	115.8859	124.6634	123.6192	136.1096	140.4746	148.3687	(64)	
Efficiency of water heater (217)m	86.8108	86.3865	85.2398	82.6357	79.9988	79.1000	79.1000	79.1000	79.1000	82.9101	85.8140	86.9275	(216)	
Fuel for water heating, kWh/month	174.6169	154.7323	166.0891	157.2876	161.4107	148.6062	146.5056	157.6023	156.2822	164.1652	163.6966	170.6810	(219)	
Water heating fuel used												1921.6757	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2097.5218	(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)													350.7672	(232)
Total delivered energy for all uses													4444.9647	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2097.5218	3.9200	82.2229 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1921.6757	3.9200	75.3297 (247)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	350.7672	16.9600	59.4901 (250)
Additional standing charges			88.0000 (251)
Total energy cost			317.7627 (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	2097.5218	0.2160	453.0647 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1921.6757	0.2160	415.0820 (264)
Space and water heating			868.1467 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	350.7672	0.5190	182.0482 (268)
Total kg/year			1089.1198 (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	2097.5218	1.2200	2558.9766 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1921.6757	1.2200	2344.4444 (264)
Space and water heating			4903.4210 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	350.7672	3.0700	1076.8552 (268)
Primary energy kWh/year			6210.5262 (272)
Primary energy kWh/m2/year			76.4843 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:
Current environmental impact rating:

B 84
B 87

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

(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	+ 1.3	-£ 32	-198 kg (18.1%)
U Solar photovoltaic panels	+ 10.6	-£ 317	-971 kg (108.9%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£32	2.43 kg/m²	B 86 B 89
Solar photovoltaic panels	£317	11.96 kg/m²	A 96 A 99
Total Savings	£349	14.39 kg/m²	

Potential energy efficiency rating: A 96
Potential environmental impact rating: A 99

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	£246	£205	£41
Space heating	£183	£184	-£1
Water heating	£75	£42	£33
Lighting	£59	£59	£0
Generated (PV)	-£0	-£317	£317
Total cost of fuels	£318	-£31	£350
Total cost of uses	£317	-£32	£349
Delivered energy	55 kWh/m²	20 kWh/m²	35 kWh/m²
Carbon dioxide emissions	1.1 tonnes	-0.1 tonnes	1.2 tonnes
CO2 emissions per m²	13 kg/m²	-1 kg/m²	14 kg/m²
Primary energy	76 kWh/m²	-8 kWh/m²	84 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	45.2400 (1b)	x 2.4200 (2b)	= 109.4808 (1b) - (3b)
First floor	35.9600 (1c)	x 2.5500 (2c)	= 91.6980 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 201.1788 (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) = 0.1988 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4488 (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) =	0.3815 (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	0.4864	0.4769	0.4673	0.4197	0.4101	0.3624	0.3624	0.3529	0.3815	0.4101	0.4292	0.4483 (22b)
Effective ac	0.6183	0.6137	0.6092	0.5881	0.5841	0.5657	0.5657	0.5623	0.5728	0.5841	0.5921	0.6005 (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			2.5500	1.0000	2.5500		(26)
W-1.4 (Uw = 1.40)			16.8000	1.3258	22.2727		(27)
Ground floor			45.2400	0.1200	5.4288		(28a)
Cavity wall	44.7300	19.3500	25.3800	0.2200	5.5836		(29a)
Ceiling	16.8100		16.8100	0.1600	2.6896		(30)
Skeiling	31.5900		31.5900	0.1600	5.0544		(30)
Total net area of external elements Aum(A, m ²)			138.3700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.5791		(33)
Party Wall			99.8900	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) =	53.5579 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	41.0484	40.7434	40.4445	39.0404	38.7777	37.5548	37.5548	37.3283	38.0258	38.7777	39.3091	39.8647 (38)
Average = Sum(39)m / 12 =	94.6063	94.3013	94.0024	92.5983	92.3356	91.1126	91.1126	90.8862	91.5837	92.3356	92.8670	93.4226 (39)
												92.5970 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1651	1.1613	1.1577	1.1404	1.1371	1.1221	1.1221	1.1193	1.1279	1.1371	1.1437	1.1505 (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													2.4852 (42)
Average daily hot water use (litres/day)													93.2243 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.5468	98.8178	95.0888	91.3599	87.6309	83.9019	83.9019	87.6309	91.3599	95.0888	98.8178	102.5468 (44)	
Energy conte	152.0739	133.0048	137.2491	119.6571	114.8138	99.0756	91.8081	105.3511	106.6093	124.2429	135.6208	147.2755 (45)	
Energy content (annual)											Total = Sum(45)m =	1466.7819 (45)	
Distribution loss	(46)m = 0.15 x (45)m												
	22.8111	19.9507	20.5874	17.9486	17.2221	14.8613	13.7712	15.8027	15.9914	18.6364	20.3431	22.0913 (46)	
Water storage loss:													
Store volume													190.0000 (47)

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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	0.9840	0.9704	0.9336	0.8375	0.6711	0.4647	0.3108	0.3524	0.6095	0.8827	0.9692	0.9870 (94)
Unstained gains	686.4779	766.4309	835.1462	841.0135	718.5955	489.6585	313.0470	330.0559	520.7339	660.7645	658.0631	655.7260 (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	1398.1794	1352.8525	1223.0323	1010.2549	763.9324	495.1837	313.5929	331.0832	541.3078	848.0640	1141.2905	1388.2122 (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	529.5059	394.0753	288.5872	121.8538	33.7307	0.0000	0.0000	0.0000	0.0000	139.3508	347.9237	544.9697 (98)
Space heating												2399.9972 (98)
Space heating per m2											(98) / (4) =	29.5566 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

[illegible]

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2672.6026	3.4800	93.0066 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	869.9349	3.4800	30.2737 (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	350.7672	13.1900	46.2662 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			78.2111 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.2603	(257)
SAP value		96.3689	
SAP rating (Section 12)		96	(258)
SAP band		A	

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

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2672.6026	0.2160	577.2822 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	869.9349	0.2160	187.9059 (264)
Space and water heating			765.1881 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	350.7672	0.5190	182.0482 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			115.6740 (272)
CO2 emissions per m2			1.4200 (273)
EI value			98.7718
EI rating			99 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property and Energy
Services Ltd.

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	45.2400 (1b)	x 2.4200 (2b)	= 109.4808 (1b) - (3b)
First floor	35.9600 (1c)	x 2.5500 (2c)	= 91.6980 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 201.1788 (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) = 0.1988 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4488 (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) =	0.3815 (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	0.4101	0.3910	0.3910	0.3624	0.3720	0.3243	0.3243	0.3147	0.3243	0.3624	0.3529	0.3815 (22b)
Effective ac	0.5841	0.5765	0.5765	0.5657	0.5692	0.5526	0.5526	0.5495	0.5526	0.5657	0.5623	0.5728 (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			2.5500	1.0000	2.5500		(26)
W-1.4 (Uw = 1.40)			16.8000	1.3258	22.2727		(27)
Ground floor			45.2400	0.1200	5.4288		(28a)
Cavity wall	44.7300	19.3500	25.3800	0.2200	5.5836		(29a)
Ceiling	16.8100		16.8100	0.1600	2.6896		(30)
Skeiling	31.5900		31.5900	0.1600	5.0544		(30)
Total net area of external elements Aum(A, m ²)			138.3700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.5791		(33)
Party Wall			99.8900	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) =	53.5579 (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	38.7777	38.2704	38.2704	37.5548	37.7873	36.6851	36.6851	36.4828	36.6851	37.5548	37.3283	38.0258 (38)
Heat transfer coeff	92.3356	91.8283	91.8283	91.1126	91.3451	90.2430	90.2430	90.0407	90.2430	91.1126	90.8862	91.5837 (39)
Average = Sum(39)m / 12 =												91.0668 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1371	1.1309	1.1309	1.1221	1.1249	1.1114	1.1114	1.1089	1.1114	1.1221	1.1193	1.1279 (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												2.4852 (42)
Average daily hot water use (litres/day)												93.2243 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.5468	98.8178	95.0888	91.3599	87.6309	83.9019	83.9019	87.6309	91.3599	95.0888	98.8178	102.5468 (44)
Energy conte	152.0739	133.0048	137.2491	119.6571	114.8138	99.0756	91.8081	105.3511	106.6093	124.2429	135.6208	147.2755 (45)
Energy content (annual)											Total = Sum(45)m =	1466.7819 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	22.8111	19.9507	20.5874	17.9486	17.2221	14.8613	13.7712	15.8027	15.9914	18.6364	20.3431	22.0913 (46)
Water storage loss:												
Store volume												190.0000 (47)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.10r08



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

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													
	191.9425	169.0151	175.7219	151.4859	141.8880	125.0513	118.6497	133.1232	139.7889	162.7157	174.2033	187.1440	(62)
WWHRS	-47.1860	-41.5162	-42.3734	-34.8733	-32.3856	-26.7201	-22.6205	-27.3861	-28.1821	-34.8317	-40.3382	-45.6052	eq. (G10)
Total of WWHRS savings													-424.0185
Aperture area of solar collector													3.0000 (H1)
Zero-loss collector efficiency													0.7000 (H2)
Collector heat loss coefficient													1.8000 (H3)
Collector 2nd order heat loss coefficient													0.0050 (H3a)
Collector effective heat loss coefficient													1.8063 (H3b)
Collector performance ratio													2.5804 (H4)
Annual solar radiation per m2													1169.5850 (H5)
Overshading factor													0.8000 (H6)
Solar energy available													1964.9028 (H7)
Adjustment factor for showers													1.0000 (H7a)
Solar-to-load ratio													1.8843 (H8)
Utilisation factor													0.4118 (H9)
Collector performance factor													0.8793 (H10)
Dedicated solar storage volume													75.0000 (H11)
Effective solar volume													109.5000 (H13)
Daily hot water demand													93.2243 (H14)
Volume ratio Veff/V													1.1746 (H15)
Solar storage volume factor													1.0000 (H16)
Solar input													-711.4842 (H17)
Solar input	-22.7358	-33.1843	-56.1757	-76.5318	-92.2069	-95.9359	-93.7161	-83.8841	-65.8564	-45.5525	-26.5739	-19.1307	(63)
													-711.4842 (63)
Output from w/h													
	122.0207	94.3146	77.1727	40.0808	17.2954	2.3953	2.3131	21.8531	45.7504	82.3315	107.2912	122.4082	(64)
													735.2271 (64)
Heat gains from water heating, kWh/month													
	82.4594	73.0324	76.4136	65.2491	59.8350	53.7232	51.9995	57.2469	61.9913	72.0890	75.9599	80.8639	(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	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.6547	44.1029	35.8669	27.1535	20.2976	17.1361	18.5161	24.0680	32.3040	41.0173	47.8733	51.0348	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	331.2391	334.6764	326.0147	307.5749	284.2981	262.4211	247.8060	244.3688	253.0305	271.4702	294.7470	316.6240	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	(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)	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	(71)
Water heating gains (Table 5)	110.8326	108.6791	102.7064	90.6237	80.4234	74.6156	69.8918	76.9448	86.0990	96.8938	105.4999	108.6881	(72)
Total internal gains	596.8278	592.5597	569.6893	530.4535	490.1204	459.2742	441.3153	450.4829	476.5348	514.4827	553.2216	581.4482	(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	8.4100	23.8018	0.6300	0.7000	0.7700	61.1754 (76)
West	8.3900	23.8018	0.6300	0.7000	0.7700	61.0299 (80)

Solar gains	122.2054	208.8077	340.7678	503.2473	599.7988	649.0590	612.0006	539.7269	422.0498	265.7881	150.1002	101.0746 (83)
Total gains	719.0332	801.3674	910.4571	1033.7009	1089.9192	1108.3332	1053.3159	990.2098	898.5846	780.2708	703.3217	682.5229 (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	61.0695	61.4069	61.4069	61.8892	61.7317	62.4856	62.4856	62.6260	62.4856	61.8892	62.0434	61.5709
alpha	5.0713	5.0938	5.0938	5.1259	5.1154	5.1657	5.1657	5.1751	5.1657	5.1259	5.1362	5.1047
util living area	0.9862	0.9746	0.9366	0.8275	0.6457	0.4205	0.2824	0.3087	0.5843	0.8769	0.9706	0.9888 (86)
MIT	20.1200	20.2758	20.5402	20.8187	20.9580	20.9963	20.9996	20.9994	20.9808	20.7892	20.4197	20.0927 (87)
Th 2	19.9706	19.9757	19.9757	19.9828	19.9805	19.9916	19.9916	19.9936	19.9916	19.9828	19.9851	19.9781 (88)
util rest of house	0.9817	0.9667	0.9176	0.7837	0.5760	0.3404	0.1963	0.2176	0.4941	0.8328	0.9598	0.9851 (89)
MIT 2	19.1971	19.3533	19.6050	19.8567	19.9584	19.9904	19.9915	19.9935	19.9841	19.8397	19.5033	19.1766 (90)
Living area fraction									fLA = Living area / (4) =			0.2064 (91)
MIT	19.3876	19.5437	19.7981	20.0552	20.1648	20.1980	20.1996	20.2011	20.1898	20.0357	19.6925	19.3657 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.2376	19.3937	19.6481	19.9052	20.0148	20.0480	20.0496	20.0511	20.0398	19.8857	19.5425	19.2157 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property and Energy
Services Ltd.

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9776	0.9609	0.9104	0.7800	0.5784	0.3449	0.2013	0.2228	0.4986	0.8278	0.9537	0.9815	(94)
Useful gains	702.9078	770.0675	828.8354	806.3270	630.4426	382.3134	211.9918	220.6300	448.0411	645.9403	670.7921	669.9069	(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	1305.4048	1257.4669	1124.7180	911.6039	649.8983	383.3560	212.0347	220.7026	454.8073	764.0425	1049.0505	1292.7663	(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	448.2578	327.5324	220.1367	75.7993	14.4750	0.0000	0.0000	0.0000	0.0000	87.8680	272.3460	463.4075	(98)
Space heating												1909.8228	(98)
Space heating per m2												(98) / (4) =	23.5200 (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													2126.7514 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	448.2578	327.5324	220.1367	75.7993	14.4750	0.0000	0.0000	0.0000	0.0000	87.8680	272.3460	463.4075	(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)	499.1735	364.7354	245.1411	84.4091	16.1192	0.0000	0.0000	0.0000	0.0000	97.8486	303.2807	516.0439	(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	122.0207	94.3146	77.1727	40.0808	17.2954	2.3953	2.3131	21.8531	45.7504	82.3315	107.2912	122.4082	(64)
Efficiency of water heater	87.2740	87.1639	86.7539	85.7862	83.6407	79.1000	79.1000	79.1000	79.1000	84.2848	86.4934	87.3315	(216)
(217)m	139.8133	108.2038	88.9560	46.7217	20.6783	3.0282	2.9242	27.6271	57.8387	97.6826	124.0456	140.1649	(219)
Fuel for water heating, kWh/month	139.8133	108.2038	88.9560	46.7217	20.6783	3.0282	2.9242	27.6271	57.8387	97.6826	124.0456	140.1649	(219)
Water heating fuel used													
Annual totals kWh/year													
Space heating fuel - main system													2126.7514 (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)													350.7672 (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													1588.8672 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2126.7514	3.9200	83.3687 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	857.6845	3.9200	33.6212 (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	350.7672	16.9600	59.4901 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	-1871.3360	16.9600	-317.3786 (252)
Total energy cost			-31.6986 (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	2126.7514	0.2160	459.3783 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	857.6845	0.2160	185.2599 (264)
Space and water heating			644.6382 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	350.7672	0.5190	182.0482 (268)
Energy saving/generation technologies			
PV Unit	-1871.3360	0.5190	-971.2234 (269)

FULL SAP CALCULATION PRINTOUT

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Property and Energy
Services Ltd.

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

Total kg/year

-79.6620 (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	2126.7514	1.2200	2594.6368 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	857.6845	1.2200	1046.3751 (264)
Space and water heating			3641.0119 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	350.7672	3.0700	1076.8552 (268)
Energy saving/generation technologies			
PV Unit	-1871.3360	3.0700	-5745.0015 (269)
Primary energy kWh/year			-643.3844 (272)
Primary energy kWh/m2/year			-7.9235 (273)