

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property and Energy
Services Ltd.

Property Reference	3260-3	Issued on Date	10/05/2019
Assessment Reference	3260-3	Prop Type Ref	
Property	3, Aldworth Rise, READING, RG1 7NA		

SAP Rating	83 B	DER	18.46	TER	18.43
Environmental	86 B	% DER<TER	-0.18		
CO ₂ Emissions (t/year)	1.24	DFEE	46.25	TFEE	55.27
General Requirements Compliance	Fail	% DFEE<TFEE	16.32		

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 Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating		secondary heating	other		total	m3 per hour					
Number of chimneys	0	+	0	+	0	=	0 * 40 = 0.0000 (6a)					
Number of open flues	0	+	0	+	0	=	0 * 20 = 0.0000 (6b)					
Number of intermittent fans							3 * 10 = 30.0000 (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) =					30.0000 / (5) =	0.1489 (8)					
Pressure test						Yes						
Measured/design AP50							4.5200					
Infiltration rate							0.3749 (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) =	0.3186 (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	0.3425	0.3266	0.3266	0.3027	0.3107	0.2708	0.2708	0.2629	0.2708	0.3027	0.2947	0.3186 (22b)
Effective ac	0.5587	0.5533	0.5533	0.5458	0.5483	0.5367	0.5367	0.5346	0.5367	0.5458	0.5434	0.5508 (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)			18.0000	1.3258	23.8636			(27)				
Velux (Uw = 1.40)			1.6200	1.3258	2.1477			(27a)				
Ground floor			45.2500	0.0900	4.0725			(28a)				
Cavity wall	89.5500	20.3000	69.2500	0.2200	15.2350			(29a)				
Ceiling	15.9600		15.9600	0.1100	1.7556			(30)				
Skelling	30.9300	1.6200	29.3100	0.1600	4.6896			(30)				
Total net area of external elements Aum(A, m2)			181.6900					(31)				
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.0641			(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)								6.5083 (36)				
Total fabric heat loss						(33) + (36) =		60.5723 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 37.1546	Feb 36.8001	Mar 36.8001	Apr 36.3000	May 36.4625	Jun 35.6924	Jul 35.6924	Aug 35.5510	Sep 35.6924	Oct 36.3000	Nov 36.1418	Dec 36.6292 (38)

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Heat transfer coeff	97.7269	97.3724	97.3724	96.8724	97.0348	96.2647	96.2647	96.1233	96.2647	96.8724	96.7141	97.2015 (39)
Average = Sum(39)m / 12 =												96.8404 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2015	1.1971	1.1971	1.1910	1.1930	1.1835	1.1835	1.1817	1.1835	1.1910	1.1890	1.1950 (40)
Days in month												1.1906 (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												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5300 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8262 (55)
Total storage loss	25.6122	23.1336	25.6122	24.7860	25.6122	24.7860	25.6122	25.6122	24.7860	25.6122	24.7860	25.6122 (56)
If cylinder contains dedicated solar storage	25.6122	23.1336	25.6122	24.7860	25.6122	24.7860	25.6122	25.6122	24.7860	25.6122	24.7860	25.6122 (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	201.0477	177.2363	186.2131	167.0331	163.7632	146.4382	140.7425	154.2944	153.9768	173.1985	183.0073	196.2461 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	201.0477	177.2363	186.2131	167.0331	163.7632	146.4382	140.7425	154.2944	153.9768	173.1985	183.0073	196.2461 (64)
RHI water heating demand												2043.1972 (64)
Heat gains from water heating, kWh/month	89.6972	79.5688	84.7647	77.6503	77.3002	70.8025	69.6458	74.1518	73.3091	80.4374	82.9617	88.1007 (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)	120.5608	118.4059	113.9311	107.8476	103.8981	98.3368	93.6099	99.6663	101.8182	108.1148	115.2246	118.4149 (72)
Total internal gains	606.9276	602.6769	581.3142	548.0761	513.9811	483.3611	465.3766	473.5290	492.5687	526.0199	563.2751	591.5242 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				10.2900	12.7650		0.6300		0.7000		0.7700		40.1430 (74)
East				3.8000	23.8018		0.6300		0.7000		0.7700		27.6417 (76)
South				3.9100	54.2217		0.6300		0.7000		0.7700		64.7921 (78)
North				1.0800	21.1256		0.6300		0.7000		1.0000		9.0555 (82)
East				0.5400	32.6211		0.6300		0.7000		1.0000		6.9915 (82)
Solar gains	148.6238	235.4260	359.9303	525.0051	639.3253	702.6979	657.8677	566.9237	440.6102	290.7014	178.2048	126.0953	(83)
Total gains	755.5514	838.1029	941.2445	1073.0812	1153.3064	1186.0590	1123.2444	1040.4527	933.1789	816.7212	741.4799	717.6194	(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	57.8000	58.0104	58.0104	58.3098	58.2122	58.6779	58.6779	58.7642	58.6779	58.3098	58.4052	58.1124
alpha	4.8533	4.8674	4.8674	4.8873	4.8808	4.9119	4.9119	4.9176	4.9119	4.8873	4.8937	4.8742
util living area	0.9842	0.9725	0.9365	0.8310	0.6442	0.4185	0.2824	0.3134	0.5952	0.8756	0.9676	0.9871 (86)
MIT	20.2490	20.3649	20.5641	20.7867	20.9074	20.9411	20.9444	20.9442	20.9257	20.7682	20.4804	20.2253 (87)

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Th 2	19.9188	19.9223	19.9223	19.9272	19.9256	19.9332	19.9332	19.9346	19.9332	19.9272	19.9288	19.9240 (88)
util rest of house	0.9792	0.9638	0.9172	0.7863	0.5717	0.3344	0.1913	0.2156	0.4997	0.8300	0.9557	0.9829 (89)
MIT 2	18.9469	19.1150	19.3929	19.6853	19.8160	19.8508	19.8523	19.8537	19.8415	19.6716	19.2871	18.9172 (90)
Living area fraction	19.2024	19.3603	19.6227	19.9014	20.0302	20.0647	20.0666	20.0677	fLA = Living area / (4) =			0.1962 (91)
MIT	19.2024	19.3603	19.6227	19.9014	20.0302	20.0647	20.0666	20.0677	20.0542	19.8867	19.5212	19.1738 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.0524	19.2103	19.4727	19.7514	19.8802	19.9147	19.9166	19.9177	19.9042	19.7367	19.3712	19.0238 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9738	0.9565	0.9073	0.7781	0.5684	0.3329	0.1899	0.2140	0.4970	0.8203	0.9475	0.9781	(94)
Useful gains	735.7348	801.6242	853.9774	834.9403	655.5584	394.8927	213.3261	222.6925	463.7452	669.9793	702.5749	701.9393	(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	1363.5224	1315.5265	1175.5521	954.3323	677.3177	396.1018	213.3756	222.7820	472.1030	797.9107	1099.7575	1353.4176	(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	467.0740	345.3423	239.2516	85.9623	16.1890	0.0000	0.0000	0.0000	0.0000	95.1809	285.9715	484.6998	(98)
Space heating												2019.6713	(98)
RHI space heating demand												2020	(98)

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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					3 * 10 = 30.0000 (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) =					30.0000 / (5) = 0.1489 (8)
Pressure test					Yes
Measured/design AP50					4.5200
Infiltration rate					0.3749 (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) =	0.3186 (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	0.4063	0.3983	0.3903	0.3505	0.3425	0.3027	0.3027	0.2947	0.3186	0.3425	0.3585	0.3744 (22b)
Effective ac	0.5825	0.5793	0.5762	0.5614	0.5587	0.5458	0.5458	0.5434	0.5508	0.5587	0.5642	0.5701 (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)			18.0000	1.3258	23.8636		(27)
Velux (Uw = 1.40)			1.6200	1.3258	2.1477		(27a)
Ground floor			45.2500	0.0900	4.0725		(28a)
Cavity wall	89.5500	20.3000	69.2500	0.2200	15.2350		(29a)
Ceiling	15.9600		15.9600	0.1100	1.7556		(30)
Skelling	30.9300	1.6200	29.3100	0.1600	4.6896		(30)
Total net area of external elements Aum(A, m ²)			181.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.0641		(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)	6.5083 (36)
Total fabric heat loss	(33) + (36) = 60.5723 (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	38.7413	38.5282	38.3193	37.3382	37.1546	36.3000	36.3000	36.1418	36.6292	37.1546	37.5260	37.9142 (38)
Heat transfer coeff	99.3136	99.1005	98.8916	97.9105	97.7269	96.8724	96.8724	96.7141	97.2015	97.7269	98.0983	98.4865 (39)
Average = Sum(39)m / 12 =												97.9096 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2210	1.2183	1.2158	1.2037	1.2015	1.1910	1.1910	1.1890	1.1950	1.2015	1.2060	1.2108 (40)
HLP (average)												1.2037 (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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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	2777.3711 (211)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	544.4034	406.0009	303.9690	133.1435	36.6495	0.0000	0.0000	0.0000	0.0000	146.2800	359.4183	564.2147 (98)
Space heating efficiency (main heating system 1)	89.8000	89.8000	89.8000	89.8000	89.8000	0.0000	0.0000	0.0000	0.0000	89.8000	89.8000	89.8000 (210)
Space heating fuel (main heating system)	606.2399	452.1168	338.4955	148.2667	40.8124	0.0000	0.0000	0.0000	0.0000	162.8953	400.2431	628.3014 (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	201.0477	177.2363	186.2131	167.0331	163.7632	146.4382	140.7425	154.2944	153.9768	173.1985	183.0073	196.2461 (64)
Efficiency of water heater (217)m	86.6392	86.2544	85.4109	83.5138	80.8620	79.1000	79.1000	79.1000	79.1000	83.6645	85.8805	79.1000 (216)
Fuel for water heating, kWh/month	232.0517	205.4810	218.0203	200.0066	202.5220	185.1304	177.9299	195.0624	194.6610	207.0156	213.0952	226.1656 (219)
Water heating fuel used												2457.1418 (219)
Annual totals kWh/year												
Space heating fuel - main system												2777.3711 (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)
Total delivered energy for all uses												5659.3800 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2777.3711	3.4800	96.6525 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2457.1418	3.4800	85.5085 (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)
Total energy cost			358.2010 (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] = 1.1908 (257)
SAP value	83.3885
SAP rating (Section 12)	83 (258)
SAP band	B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2777.3711	0.2160	599.9122 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2457.1418	0.2160	530.7426 (264)
Space and water heating			1130.6548 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	349.8671	0.5190	181.5810 (268)
Total kg/year			1351.1608 (272)
CO2 emissions per m2			16.6100 (273)
EI value			85.6692
EI rating			86 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.25) / 0.8980 = 4.156$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.25) / 0.8980 = 0.2580$, stars = 4
Water heating energy efficiency	$3.48 / 0.8295 = 4.195$, stars = 4
Water heating environmental impact	$0.216 / 0.8295 = 0.2604$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

SAP 2012 WORKSHEET FOR New Build (As Built) (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					3 * 10 = 30.0000 (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) =					30.0000 / (5) = 0.1489 (8)
Pressure test					Yes
Measured/design AP50					4.5200
Infiltration rate					0.3749 (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) =	0.3186 (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	0.3425	0.3266	0.3266	0.3027	0.3107	0.2708	0.2708	0.2629	0.2708	0.3027	0.2947	0.3186 (22b)
Effective ac	0.5587	0.5533	0.5533	0.5458	0.5483	0.5367	0.5367	0.5346	0.5367	0.5458	0.5434	0.5508 (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)			18.0000	1.3258	23.8636		(27)
Velux (Uw = 1.40)			1.6200	1.3258	2.1477		(27a)
Ground floor			45.2500	0.0900	4.0725		(28a)
Cavity wall	89.5500	20.3000	69.2500	0.2200	15.2350		(29a)
Ceiling	15.9600		15.9600	0.1100	1.7556		(30)
Skelling	30.9300	1.6200	29.3100	0.1600	4.6896		(30)
Total net area of external elements Aum(A, m ²)			181.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.0641		(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)							6.5083 (36)
Total fabric heat loss						(33) + (36) =	60.5723 (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	37.1546	36.8001	36.8001	36.3000	36.4625	35.6924	35.6924	35.5510	35.6924	36.3000	36.1418	36.6292 (38)
Heat transfer coeff	97.7269	97.3724	97.3724	96.8724	97.0348	96.2647	96.2647	96.1233	96.2647	96.8724	96.7141	97.2015 (39)
Average = Sum(39)m / 12 =												96.8404 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2015	1.1971	1.1971	1.1910	1.1930	1.1835	1.1835	1.1817	1.1835	1.1910	1.1890	1.1950 (40)
HLP (average)												1.1906 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

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FULL SAP CALCULATION PRINTOUT

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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													89.8000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2249.0772 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	467.0740	345.3423	239.2516	85.9623	16.1890	0.0000	0.0000	0.0000	0.0000	95.1809	285.9715	484.6998	(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)	520.1269	384.5683	266.4271	95.7263	18.0278	0.0000	0.0000	0.0000	0.0000	105.9921	318.4538	539.7548	(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	201.0477	177.2363	186.2131	167.0331	163.7632	146.4382	140.7425	154.2944	153.9768	173.1985	183.0073	196.2461	(64)
Efficiency of water heater (217)m	86.2876	85.8608	84.7806	82.4376	79.9571	79.1000	79.1000	79.1000	79.1000	82.5901	85.2975	86.4305	(216)
Fuel for water heating, kWh/month	232.9971	206.4228	219.6412	202.6177	204.8139	185.1304	177.9299	195.0624	194.6610	209.7086	214.5519	227.0565	(219)
Water heating fuel used												2470.5932	(219)
Annual totals kWh/year													
Space heating fuel - main system												2249.0772	(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)
Total delivered energy for all uses													5144.5375 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2249.0772	3.9200	88.1638 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2470.5932	3.9200	96.8473 (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)
Total energy cost			345.0685 (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	2249.0772	0.2160	485.8007 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2470.5932	0.2160	533.6481 (264)
Space and water heating			1019.4488 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	349.8671	0.5190	181.5810 (268)
Total kg/year			1239.9548 (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	2249.0772	1.2200	2743.8741 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2470.5932	1.2200	3014.1238 (264)
Space and water heating			5757.9979 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	349.8671	3.0700	1074.0920 (268)
Primary energy kWh/year			7062.3399 (272)
Primary energy kWh/m2/year			86.8249 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:

B 83

FULL SAP CALCULATION PRINTOUT

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Current environmental impact rating:

B 86

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.7	-£ 43	-257 kg (20.7%)
U Solar photovoltaic panels	+ 10.6	-£ 317	-971 kg (98.8%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£43	3.16 kg/m²	B 85
Solar photovoltaic panels	£317	11.94 kg/m²	A 96
Total Savings	£360	15.10 kg/m²	B 88

Potential energy efficiency rating: A 96
Potential environmental impact rating: A 98

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	£273	£222	£51
Space heating	£189	£190	-£2
Water heating	£97	£52	£44
Lighting	£59	£59	£0
Generated (PV)	-£0	-£317	£317
Total cost of fuels	£345	-£14	£360
Total cost of uses	£345	-£16	£359
Delivered energy	63 kWh/m²	25 kWh/m²	38 kWh/m²
Carbon dioxide emissions	1.2 tonnes	0.0 tonnes	1.2 tonnes
CO2 emissions per m²	15 kg/m²	0 kg/m²	15 kg/m²
Primary energy	87 kWh/m²	-2 kWh/m²	88 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property and Energy
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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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					3 * 10 = 30.0000 (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)					30.0000 / (5) = 0.1489 (8)
Pressure test					Yes
Measured/design AP50					4.5200
Infiltration rate					0.3749 (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) =	0.3186 (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	0.4063	0.3983	0.3903	0.3505	0.3425	0.3027	0.3027	0.2947	0.3186	0.3425	0.3585	0.3744 (22b)
Effective ac	0.5825	0.5793	0.5762	0.5614	0.5587	0.5458	0.5458	0.5434	0.5508	0.5587	0.5642	0.5701 (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)			18.0000	1.3258	23.8636		(27)
Velux (Uw = 1.40)			1.6200	1.3258	2.1477		(27a)
Ground floor			45.2500	0.0900	4.0725		(28a)
Cavity wall	89.5500	20.3000	69.2500	0.2200	15.2350		(29a)
Ceiling	15.9600		15.9600	0.1100	1.7556		(30)
Skelling	30.9300	1.6200	29.3100	0.1600	4.6896		(30)
Total net area of external elements Aum(A, m ²)			181.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.0641		(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)							6.5083 (36)
Total fabric heat loss						(33) + (36) =	60.5723 (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	38.7413	38.5282	38.3193	37.3382	37.1546	36.3000	36.3000	36.1418	36.6292	37.1546	37.5260	37.9142 (38)
Heat transfer coeff	99.3136	99.1005	98.8916	97.9105	97.7269	96.8724	96.8724	96.7141	97.2015	97.7269	98.0983	98.4865 (39)
Average = Sum(39)m / 12 =												97.9096 (39)
HLP	1.2210	1.2183	1.2158	1.2037	1.2015	1.1910	1.1910	1.1890	1.1950	1.2015	1.2060	1.2108 (40)
HLP (average)												1.2037 (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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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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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	0.9819	0.9672	0.9318	0.8400	0.6716	0.4617	0.3062	0.3527	0.6144	0.8786	0.9658	0.9852	(94)
Useful gains	708.9421	791.8608	853.0080	860.0077	742.0547	506.8299	319.9791	338.1454	535.9361	679.9425	681.2855	676.9757	(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	1448.9180	1403.7185	1269.0158	1052.0334	794.8157	513.5787	320.6703	339.5118	561.1375	882.2854	1188.1088	1443.7214	(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	550.5420	411.1684	309.5098	138.2585	39.2542	0.0000	0.0000	0.0000	0.0000	150.5431	364.9128	570.4588	(98)
Space heating												2534.6475	(98)
Space heating per m2											(98) / (4) =	31.1611	(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													2822.5474	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	550.5420	411.1684	309.5098	138.2585	39.2542	0.0000	0.0000	0.0000	0.0000	150.5431	364.9128	570.4588	(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)	613.0758	457.8713	344.6657	153.9627	43.7129	0.0000	0.0000	0.0000	0.0000	167.6426	406.3616	635.2548	(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	165.8497	125.8047	102.3595	53.3232	20.6994	5.9029	1.0478	30.3227	59.1925	107.5299	143.3413	165.2346	(64)	
Efficiency of water heater	87.0732	87.0415	86.8793	86.5417	85.7932	79.1000	79.1000	79.1000	79.1000	85.0087	86.5000	87.1522	(216)	
Fuel for water heating, kWh/month	190.4717	144.5343	117.8181	61.6157	24.1271	7.4625	1.3247	38.3346	74.8325	126.4929	165.7125	189.5932	(219)	
Water heating fuel used												1142.3196	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2822.5474	(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 * 2.50 * 1080 * 0.80) =									-1727.2394			-1727.2394	(233)	
Total delivered energy for all uses												2712.4947	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2822.5474	3.4800	98.2246	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1142.3196	3.4800	39.7527	(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	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			92.7895	(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] =	0.3085	(257)
SAP value		95.6969	
SAP rating (Section 12)		96	(258)
SAP band		A	

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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	2822.5474	0.2160	609.6702 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1142.3196	0.2160	246.7410 (264)
Space and water heating			856.4113 (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	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			206.4300 (272)
CO2 emissions per m2			2.5400 (273)
EI value			97.8105
EI rating			98 (274)
EI band			A

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

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (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)					30.0000 / (5) = 0.1489 (8)
Pressure test					Yes
Measured/design AP50					4.5200
Infiltration rate					0.3749 (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) =	0.3186 (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	0.3425	0.3266	0.3266	0.3027	0.3107	0.2708	0.2708	0.2629	0.2708	0.3027	0.2947	0.3186 (22b)
Effective ac	0.5587	0.5533	0.5533	0.5458	0.5483	0.5367	0.5367	0.5346	0.5367	0.5458	0.5434	0.5508 (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)			18.0000	1.3258	23.8636		(27)
Velux (Uw = 1.40)			1.6200	1.3258	2.1477		(27a)
Ground floor			45.2500	0.0900	4.0725		(28a)
Cavity wall	89.5500	20.3000	69.2500	0.2200	15.2350		(29a)
Ceiling	15.9600		15.9600	0.1100	1.7556		(30)
Skelling	30.9300	1.6200	29.3100	0.1600	4.6896		(30)
Total net area of external elements Aum(A, m ²)			181.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.0641		(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)							6.5083 (36)
Total fabric heat loss						(33) + (36) =	60.5723 (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	37.1546	36.8001	36.8001	36.3000	36.4625	35.6924	35.6924	35.5510	35.6924	36.3000	36.1418	36.6292 (38)
Heat transfer coeff	97.7269	97.3724	97.3724	96.8724	97.0348	96.2647	96.2647	96.1233	96.2647	96.8724	96.7141	97.2015 (39)
Average = Sum(39)m / 12 =												96.8404 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2015	1.1971	1.1971	1.1910	1.1930	1.1835	1.1835	1.1817	1.1835	1.1910	1.1890	1.1950 (40)
HLP (average)												1.1906 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9750	0.9582	0.9106	0.7855	0.5788	0.3398	0.1941	0.2189	0.5050	0.8262	0.9499	0.9793	(94)
Useful gains	726.6817	793.2695	846.3544	828.9797	653.5997	394.7598	213.3194	222.6803	463.0625	665.0275	694.5591	692.7028	(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	1362.4546	1314.5369	1174.6433	953.6329	677.0873	396.0840	213.3743	222.7797	472.0184	797.3215	1098.8097	1352.3354	(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	473.0150	350.2917	244.2469	89.7503	17.4748	0.0000	0.0000	0.0000	0.0000	98.4267	291.0604	490.7667	(98)
Space heating												2055.0324	(98)
Space heating per m2											(98) / (4) =	25.2647	(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													2288.4548	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	473.0150	350.2917	244.2469	89.7503	17.4748	0.0000	0.0000	0.0000	0.0000	98.4267	291.0604	490.7667	(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)	526.7428	390.0799	271.9898	99.9446	19.4596	0.0000	0.0000	0.0000	0.0000	109.6065	324.1208	546.5108	(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	162.4546	126.2156	103.4949	53.2537	23.6056	2.0111	0.0000	25.4696	55.1892	104.0545	139.8178	162.2598	(64)	
Efficiency of water heater	86.7984	86.6937	86.3246	85.4933	83.3233	79.1000	79.1000	79.1000	79.1000	83.9632	86.0240	86.8798	(216)	
Fuel for water heating, kWh/month	187.1632	145.5879	119.8903	62.2898	28.3301	2.5424	0.0000	32.1992	69.7714	123.9287	162.5335	186.7634	(219)	
Water heating fuel used												1121.0002	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2288.4548	(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 * 2.50 * 1170 * 0.80) =									-1871.3360			-1871.3360	(233)	
Total delivered energy for all uses												2012.9861	(238)	

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2288.4548	3.9200	89.7074	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1121.0002	3.9200	43.9432	(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	-1871.3360	16.9600	-317.3786	(252)
Total energy cost			-15.1905	(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	2288.4548	0.2160	494.3062	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1121.0002	0.2160	242.1360	(264)
Space and water heating			736.4423	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	349.8671	0.5190	181.5810	(268)

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Energy saving/generation technologies			
PV Unit	-1871.3360	0.5190	-971.2234 (269)
Total kg/year			11.6749 (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	2288.4548	1.2200	2791.9149 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1121.0002	1.2200	1367.6202 (264)
Space and water heating			4159.5351 (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	-1871.3360	3.0700	-5745.0015 (269)
Primary energy kWh/year			-127.6244 (272)
Primary energy kWh/m2/year			-1.5690 (273)