

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	1 Be Lean	Issued on Date	05/05/2026
Assessment Reference	001	Prop Type Ref	Westbury Avenue
Property			
SAP Rating	83 B	DER	18.81
Environmental	85 B	% DER<TER	5.10
CO ₂ Emissions (t/year)	1.24	DFEE	57.99
General Requirements Compliance	Fail	% DFEE<TFEE	7.50
Assessor Details	Mr. Neil Ingham, The PES Ltd, Tel: 02071 486 292, neil@thepes.co.uk	Assessor ID	AV35-0001
Client			

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)
Basement floor	41.1400 (1a)	x 2.4600 (2a)	= 101.2044 (1a) - (3a)
Ground floor	35.5500 (1b)	x 2.7600 (2b)	= 98.1180 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.3224 (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) =	0.1505 (8)				
Pressure test							Yes					
Measured/design AP50							4.0000					
Infiltration rate							0.3505	(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) =	0.2979 (21)				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.3128	0.2979	0.2979	0.2756	0.2756	0.2458	0.2532	0.2383	0.2458	0.2607	0.2607	0.2830 (22b)
Effective ac	0.5489	0.5444	0.5444	0.5380	0.5380	0.5302	0.5321	0.5284	0.5302	0.5340	0.5340	0.5401 (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
G (Uw = 1.40)			18.9400	1.3258	25.1098		(27)
D			2.0700	1.4000	2.8980		(26)
RL (Uw = 1.40)			14.0500	1.3258	18.6269		(27a)
BF			39.6400	0.1800	7.1352	110.0000	4360.4000 (28)
EF			1.5000	0.1800	0.2700	110.0000	165.0000 (28a)
EW	157.4000	21.0100	136.3900	0.2000	27.2780	60.0000	8183.4000 (29a)
FR	42.6400	14.0500	28.5900	0.1500	4.2885	9.0000	257.3100 (30)
Total net area of external elements Aum(A, m ²)			241.1800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	85.6064		(33)
Internal Wall 1			115.0500			9.0000	1035.4500 (32c)
Internal Floor 1			34.0500			18.0000	612.9000 (32d)
Internal Ceiling 1			34.0500			18.0000	612.9000 (32e)
Heat capacity Cm = Sum (A x k)					(28)...(30) + (32) + (32a)...(32e) =		15227.3600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							198.5573 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.1659 (36)
Total fabric heat loss						(33) + (36) =	95.7724 (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
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(38)m	36.1067	35.8075	35.8075	35.3860	35.3860	34.8751	34.9974	34.7565	34.8751	35.1233	35.1233	35.5229 (38)
Heat transfer coeff	131.8791	131.5799	131.5799	131.1584	131.1584	130.6475	130.7698	130.5289	130.6475	130.8957	130.8957	131.2952 (39)
Average = Sum(39)m / 12 =												131.0863 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.7196	1.7157	1.7157	1.7102	1.7102	1.7036	1.7052	1.7020	1.7036	1.7068	1.7068	1.7120 (40)
HLP (average)												1.7093 (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												2.3971 (42)
Average daily hot water use (litres/day)												91.1301 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	100.2431	96.5979	92.9527	89.3075	85.6623	82.0171	82.0171	85.6623	89.3075	92.9527	96.5979	100.2431 (44)
Energy conte	148.6576	130.0169	134.1658	116.9690	112.2346	96.8499	89.7457	102.9845	104.2144	121.4519	132.5742	143.9670 (45)
Energy content (annual)										Total = Sum(45)m =		1433.8314 (45)
Distribution loss (46)m = 0.15 x (45)m	22.2986	19.5025	20.1249	17.5454	16.8352	14.5275	13.4618	15.4477	15.6322	18.2178	19.8861	21.5950 (46)
Water storage loss:												
Store volume												170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6480 (55)
Total storage loss	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (56)
If cylinder contains dedicated solar storage												
Primary loss	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (57)
Total heat required for water heating calculated for each month	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)
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	192.0080	169.1721	177.5162	158.9210	155.5850	138.8019	133.0961	146.3349	146.1664	164.8023	174.5262	187.3174 (62)
RHI water heating demand												1944.2474 (64)
Heat gains from water heating, kWh/month	84.1090	74.5548	79.2905	72.4538	71.9983	65.7642	64.5208	68.9227	68.2129	75.0631	77.6425	82.5493 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	143.8234	143.8234	143.8234	143.8234	143.8234	143.8234	143.8234	143.8234	143.8234	143.8234	143.8234	143.8234 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.3355	42.0429	34.1916	25.8853	19.3495	16.3357	17.6513	22.9438	30.7951	39.1015	45.6372	48.6511 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	316.9910	320.2804	311.9912	294.3447	272.0691	251.1332	237.1467	233.8573	242.1464	259.7930	282.0686	303.0045 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.7794	51.7794	51.7794	51.7794	51.7794	51.7794	51.7794	51.7794	51.7794	51.7794	51.7794	51.7794 (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)	-95.8823	-95.8823	-95.8823	-95.8823	-95.8823	-95.8823	-95.8823	-95.8823	-95.8823	-95.8823	-95.8823	-95.8823 (71)
Water heating gains (Table 5)	113.0497	110.9446	106.5732	100.6303	96.7719	91.3391	86.7214	92.6380	94.7401	100.8912	107.8368	110.9534 (72)
Total internal gains	580.0967	575.9885	555.4766	523.5808	490.9111	461.5285	444.2399	452.1596	470.4022	502.5062	538.2632	565.3295 (73)

6. Solar gains

[Jan]			Area		Solar flux		g		FF		Access		Gains
			m2		Table 6a		Specific data		Specific data		factor		W
					W/m2		or Table 6b		or Table 6c		Table 6d		
Northeast			1.1300		12.9236		0.6300		0.7000		0.7700		4.4631 (75)
Southeast			14.0500		40.4699		0.6300		0.7000		0.7700		173.7723 (77)
Southwest			3.7600		40.4699		0.6300		0.7000		0.7700		46.5042 (79)
Northeast			14.0500		30.0000		0.6300		0.7000		1.0000		167.2934 (82)
Solar gains	392.0328	658.0360	1018.1107	1486.6493	1763.0511	1932.1514	1818.8873	1601.5690	1264.7595	816.2422	493.4959	324.1716	(83)
Total gains	972.1295	1234.0244	1573.5873	2010.2301	2253.9622	2393.6799	2263.1272	2053.7286	1735.1618	1318.7484	1031.7591	889.5012	(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	32.0735	32.1464	32.1464	32.2497	32.2497	32.3758	32.3456	32.4052	32.3758	32.3145	32.3145	32.2161
alpha	3.1382	3.1431	3.1431	3.1500	3.1500	3.1584	3.1564	3.1603	3.1584	3.1543	3.1543	3.1477
util living area	0.9499	0.9056	0.8050	0.6263	0.4422	0.2696	0.1785	0.2023	0.4181	0.7323	0.9071	0.9597 (86)
MIT	19.7689	20.0268	20.4037	20.7220	20.8630	20.9070	20.9132	20.9127	20.8832	20.6557	20.1655	19.7084 (87)

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Th 2	19.5268	19.5296	19.5296	19.5335	19.5335	19.5383	19.5371	19.5394	19.5383	19.5360	19.5360	19.5322 (88)
util rest of house	0.9366	0.8831	0.7640	0.5653	0.3688	0.1923	0.0945	0.1105	0.3202	0.6624	0.8801	0.9487 (89)
MIT 2	17.9830	18.3410	18.8407	19.2261	19.3715	19.4104	19.4120	19.4143	19.3972	19.1742	18.5483	17.9023 (90)
Living area fraction	18.2729	18.6147	19.0945	19.4689	19.6136	19.6534	19.6557	19.6575	fLA = Living area / (4) =			0.1623 (91)
MIT	18.2729	18.6147	19.0945	19.4689	19.6136	19.6534	19.6557	19.6575	19.6385	19.4147	18.8108	18.1955 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1229	18.4647	18.9445	19.3189	19.4636	19.5034	19.5057	19.5075	19.4885	19.2647	18.6608	18.0455 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9196	0.8625	0.7451	0.5556	0.3651	0.1904	0.0927	0.1084	0.3167	0.6476	0.8593	0.9334 (94)	
Useful gains	893.9967	1064.4000	1172.4523	1116.9348	823.0266	455.7126	209.8737	222.7048	549.5035	854.0307	886.6161	830.2348 (95)	
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)	
Heat loss rate W	1717.4502	1692.7350	1519.0172	1235.3727	847.7567	457.7062	209.9786	222.8827	560.2795	1003.2769	1395.4551	1699.6864 (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	612.6494	422.2411	257.8443	85.2753	18.3992	0.0000	0.0000	0.0000	0.0000	111.0392	366.3641	646.8720 (98)	
Space heating												2520.6845 (98)	
RHI space heating demand												2521 (98)	

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Basement floor	41.1400 (1a)	x 2.4600 (2a)	= 101.2044 (1a) - (3a)
Ground floor	35.5500 (1b)	x 2.7600 (2b)	= 98.1180 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.3224 (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) = 0.1505 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.3505 (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) =	0.2979 (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	0.3799	0.3724	0.3650	0.3277	0.3203	0.2830	0.2830	0.2756	0.2979	0.3203	0.3352	0.3501 (22b)
Effective ac	0.5721	0.5693	0.5666	0.5537	0.5513	0.5401	0.5401	0.5380	0.5444	0.5513	0.5562	0.5613 (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
G (Uw = 1.40)			18.9400	1.3258	25.1098		(27)
D			2.0700	1.4000	2.8980		(26)
RL (Uw = 1.40)			14.0500	1.3258	18.6269		(27a)
BF			39.6400	0.1800	7.1352	110.0000	4360.4000 (28)
EF			1.5000	0.1800	0.2700	110.0000	165.0000 (28a)
EW	157.4000	21.0100	136.3900	0.2000	27.2780	60.0000	8183.4000 (29a)
FR	42.6400	14.0500	28.5900	0.1500	4.2885	9.0000	257.3100 (30)
Total net area of external elements Aum(A, m ²)			241.1800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	85.6064		(33)
Internal Wall 1			115.0500			9.0000	1035.4500 (32c)
Internal Floor 1			34.0500			18.0000	612.9000 (32d)
Internal Ceiling 1			34.0500			18.0000	612.9000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15227.3600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							198.5573 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.1659 (36)
Total fabric heat loss						(33) + (36) =	95.7724 (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	37.6339	37.4496	37.2690	36.4205	36.2618	35.5229	35.5229	35.3860	35.8075	36.2618	36.5829	36.9187 (38)
Heat transfer coeff	133.4063	133.2220	133.0413	132.1929	132.0342	131.2952	131.2952	131.1584	131.5799	132.0342	132.3553	132.6910 (39)
Average = Sum(39)m / 12 =												132.1922 (39)
HLP	1.7396	1.7371	1.7348	1.7237	1.7217	1.7120	1.7120	1.7102	1.7157	1.7217	1.7258	1.7302 (40)
HLP (average)												1.7237 (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												2.3971 (42)
Average daily hot water use (litres/day)												91.1301 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.2431	96.5979	92.9527	89.3075	85.6623	82.0171	82.0171	85.6623	89.3075	92.9527	96.5979	100.2431 (44)
Energy conte	148.6576	130.0169	134.1658	116.9690	112.2346	96.8499	89.7457	102.9845	104.2144	121.4519	132.5742	143.9670 (45)
Energy content (annual)										Total = Sum(45)m =		1433.8314 (45)

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Distribution loss (46)m = 0.15 x (45)m	22.2986	19.5025	20.1249	17.5454	16.8352	14.5275	13.4618	15.4477	15.6322	18.2178	19.8861	21.5950 (46)
Water storage loss:												
Store volume												170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6480 (55)
Total storage loss												
20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880 (56)
If cylinder contains dedicated solar storage												
20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880 (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												
192.0080	169.1721	177.5162	158.9210	155.5850	138.8019	133.0961	146.3349	146.1664	164.8023	174.5262	187.3174	187.3174 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 eq. (G10)
Total of WWHRS savings												0.0000
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												
192.0080	169.1721	177.5162	158.9210	155.5850	138.8019	133.0961	146.3349	146.1664	164.8023	174.5262	187.3174	187.3174 (64)
Heat gains from water heating, kWh/month	84.1090	74.5548	79.2905	72.4538	71.9983	65.7642	64.5208	68.9227	68.2129	75.0631	77.6425	82.5493 (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	143.8234	143.8234	143.8234	143.8234	143.8234	143.8234	143.8234	143.8234	143.8234	143.8234	143.8234	143.8234	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.3355	42.0429	34.1916	25.8853	19.3495	16.3357	17.6513	22.9438	30.7951	39.1015	45.6372	48.6511	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	316.9910	320.2804	311.9912	294.3447	272.0691	251.1332	237.1467	233.8573	242.1464	259.7930	282.0686	303.0045	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.7794	51.7794	51.7794	51.7794	51.7794	51.7794	51.7794	51.7794	51.7794	51.7794	51.7794	51.7794	(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)	-95.8823	-95.8823	-95.8823	-95.8823	-95.8823	-95.8823	-95.8823	-95.8823	-95.8823	-95.8823	-95.8823	-95.8823	(71)
Water heating gains (Table 5)	113.0497	110.9446	106.5732	100.6303	96.7719	91.3391	86.7214	92.6380	94.7401	100.8912	107.8368	110.9534	(72)
Total internal gains	580.0967	575.9885	555.4766	523.5808	490.9111	461.5285	444.2399	452.1596	470.4022	502.5062	538.2632	565.3295	(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	
Northeast				1.1300	11.2829		0.6300	0.7000	0.7700		3.8965 (75)	
Southeast				14.0500	36.7938		0.6300	0.7000	0.7700		157.9877 (77)	
Southwest				3.7600	36.7938		0.6300	0.7000	0.7700		42.2800 (79)	
Northeast				14.0500	26.0000		0.6300	0.7000	1.0000		144.9876 (82)	

Solar gains	349.1517	650.1893	1016.3774	1438.2592	1749.9946	1792.0072	1705.4139	1468.7770	1164.0938	754.7594	428.7999	291.6748 (83)
Total gains	929.2484	1226.1778	1571.8539	1961.8399	2240.9057	2253.5357	2149.6538	1920.9366	1634.4960	1257.2656	967.0631	857.0043 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	31.7063	31.7502	31.7933	31.9973	32.0358	32.2161	32.2161	32.2497	32.1464	32.0358	31.9581	31.8772	
alpha	3.1138	3.1167	3.1196	3.1332	3.1357	3.1477	3.1477	3.1500	3.1431	3.1357	3.1305	3.1251	
util living area	0.9606	0.9167	0.8285	0.6760	0.5070	0.3622	0.2656	0.3084	0.5128	0.7905	0.9319	0.9684	(86)
MIT	19.6154	19.9207	20.3037	20.6475	20.8246	20.8910	20.9078	20.9039	20.8463	20.5441	19.9991	19.5509	(87)
Th 2	19.5126	19.5143	19.5160	19.5239	19.5253	19.5322	19.5322	19.5335	19.5296	19.5253	19.5224	19.5192	(88)
util rest of house	0.9504	0.8970	0.7926	0.6206	0.4382	0.2833	0.1784	0.2126	0.4182	0.7331	0.9120	0.9600	(89)
MIT 2	17.7537	18.1811	18.6971	19.1309	19.3264	19.3938	19.4049	19.4047	19.3600	19.0328	18.3081	17.6669	(90)
Living area fraction	18.0559	18.4635	18.9579	19.3771	19.5696	19.6369	19.6489	19.6481	19.6013	19.2781	18.5827	17.9728	(91)
MIT	18.0559	18.4635	18.9579	19.3771	19.5696	19.6369	19.6489	19.6481	19.6013	19.2781	18.5827	17.9728	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.9059	18.3135	18.8079	19.2271	19.4196	19.4869	19.4989	19.4981	19.4513	19.1281	18.4327	17.8228	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9352	0.8768	0.7725	0.6084	0.4330	0.2808	0.1764	0.2103	0.4129	0.7149	0.8926	0.9465	(94)
Ext temp.	869.0248	1075.1624	1214.2701	1193.5109	970.3895	632.7753	379.2635	403.9315	674.8214	898.8223	863.1591	811.1473	(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	1815.1144	1786.9743	1637.4641	1365.1734	1019.2521	641.6218	380.6107	406.3375	704.1195	1126.0022	1499.9367	1807.6198	(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)
	703.8907	478.3376	314.8564	123.5970	36.3538	0.0000	0.0000	0.0000	0.0000	169.0219	458.4798	741.3755	(98)

FULL SAP CALCULATION PRINTOUT

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Space heating 3025.9126 (98)
Space heating per m2 (98) / (4) = 39.4564 (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 %) 96.3000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 3142.1731 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	703.8907	478.3376	314.8564	123.5970	36.3538	0.0000	0.0000	0.0000	0.0000	169.0219	458.4798	741.3755	(98)
Space heating efficiency (main heating system 1)	96.3000	96.3000	96.3000	96.3000	96.3000	0.0000	0.0000	0.0000	0.0000	96.3000	96.3000	96.3000	(210)
Space heating fuel (main heating system)	730.9353	496.7161	326.9537	128.3458	37.7505	0.0000	0.0000	0.0000	0.0000	175.5160	476.0954	769.8604	(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	192.0080	169.1721	177.5162	158.9210	155.5850	138.8019	133.0961	146.3349	146.1664	164.8023	174.5262	187.3174	(64)
Efficiency of water heater (217)m	90.7797	90.2457	89.1370	86.9631	84.4340	82.6000	82.6000	82.6000	82.6000	87.6920	90.0827	90.9243	(216)
Fuel for water heating, kWh/month	211.5099	187.4573	199.1499	182.7453	184.2681	168.0410	161.1332	177.1608	176.9569	187.9331	193.7401	206.0146	(219)
Water heating fuel used												2236.1102	(219)
Annual totals kWh/year													
Space heating fuel - main system												3142.1731	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
Total electricity for the above, kWh/year												30.0000	(231)
Electricity for lighting (calculated in Appendix L)												334.3836	(232)
Total delivered energy for all uses												5742.6669	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3142.1731	3.4800	109.3476	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2236.1102	3.4800	77.8166	(247)
Pumps and fans for heating	30.0000	13.1900	3.9570	(249)
Energy for lighting	334.3836	13.1900	44.1052	(250)
Additional standing charges			120.0000	(251)
Total energy cost			355.2265	(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] = 1.2260 (257)
SAP value 82.8969
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	3142.1731	0.2160	678.7094	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2236.1102	0.2160	482.9998	(264)
Space and water heating			1161.7092	(265)
Pumps and fans	30.0000	0.5190	15.5700	(267)
Energy for lighting	334.3836	0.5190	173.5451	(268)
Total kg/year			1350.8243	(272)
CO2 emissions per m2			17.6100	(273)
EI value			85.1253	
EI rating			85	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency $3.48 \times (1 + 0.29 \times 0.25) / 0.9330 = 4.000$, stars = 4
Main heating environmental impact $0.216 \times (1 + 0.29 \times 0.25) / 0.9330 = 0.2483$, stars = 4
Water heating energy efficiency $3.48 / 0.8672 = 4.013$, stars = 5

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Water heating environmental impact

$0.216 / 0.8672 = 0.2491$, stars = 5

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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)
Basement floor	41.1400 (1a)	x 2.4600 (2a)	= 101.2044 (1a) - (3a)
Ground floor	35.5500 (1b)	x 2.7600 (2b)	= 98.1180 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.3224 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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) = 0.1505 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.3505 (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) =	0.2979 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
Effective ac	0.3128	0.2979	0.2979	0.2756	0.2756	0.2458	0.2532	0.2383	0.2458	0.2607	0.2607	0.2830 (22b)
	0.5489	0.5444	0.5444	0.5380	0.5380	0.5302	0.5321	0.5284	0.5302	0.5340	0.5340	0.5401 (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
G (Uw = 1.40)			18.9400	1.3258	25.1098		(27)
D			2.0700	1.4000	2.8980		(26)
RL (Uw = 1.40)			14.0500	1.3258	18.6269		(27a)
BF			39.6400	0.1800	7.1352	110.0000	4360.4000 (28)
EF			1.5000	0.1800	0.2700	110.0000	165.0000 (28a)
EW	157.4000	21.0100	136.3900	0.2000	27.2780	60.0000	8183.4000 (29a)
FR	42.6400	14.0500	28.5900	0.1500	4.2885	9.0000	257.3100 (30)
Total net area of external elements Aum(A, m ²)			241.1800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	85.6064		(33)
Internal Wall 1			115.0500			9.0000	1035.4500 (32c)
Internal Floor 1			34.0500			18.0000	612.9000 (32d)
Internal Ceiling 1			34.0500			18.0000	612.9000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15227.3600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							198.5573 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.1659 (36)
Total fabric heat loss						(33) + (36) =	95.7724 (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	36.1067	35.8075	35.8075	35.3860	35.3860	34.8751	34.9974	34.7565	34.8751	35.1233	35.1233	35.5229 (38)
Heat transfer coeff	131.8791	131.5799	131.5799	131.1584	131.1584	130.6475	130.7698	130.5289	130.6475	130.8957	130.8957	131.2952 (39)
Average = Sum(39)m / 12 =												131.0863 (39)
HLP	1.7196	1.7157	1.7157	1.7102	1.7102	1.7036	1.7052	1.7020	1.7036	1.7068	1.7068	1.7120 (40)
HLP (average)												1.7093 (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												2.3971 (42)
Average daily hot water use (litres/day)												91.1301 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	100.2431	96.5979	92.9527	89.3075	85.6623	82.0171	82.0171	85.6623	89.3075	92.9527	96.5979	100.2431 (44)
Energy conte	148.6576	130.0169	134.1658	116.9690	112.2346	96.8499	89.7457	102.9845	104.2144	121.4519	132.5742	143.9670 (45)
Energy content (annual)										Total = Sum(45)m =		1433.8314 (45)

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

Distribution loss (46)m = 0.15 x (45)m	22.2986	19.5025	20.1249	17.5454	16.8352	14.5275	13.4618	15.4477	15.6322	18.2178	19.8861	21.5950 (46)
Water storage loss:												
Store volume												170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6480 (55)
Total storage loss												
20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880 (56)
If cylinder contains dedicated solar storage												
20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880 (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												
192.0080	169.1721	177.5162	158.9210	155.5850	138.8019	133.0961	146.3349	146.1664	164.8023	174.5262	187.3174	187.3174 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 eq. (G10)
Total of WWHRS savings												0.0000
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												
192.0080	169.1721	177.5162	158.9210	155.5850	138.8019	133.0961	146.3349	146.1664	164.8023	174.5262	187.3174	187.3174 (64)
Heat gains from water heating, kWh/month												
84.1090	74.5548	79.2905	72.4538	71.9983	65.7642	64.5208	68.9227	68.2129	75.0631	77.6425	82.5493	82.5493 (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	143.8234	143.8234	143.8234	143.8234	143.8234	143.8234	143.8234	143.8234	143.8234	143.8234	143.8234	143.8234	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.3355	42.0429	34.1916	25.8853	19.3495	16.3357	17.6513	22.9438	30.7951	39.1015	45.6372	48.6511	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	316.9910	320.2804	311.9912	294.3447	272.0691	251.1332	237.1467	233.8573	242.1464	259.7930	282.0686	303.0045	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.7794	51.7794	51.7794	51.7794	51.7794	51.7794	51.7794	51.7794	51.7794	51.7794	51.7794	51.7794	(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)	-95.8823	-95.8823	-95.8823	-95.8823	-95.8823	-95.8823	-95.8823	-95.8823	-95.8823	-95.8823	-95.8823	-95.8823	(71)
Water heating gains (Table 5)	113.0497	110.9446	106.5732	100.6303	96.7719	91.3391	86.7214	92.6380	94.7401	100.8912	107.8368	110.9534	(72)
Total internal gains	580.0967	575.9885	555.4766	523.5808	490.9111	461.5285	444.2399	452.1596	470.4022	502.5062	538.2632	565.3295	(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	
Northeast					1.1300	12.9236		0.6300	0.7000	0.7700		4.4631 (75)	
Southeast					14.0500	40.4699		0.6300	0.7000	0.7700		173.7723 (77)	
Southwest					3.7600	40.4699		0.6300	0.7000	0.7700		46.5042 (79)	
Northeast					14.0500	30.0000		0.6300	0.7000	1.0000		167.2934 (82)	

Solar gains	392.0328	658.0360	1018.1107	1486.6493	1763.0511	1932.1514	1818.8873	1601.5690	1264.7595	816.2422	493.4959	324.1716	(83)
Total gains	972.1295	1234.0244	1573.5873	2010.2301	2253.9622	2393.6799	2263.1272	2053.7286	1735.1618	1318.7484	1031.7591	889.5012	(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	32.0735	32.1464	32.1464	32.2497	32.2497	32.3758	32.3456	32.4052	32.3758	32.3145	32.3145	32.2161
alpha	3.1382	3.1431	3.1431	3.1500	3.1500	3.1584	3.1564	3.1603	3.1584	3.1543	3.1543	3.1477
util living area	0.9499	0.9056	0.8050	0.6263	0.4422	0.2696	0.1785	0.2023	0.4181	0.7323	0.9071	0.9597 (86)
MIT	19.7689	20.0268	20.4037	20.7220	20.8630	20.9070	20.9132	20.9127	20.8832	20.6557	20.1655	19.7084 (87)
Th 2	19.5268	19.5296	19.5296	19.5335	19.5335	19.5383	19.5371	19.5394	19.5383	19.5360	19.5360	19.5322 (88)
util rest of house	0.9366	0.8831	0.7640	0.5653	0.3688	0.1923	0.0945	0.1105	0.3202	0.6624	0.8801	0.9487 (89)
MIT 2	17.9830	18.3410	18.8407	19.2261	19.3715	19.4104	19.4120	19.4143	19.3972	19.1742	18.5483	17.9023 (90)
Living area fraction									fLA = Living area / (4) =			0.1623 (91)
MIT	18.2729	18.6147	19.0945	19.4689	19.6136	19.6534	19.6557	19.6575	19.6385	19.4147	18.8108	18.1955 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1229	18.4647	18.9445	19.3189	19.4636	19.5034	19.5057	19.5075	19.4885	19.2647	18.6608	18.0455 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	893.9967	1064.4000	1172.4523	1116.9348	823.0266	455.7126	209.8737	222.7048	549.5035	854.0307	886.6161	830.2348	(94)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1717.4502	1692.7350	1519.0172	1235.3727	847.7567	457.7062	209.9786	222.8827	560.2795	1003.2769	1395.4551	1699.6864	(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	612.6494	422.2411	257.8443	85.2753	18.3992	0.0000	0.0000	0.0000	0.0000	111.0392	366.3641	646.8720	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space heating 2520.6845 (98)
Space heating per m2 (98) / (4) = 32.8685 (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 %)													96.3000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2617.5332 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	612.6494	422.2411	257.8443	85.2753	18.3992	0.0000	0.0000	0.0000	0.0000	111.0392	366.3641	646.8720	(98)
Space heating efficiency (main heating system 1)	96.3000	96.3000	96.3000	96.3000	96.3000	0.0000	0.0000	0.0000	0.0000	96.3000	96.3000	96.3000	(210)
Space heating fuel (main heating system)	636.1884	438.4643	267.7511	88.5517	19.1061	0.0000	0.0000	0.0000	0.0000	115.3055	380.4404	671.7258	(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	192.0080	169.1721	177.5162	158.9210	155.5850	138.8019	133.0961	146.3349	146.1664	164.8023	174.5262	187.3174	(64)
Efficiency of water heater (217)m	90.5025	89.9663	88.6192	86.0460	83.6141	82.6000	82.6000	82.6000	82.6000	86.5978	89.5567	90.6628	(216)
Fuel for water heating, kWh/month	212.1578	188.0394	200.3135	184.6931	186.0751	168.0410	161.1332	177.1608	176.9569	190.3076	194.8779	206.6089	(219)
Water heating fuel used												2246.3652	(219)
Annual totals kWh/year													
Space heating fuel - main system												2617.5332	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
Total electricity for the above, kWh/year												30.0000	(231)
Electricity for lighting (calculated in Appendix L)												334.3836	(232)
Total delivered energy for all uses												5228.2820	(238)

10a. Fuel costs - using BEDF prices (589)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2617.5332	6.3300	165.6899 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2246.3652	6.3300	142.1949 (247)
Pumps and fans for heating	30.0000	26.0600	7.8180 (249)
Energy for lighting	334.3836	26.0600	87.1404 (250)
Additional standing charges			113.0000 (251)
Total energy cost			515.8431 (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	2617.5332	0.2160	565.3872 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2246.3652	0.2160	485.2149 (264)
Space and water heating			1050.6020 (265)
Pumps and fans	30.0000	0.5190	15.5700 (267)
Energy for lighting	334.3836	0.5190	173.5451 (268)
Total kg/year			1239.7171 (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	2617.5332	1.2200	3193.3905 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2246.3652	1.2200	2740.5655 (264)
Space and water heating			5933.9560 (265)
Pumps and fans	30.0000	3.0700	92.1000 (267)
Energy for lighting	334.3836	3.0700	1026.5577 (268)
Primary energy kWh/year			7052.6137 (272)
Primary energy kWh/m2/year			91.9626 (273)

SAP 2012 EPC IMPROVEMENTS

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

(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:			
N	Solar water heating	SAP change + 1.7	Cost change -£ 63
U	Solar photovoltaic panels	+ 11.0	-£ 475
			CO2 change
			-234 kg (18.9%)
			-947 kg (94.2%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Solar water heating	£63	3.05 kg/m²	B 85
Solar photovoltaic panels	£475	12.35 kg/m²	A 96
Total Savings	£539	15.40 kg/m²	A 98

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

Fuel prices for cost data on this page from database revision number 589 TEST (12 Dec 2025)
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	£95	£108	-£13
Mains gas	£421	£345	£76
Space heating	£287	£288	-£1
Water heating	£142	£78	£64
Lighting	£87	£87	£0
Generated (PV)	-£0	-£475	£475
Total cost of fuels	£516	-£22	£538
Total cost of uses	£516	-£22	£538
Delivered energy	68 kWh/m²	29 kWh/m²	39 kWh/m²
Carbon dioxide emissions	1.2 tonnes	0.1 tonnes	1.2 tonnes
CO2 emissions per m²	16 kg/m²	1 kg/m²	15 kg/m²
Primary energy	92 kWh/m²	2 kWh/m²	90 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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)
Basement floor	41.1400 (1a)	x 2.4600 (2a)	= 101.2044 (1a) - (3a)
Ground floor	35.5500 (1b)	x 2.7600 (2b)	= 98.1180 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.3224 (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) = 0.1505 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.3505 (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) =	0.2979 (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	0.3799	0.3724	0.3650	0.3277	0.3203	0.2830	0.2830	0.2756	0.2979	0.3203	0.3352	0.3501 (22b)
Effective ac	0.5721	0.5693	0.5666	0.5537	0.5513	0.5401	0.5401	0.5380	0.5444	0.5513	0.5562	0.5613 (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
G (Uw = 1.40)			18.9400	1.3258	25.1098		(27)
D			2.0700	1.4000	2.8980		(26)
RL (Uw = 1.40)			14.0500	1.3258	18.6269		(27a)
BF			39.6400	0.1800	7.1352	110.0000	4360.4000 (28)
EF			1.5000	0.1800	0.2700	110.0000	165.0000 (28a)
EW	157.4000	21.0100	136.3900	0.2000	27.2780	60.0000	8183.4000 (29a)
FR	42.6400	14.0500	28.5900	0.1500	4.2885	9.0000	257.3100 (30)
Total net area of external elements Aum(A, m ²)			241.1800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	85.6064		(33)
Internal Wall 1			115.0500			9.0000	1035.4500 (32c)
Internal Floor 1			34.0500			18.0000	612.9000 (32d)
Internal Ceiling 1			34.0500			18.0000	612.9000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15227.3600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							198.5573 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.1659 (36)
Total fabric heat loss						(33) + (36) =	95.7724 (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	37.6339	37.4496	37.2690	36.4205	36.2618	35.5229	35.5229	35.3860	35.8075	36.2618	36.5829	36.9187 (38)
Heat transfer coeff	133.4063	133.2220	133.0413	132.1929	132.0342	131.2952	131.2952	131.1584	131.5799	132.0342	132.3553	132.6910 (39)
Average = Sum(39)m / 12 =												132.1922 (39)
HLP	1.7396	1.7371	1.7348	1.7237	1.7217	1.7120	1.7120	1.7102	1.7157	1.7217	1.7258	1.7302 (40)
HLP (average)												1.7237 (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												2.3971 (42)
Average daily hot water use (litres/day)												91.1301 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.2431	96.5979	92.9527	89.3075	85.6623	82.0171	82.0171	85.6623	89.3075	92.9527	96.5979	100.2431 (44)
Energy conte	148.6576	130.0169	134.1658	116.9690	112.2346	96.8499	89.7457	102.9845	104.2144	121.4519	132.5742	143.9670 (45)
Energy content (annual)										Total = Sum(45)m =		1433.8314 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	22.2986	19.5025	20.1249	17.5454	16.8352	14.5275	13.4618	15.4477	15.6322	18.2178	19.8861	21.5950 (46)
Water storage loss:												
Store volume												190.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2924 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6979 (55)
Total storage loss												
21.6341 19.5405 21.6341 20.9363 21.6341 20.9363 21.6341 21.6341 20.9363 21.6341 20.9363 21.6341 (56)												
If cylinder contains dedicated solar storage												
13.0944 11.8272 13.0944 12.6720 13.0944 12.6720 13.0944 12.6720 13.0944 12.6720 13.0944 (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												
185.0144 162.8553 169.1268 145.3994 135.7970 119.4271 113.0755 127.2448 133.9955 156.4129 167.7582 180.3237 (62)												
WWHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 eq. (G10)												
Total of WWHRS savings												
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												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2649 (H8)
Utilisation factor												0.5464 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												109.5000 (H13)
Daily hot water demand												91.1301 (H14)
Volume ratio Veff/V												1.2016 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-871.3804 (H17)
Solar input -25.2683 -42.1655 -71.8127 -96.2432 -118.9003 -116.8980 -115.3531 -100.7846 -78.9346 -53.9030 -29.9718 -21.1452 (63)												
Solar input (sum of months) = Sum(63)m =												-871.3804 (63)
Output from w/h												
159.7461 120.6898 97.3141 49.1562 16.8966 2.5291 0.0000 26.4602 55.0609 102.5099 137.7863 159.1785 (64)												
Total per year (kWh/year) = Sum(64)m =												927.3277 (64)
Heat gains from water heating, kWh/month												
78.5141 69.5013 72.5789 61.6365 56.1679 50.2644 48.5043 53.6506 58.4762 68.3515 72.2281 76.9544 (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	143.8234	143.8234	143.8234	143.8234	143.8234	143.8234	143.8234	143.8234	143.8234	143.8234	143.8234	143.8234	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.3355	42.0429	34.1916	25.8853	19.3495	16.3357	17.6513	22.9438	30.7951	39.1015	45.6372	48.6511	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	316.9910	320.2804	311.9912	294.3447	272.0691	251.1332	237.1467	233.8573	242.1464	259.7930	282.0686	303.0045	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.7794	51.7794	51.7794	51.7794	51.7794	51.7794	51.7794	51.7794	51.7794	51.7794	51.7794	51.7794	(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)	-95.8823	-95.8823	-95.8823	-95.8823	-95.8823	-95.8823	-95.8823	-95.8823	-95.8823	-95.8823	-95.8823	-95.8823	(71)
Water heating gains (Table 5)	105.5297	103.4246	97.5523	85.6062	75.4945	69.8116	65.1939	72.1110	81.2169	91.8704	100.3168	103.4334	(72)
Total internal gains	572.5766	568.4684	546.4557	508.5567	469.6337	440.0010	422.7124	431.6326	456.8790	493.4854	530.7431	557.8095	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g		FF		Access factor		Gains W	
						Specific data or Table 6b		Specific data or Table 6c		Table 6d			
Northeast				1.1300	11.2829	0.6300		0.7000		0.7700		3.8965 (75)	
Southeast				14.0500	36.7938	0.6300		0.7000		0.7700		157.9877 (77)	
Southwest				3.7600	36.7938	0.6300		0.7000		0.7700		42.2800 (79)	
Northeast				14.0500	26.0000	0.6300		0.7000		1.0000		144.9876 (82)	

Solar gains	349.1517	650.1893	1016.3774	1438.2592	1749.9946	1792.0072	1705.4139	1468.7770	1164.0938	754.7594	428.7999	291.6748	(83)
Total gains	921.7283	1218.6577	1562.8331	1946.8159	2219.6283	2232.0082	2128.1263	1900.4097	1620.9728	1248.2447	959.5431	849.4842	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	31.7063	31.7502	31.7933	31.9973	32.0358	32.2161	32.2161	32.2497	32.1464	32.0358	31.9581	31.8772	
alpha	3.1138	3.1167	3.1196	3.1332	3.1357	3.1477	3.1477	3.1500	3.1431	3.1357	3.1305	3.1251	
util living area	0.9614	0.9178	0.8303	0.6792	0.5109	0.3654	0.2682	0.3116	0.5163	0.7931	0.9331	0.9691	(86)
MIT	19.6091	19.9153	20.2991	20.6437	20.8226	20.8904	20.9076	20.9036	20.8450	20.5403	19.9934	19.5444	(87)
Th 2	19.5126	19.5143	19.5160	19.5239	19.5253	19.5322	19.5322	19.5335	19.5296	19.5253	19.5224	19.5192	(88)
util rest of house													
0.9514 0.8984 0.7946 0.6239 0.4419 0.2859 0.1802 0.2149 0.4213 0.7360 0.9135 0.9608 (89)													
MIT 2	17.7448	18.1738	18.6914	19.1268	19.3247	19.3935	19.4048	19.4046	19.3591	19.0284	18.3004	17.6577	(90)
Living area fraction													0.1623 (91)
fLA = Living area / (4) =													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

MIT	18.0474	18.4565	18.9524	19.3731	19.5678	19.6365	19.6488	19.6479	19.6003	19.2738	18.5753	17.9640 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8974	18.3065	18.8024	19.2231	19.4178	19.4865	19.4988	19.4979	19.4503	19.1238	18.4253	17.8140 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9363	0.8782	0.7745	0.6115	0.4366	0.2834	0.1782	0.2125	0.4159	0.7176	0.8942	0.9475 (94)	
Useful gains	863.0351	1070.2850	1210.3405	1190.4810	969.0335	632.4881	379.2126	403.8370	674.0926	895.7527	858.0028	804.9216 (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	1813.9836	1786.0470	1636.7296	1364.6351	1019.0181	641.5702	380.6000	406.3184	703.9895	1125.4344	1498.9594	1806.4536 (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	707.5057	480.9921	317.2335	125.3909	37.1885	0.0000	0.0000	0.0000	0.0000	170.8832	461.4887	745.1398 (98)	
Space heating												3045.8225 (98)	
Space heating per m2												39.7160 (99)	(98) / (4) =

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													96.3000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3162.8478 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	707.5057	480.9921	317.2335	125.3909	37.1885	0.0000	0.0000	0.0000	0.0000	170.8832	461.4887	745.1398 (98)	
Space heating efficiency (main heating system 1)	96.3000	96.3000	96.3000	96.3000	96.3000	0.0000	0.0000	0.0000	0.0000	96.3000	96.3000	96.3000 (210)	
Space heating fuel (main heating system)	734.6892	499.4726	329.4221	130.2086	38.6174	0.0000	0.0000	0.0000	0.0000	177.4488	479.2199	773.7693 (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	159.7461	120.6898	97.3141	49.1562	16.8966	2.5291	0.0000	26.4602	55.0609	102.5099	137.7863	159.1785 (64)	
Efficiency of water heater (217)m	91.1257	90.9371	90.5466	90.0161	89.6711	82.6000	82.6000	82.6000	82.6000	88.9782	90.6015	91.2200 (217)	
Fuel for water heating, kWh/month	175.3031	132.7179	107.4741	54.6082	18.8429	3.0619	0.0000	32.0341	66.6597	115.2078	152.0795	174.4995 (219)	
Water heating fuel used												1032.4888 (219)	
Annual totals kWh/year													
Space heating fuel - main system													3162.8478 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													80.0000 (231)
Electricity for lighting (calculated in Appendix L)													334.3836 (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													2882.4808 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3162.8478	3.4800	110.0671 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	1032.4888	3.4800	35.9306 (247)	
Pumps and fans for heating	30.0000	13.1900	3.9570 (249)	
Pump for solar water heating	50.0000	13.1900	6.5950 (249)	
Energy for lighting	334.3836	13.1900	44.1052 (250)	
Additional standing charges			120.0000 (251)	
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229 (252)	
Total energy cost			92.8320 (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] =	0.3204 (257)
SAP value			95.5304
SAP rating (Section 12)			96 (258)
SAP band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	3162.8478	0.2160	683.1751	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1032.4888	0.2160	223.0176	(264)
Space and water heating			906.1927	(265)
Pumps and fans	80.0000	0.5190	41.5200	(267)
Energy for lighting	334.3836	0.5190	173.5451	(268)
Energy saving/generation technologies				
PV Unit	-1727.2394	0.5190	-896.4372	(269)
Total kg/year			224.8206	(272)
CO2 emissions per m2			2.9300	(273)
EI value			97.5244	
EI rating			98	(274)
EI band			A	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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)
Basement floor	41.1400 (1a)	x 2.4600 (2a)	= 101.2044 (1a) - (3a)
Ground floor	35.5500 (1b)	x 2.7600 (2b)	= 98.1180 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.3224 (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) = 0.1505 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.3505 (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) =		0.2979 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
Effective ac	0.3128	0.2979	0.2979	0.2756	0.2756	0.2458	0.2532	0.2383	0.2458	0.2607	0.2607	0.2830 (22b)
	0.5489	0.5444	0.5444	0.5380	0.5380	0.5302	0.5321	0.5284	0.5302	0.5340	0.5340	0.5401 (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
G (Uw = 1.40)			18.9400	1.3258	25.1098		(27)
D			2.0700	1.4000	2.8980		(26)
RL (Uw = 1.40)			14.0500	1.3258	18.6269		(27a)
BF			39.6400	0.1800	7.1352	110.0000	4360.4000 (28)
EF			1.5000	0.1800	0.2700	110.0000	165.0000 (28a)
EW	157.4000	21.0100	136.3900	0.2000	27.2780	60.0000	8183.4000 (29a)
FR	42.6400	14.0500	28.5900	0.1500	4.2885	9.0000	257.3100 (30)
Total net area of external elements Aum(A, m ²)			241.1800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	85.6064		(33)
Internal Wall 1			115.0500			9.0000	1035.4500 (32c)
Internal Floor 1			34.0500			18.0000	612.9000 (32d)
Internal Ceiling 1			34.0500			18.0000	612.9000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15227.3600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							198.5573 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.1659 (36)
Total fabric heat loss						(33) + (36) =	95.7724 (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	36.1067	35.8075	35.8075	35.3860	35.3860	34.8751	34.9974	34.7565	34.8751	35.1233	35.1233	35.5229 (38)
Heat transfer coeff	131.8791	131.5799	131.5799	131.1584	131.1584	130.6475	130.7698	130.5289	130.6475	130.8957	130.8957	131.2952 (39)
Average = Sum(39)m / 12 =												131.0863 (39)
HLP	1.7196	1.7157	1.7157	1.7102	1.7102	1.7036	1.7052	1.7020	1.7036	1.7068	1.7068	1.7120 (40)
HLP (average)												1.7093 (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												2.3971 (42)
Average daily hot water use (litres/day)												91.1301 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	100.2431	96.5979	92.9527	89.3075	85.6623	82.0171	82.0171	85.6623	89.3075	92.9527	96.5979	100.2431 (44)
Energy conte	148.6576	130.0169	134.1658	116.9690	112.2346	96.8499	89.7457	102.9845	104.2144	121.4519	132.5742	143.9670 (45)
Energy content (annual)										Total = Sum(45)m =		1433.8314 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Distribution loss (46)m = 0.15 x (45)m	22.2986	19.5025	20.1249	17.5454	16.8352	14.5275	13.4618	15.4477	15.6322	18.2178	19.8861	21.5950 (46)
Water storage loss:												
Store volume												190.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2924 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6979 (55)
Total storage loss												
21.6341 19.5405 21.6341 20.9363 21.6341 20.9363 21.6341 21.6341 20.9363 21.6341 20.9363 21.6341 (56)												
If cylinder contains dedicated solar storage												
13.0944 11.8272 13.0944 12.6720 13.0944 12.6720 13.0944 13.0944 12.6720 13.0944 12.6720 13.0944 (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												
185.0144 162.8553 169.1268 145.3994 135.7970 119.4271 113.0755 127.2448 133.9955 156.4129 167.7582 180.3237 (62)												
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	eq. (G10)
Total of WWHRS savings												0.0000
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												1140.0998 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1915.3676 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3358 (H8)
Utilisation factor												0.5270 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												109.5000 (H13)
Daily hot water demand												91.1301 (H14)
Volume ratio Veff/V												1.2016 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-887.5047 (H17)
Solar input	-27.3169	-41.0573	-69.1457	-95.5806	-115.1111	-121.1495	-118.2404	-105.5894	-82.4129	-56.0640	-33.2045	-22.6323 (63)
Solar input (sum of months) = Sum(63)m =												-887.5047 (63)
Output from w/h												
157.6975 121.7980 99.9811 49.8188 20.6859 0.0000 0.0000 21.6553 51.5826 100.3489 134.5537 157.6915 (64)												
Total per year (kWh/year) = Sum(64)m =												915.8131 (64)
Heat gains from water heating, kWh/month												
78.5141 69.5013 72.5789 61.6365 56.1679 50.2644 48.5043 53.6506 58.4762 68.3515 72.2281 76.9544 (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)
(66)m	143.8234	143.8234	143.8234	143.8234	143.8234	143.8234	143.8234	143.8234	143.8234	143.8234	143.8234	143.8234	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.3355	42.0429	34.1916	25.8853	19.3495	16.3357	17.6513	22.9438	30.7951	39.1015	45.6372	48.6511	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	316.9910	320.2804	311.9912	294.3447	272.0691	251.1332	237.1467	233.8573	242.1464	259.7930	282.0686	303.0045	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.7794	51.7794	51.7794	51.7794	51.7794	51.7794	51.7794	51.7794	51.7794	51.7794	51.7794	51.7794	(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)	-95.8823	-95.8823	-95.8823	-95.8823	-95.8823	-95.8823	-95.8823	-95.8823	-95.8823	-95.8823	-95.8823	-95.8823	(71)
Water heating gains (Table 5)	105.5297	103.4246	97.5523	85.6062	75.4945	69.8116	65.1939	72.1110	81.2169	91.8704	100.3168	103.4334	(72)
Total internal gains	572.5766	568.4684	546.4557	508.5567	469.6337	440.0010	422.7124	431.6326	456.8790	493.4854	530.7431	557.8095	(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
Northeast					1.1300	12.9236	0.6300	0.7000			0.7700			4.4631 (75)
Southeast					14.0500	40.4699	0.6300	0.7000			0.7700			173.7723 (77)
Southwest					3.7600	40.4699	0.6300	0.7000			0.7700			46.5042 (79)
Northeast					14.0500	30.0000	0.6300	0.7000			1.0000			167.2934 (82)

Solar gains	392.0328	658.0360	1018.1107	1486.6493	1763.0511	1932.1514	1818.8873	1601.5690	1264.7595	816.2422	493.4959	324.1716 (83)		
Total gains	964.6095	1226.5044	1564.5665	1995.2060	2232.6848	2372.1524	2241.5997	2033.2016	1721.6385	1309.7276	1024.2390	881.9811 (84)		

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	32.0735	32.1464	32.1464	32.2497	32.2497	32.3758	32.3456	32.4052	32.3758	32.3145	32.3145	32.2161	
alpha	3.1382	3.1431	3.1431	3.1500	3.1500	3.1584	3.1564	3.1603	3.1584	3.1543	3.1543	3.1477	
util living area	0.9508	0.9069	0.8069	0.6295	0.4458	0.2720	0.1802	0.2043	0.4211	0.7351	0.9086	0.9605	(86)
MIT	19.7628	20.0216	20.3996	20.7191	20.8618	20.9068	20.9132	20.9126	20.8826	20.6527	20.1603	19.7021	(87)
Th 2	19.5268	19.5296	19.5296	19.5335	19.5335	19.5383	19.5371	19.5394	19.5383	19.5360	19.5360	19.5322	(88)
util rest of house	0.9378	0.8845	0.7661	0.5685	0.3720	0.1940	0.0955	0.1116	0.3225	0.6654	0.8819	0.9497	(89)
MIT 2	17.9745	18.3341	18.8357	19.2231	19.3705	19.4103	19.4120	19.4143	19.3969	19.1711	18.5414	17.8935	(90)
Living area fraction													fLA = Living area / (4) = 0.1623 (91)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

MIT	18.2648	18.6081	19.0896	19.4660	19.6126	19.6533	19.6557	19.6575	19.6381	19.4116	18.8043	18.1871 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1148	18.4581	18.9396	19.3160	19.4626	19.5033	19.5057	19.5075	19.4881	19.2616	18.6543	18.0371 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9209	0.8641	0.7471	0.5587	0.3683	0.1921	0.0936	0.1095	0.3190	0.6504	0.8612	0.9346 (94)	
Useful gains	888.3291	1059.7798	1168.9626	1114.7083	822.2916	455.6466	209.8692	222.6971	549.2245	851.8106	882.0521	824.2912 (95)	
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)	
Heat loss rate W	1716.3840	1691.8643	1518.3740	1234.9838	847.6294	457.6933	209.9772	222.8805	560.2284	1002.8747	1394.5960	1698.5755 (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	616.0729	424.7608	259.9621	86.5983	18.8513	0.0000	0.0000	0.0000	0.0000	112.3917	369.0316	650.4675 (98)	
Space heating												2538.1362 (98)	
Space heating per m2												(98) / (4) = 33.0961 (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 %)													96.3000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2635.6555 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	616.0729	424.7608	259.9621	86.5983	18.8513	0.0000	0.0000	0.0000	0.0000	112.3917	369.0316	650.4675 (98)	
Space heating efficiency (main heating system 1)	96.3000	96.3000	96.3000	96.3000	96.3000	0.0000	0.0000	0.0000	0.0000	96.3000	96.3000	96.3000 (210)	
Space heating fuel (main heating system)	639.7434	441.0808	269.9503	89.9256	19.5756	0.0000	0.0000	0.0000	0.0000	116.7099	383.2104	675.4595 (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	157.6975	121.7980	99.9811	49.8188	20.6859	0.0000	0.0000	21.6553	51.5826	100.3489	134.5537	157.6915 (64)	
Efficiency of water heater (217)m	90.9002	90.6822	90.0595	89.0856	87.3779	82.6000	82.6000	82.6000	82.6000	87.9273	90.1787	90.9999 (217)	
Fuel for water heating, kWh/month	173.4842	134.3129	111.0168	55.9224	23.6740	0.0000	0.0000	26.2171	62.4486	114.1271	149.2078	173.2876 (219)	
Water heating fuel used												1023.6985 (219)	
Annual totals kWh/year													
Space heating fuel - main system												2635.6555 (211)	
Space heating fuel - secondary												0.0000 (215)	
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													80.0000 (231)
Electricity for lighting (calculated in Appendix L)													334.3836 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1140 * 0.80) =									-1824.1596			-1824.1596 (233)	
Total delivered energy for all uses												2249.5780 (238)	

10a. Fuel costs - using BEDF prices (589)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2635.6555	6.3300	166.8370 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	1023.6985	6.3300	64.8001 (247)	
Pumps and fans for heating	30.0000	26.0600	7.8180 (249)	
Pump for solar water heating	50.0000	26.0600	13.0300 (249)	
Energy for lighting	334.3836	26.0600	87.1404 (250)	
Additional standing charges			113.0000 (251)	
Energy saving/generation technologies				
PV Unit	-1824.1596	26.0600	-475.3760 (252)	
Total energy cost			-22.7505 (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	2635.6555	0.2160	569.3016 (261)	
Space heating - secondary	0.0000	0.0000	0.0000 (263)	
Water heating (other fuel)	1023.6985	0.2160	221.1189 (264)	
Space and water heating			790.4205 (265)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Pumps and fans	80.0000	0.5190	41.5200 (267)
Energy for lighting	334.3836	0.5190	173.5451 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			58.7467 (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	2635.6555	1.2200	3215.4997 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1023.6985	1.2200	1248.9122 (264)
Space and water heating			4464.4119 (265)
Pumps and fans	80.0000	3.0700	245.6000 (267)
Energy for lighting	334.3836	3.0700	1026.5577 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			136.3995 (272)
Primary energy kWh/m2/year			1.7786 (273)