

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	2 Be Green	Issued on Date	05/05/2026
Assessment Reference	001	Prop Type Ref	Westbury Avenue
Property			
SAP Rating	109 A	DER	-8.30
TER		TER	29.20
Environmental	108 A	% DER<TER	128.43
CO ₂ Emissions (t/year)	-0.95	DFEE	57.99
TREE		TREE	62.69
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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CALCULATION OF HEAT DEMAND 09 Jan 2014

(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												0.0000 (63)
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)
												1944 (64)
												1944 (64)

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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	577.0967	572.9885	552.4766	520.5808	487.9111	458.5285	441.2399	449.1596	467.4022	499.5062	535.2632	562.3295 (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	969.1295	1231.0244	1570.5873	2007.2301	2250.9622	2390.6799	2260.1272	2050.7286	1732.1618	1315.7484	1028.7591	886.5012 (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	0.9502	0.9062	0.8056	0.6269	0.4427	0.2699	0.1787	0.2026	0.4188	0.7332	0.9077	0.9600 (86)
Tweekday	17.9796	18.3383	18.8390	19.2255	19.3713	19.4104	19.4120	19.4143	19.3972	19.1732	18.5456	17.8988

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Tweekend	20.2026	20.3695	20.6136	20.8199	20.9113	20.9399	20.9439	20.9435	20.9244	20.7768	20.4592	20.1634
24 / 16	9	8	9	8	9	9	9	9	8	9	8	9
24 / 9	22	20	22	22	22	21	22	22	22	22	22	22
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000 (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	0.9371	0.8837	0.7647	0.5659	0.3692	0.1925	0.0947	0.1106	0.3207	0.6634	0.8808	0.9491 (89)
Tweekday	17.9796	18.3383	18.8390	19.2255	19.3713	19.4104	19.4120	19.4143	19.3972	19.1732	18.5456	17.8988
Tweekend	17.9796	18.3383	18.8390	19.2255	19.3713	19.4104	19.4120	19.4143	19.3972	19.1732	18.5456	17.8988
MIT 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 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	19.7660	19.7683	19.7683	19.7716	19.7716	19.7756	19.7746	19.7765	19.7756	19.7736	19.7736	19.7705 (92)
Temperature adjustment												0.0000
adjusted MIT	19.7660	19.7683	19.7683	19.7716	19.7716	19.7756	19.7746	19.7765	19.7756	19.7736	19.7736	19.7705 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9395	0.8877	0.7719	0.5764	0.3815	0.2052	0.1084	0.1256	0.3372	0.6759	0.8858	0.9511 (94)
Useful gains	910.4820	1092.8088	1212.4019	1156.9019	858.8006	490.5867	244.9457	257.6679	584.0260	889.3181	911.2476	843.1724 (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	1934.1328	1864.2614	1627.4176	1294.7401	888.1491	493.2687	245.1427	257.9900	597.7868	1069.8926	1541.1169	1926.1678 (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	761.5962	518.4161	308.7716	99.2435	21.8353	0.0000	0.0000	0.0000	0.0000	134.3474	453.5059	805.7486 (98)
Space heating												3103.4647 (98)
RHI space heating demand												3103 (98)

FULL SAP CALCULATION PRINTOUT

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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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CALCULATION OF ENERGY RATINGS 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	22.5120	23.2624	22.5120	23.2624	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												0.0000 (63)
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												1944.2474 (64)
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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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	577.0967	572.9885	552.4766	520.5808	487.9111	458.5285	441.2399	449.1596	467.4022	499.5062	535.2632	562.3295 (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	926.2484	1223.1778	1568.8539	1958.8399	2237.9057	2250.5357	2146.6538	1917.9366	1631.4960	1254.2656	964.0631	854.0043 (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	0.9609	0.9171	0.8291	0.6766	0.5075	0.3627	0.2659	0.3089	0.5136	0.7914	0.9324	0.9686 (86)
Tweekday	17.7501	18.1782	18.6952	19.1301	19.3261	19.3938	19.4049	19.4047	19.3598	19.0313	18.3051	17.6632
Tweekend	20.1033	20.3009	20.5489	20.7716	20.8864	20.9295	20.9404	20.9378	20.9004	20.7045	20.3515	20.0616
24 / 16	9	8	9	8	9	9	9	9	8	9	8	9
24 / 9	22	20	22	22	22	21	22	22	22	22	22	22
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000 (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	0.9508	0.8976	0.7932	0.6212	0.4387	0.2837	0.1787	0.2130	0.4189	0.7341	0.9126	0.9603 (89)
Tweekday	17.7501	18.1782	18.6952	19.1301	19.3261	19.3938	19.4049	19.4047	19.3598	19.0313	18.3051	17.6632
Tweekend	17.7501	18.1782	18.6952	19.1301	19.3261	19.3938	19.4049	19.4047	19.3598	19.0313	18.3051	17.6632
MIT 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 (90)
Living area fraction									fLA = Living area / (4) =			0.1623 (91)
MIT	19.7541	19.7555	19.7569	19.7635	19.7647	19.7705	19.7705	19.7716	19.7683	19.7647	19.7622	19.7596 (92)
Temperature adjustment												0.0000
adjusted MIT	19.7541	19.7555	19.7569	19.7635	19.7647	19.7705	19.7705	19.7716	19.7683	19.7647	19.7622	19.7596 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9526	0.9011	0.7996	0.6308	0.4503	0.2968	0.1930	0.2288	0.4351	0.7444	0.9162	0.9618 (94)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Useful gains	882.3829	1102.2141	1254.4631	1235.6136	1007.8191	667.8864	414.3502	438.8563	709.8457	933.7164	883.3177	821.4176 (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	2061.6712	1979.0806	1763.7176	1436.0792	1064.8222	678.8631	416.2726	442.2106	745.8325	1210.0598	1675.9155	2064.6240 (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	877.3905	589.2543	378.8854	144.3352	42.4103	0.0000	0.0000	0.0000	0.0000	205.5995	570.6704	924.9456 (98)
Space heating												3733.4912 (98)
Space heating per m2											(98) / (4) =	48.6829 (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 %)												320.1634 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												1166.1207 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	877.3905	589.2543	378.8854	144.3352	42.4103	0.0000	0.0000	0.0000	0.0000	205.5995	570.6704	924.9456 (98)
Space heating efficiency (main heating system 1)	320.1634	320.1634	320.1634	320.1634	320.1634	0.0000	0.0000	0.0000	0.0000	320.1634	320.1634	320.1634 (210)
Space heating fuel (main heating system)	274.0447	184.0480	118.3413	45.0817	13.2465	0.0000	0.0000	0.0000	0.0000	64.2171	178.2435	288.8980 (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	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250 (216)
(217)m	107.7940	94.9738	99.6582	89.2188	87.3459	77.9239	74.7206	82.1529	82.0583	92.5206	97.9796	105.1606 (219)
Fuel for water heating, kWh/month												1091.5073 (219)
Water heating fuel used												1166.1207 (211)
Annual totals kWh/year												0.0000 (215)
Space heating fuel - main system												
Space heating fuel - secondary												
Electricity for pumps and fans:												0.0000 (231)
Total electricity for the above, kWh/year												334.3836 (232)
Electricity for lighting (calculated in Appendix L)												
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 4.84 * 1029 * 1.00) =										-3985.0110		-3985.0110 (233)
Total delivered energy for all uses												-1392.9993 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1166.1207	13.1900	153.8113 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1091.5073	13.1900	143.9698 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	334.3836	13.1900	44.1052 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	-3985.0110	13.1900	-525.6229 (252)
Total energy cost			-183.7366 (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] =	-0.6341 (257)
SAP value		108.8464
SAP rating (Section 12)		109 (258)
SAP band		A

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	1166.1207	0.5190	605.2166 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1091.5073	0.5190	566.4923 (264)
Space and water heating			1171.7090 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	334.3836	0.5190	173.5451 (268)

Energy saving/generation technologies

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

PV Unit	-3985.0110	0.5190	-2068.2207 (269)
Total kg/year			-722.9666 (272)
CO2 emissions per m2			-9.4300 (273)
EI value			107.9610
EI rating			108 (274)
EI band			A

----- Calculation of stars for heating and DHW

Main heating energy efficiency	$13.19 \times (1 + 0.29 \times 0.25) / 3.2016 = 4.418$, stars = 4
Main heating environmental impact	$0.519 \times (1 + 0.29 \times 0.25) / 3.2016 = 0.1739$, stars = 5
Water heating energy efficiency	$13.19 / 1.7813 = 7.405$, stars = 4
Water heating environmental impact	$0.519 / 1.7813 = 0.2914$, 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	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 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	22.5120	23.2624	22.5120	23.2624	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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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	577.0967	572.9885	552.4766	520.5808	487.9111	458.5285	441.2399	449.1596	467.4022	499.5062	535.2632	562.3295	(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
													1.1300	12.9236	0.6300	0.7000	0.7700	4.4631 (75)
Northeast													14.0500	40.4699	0.6300	0.7000	0.7700	173.7723 (77)
Southeast													3.7600	40.4699	0.6300	0.7000	0.7700	46.5042 (79)
Southwest													14.0500	30.0000	0.6300	0.7000	1.0000	167.2934 (82)
Northeast																		
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	969.1295	1231.0244	1570.5873	2007.2301	2250.9622	2390.6799	2260.1272	2050.7286	1732.1618	1315.7484	1028.7591	886.5012	(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)													
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	0.9502	0.9062	0.8056	0.6269	0.4427	0.2699	0.1787	0.2026	0.4188	0.7332	0.9077	0.9600	(86)
Tweekday	17.9796	18.3383	18.8390	19.2255	19.3713	19.4104	19.4120	19.4143	19.3972	19.1732	18.5456	17.8988	
Tweekend	20.2026	20.3695	20.6136	20.8199	20.9113	20.9399	20.9439	20.9435	20.9244	20.7768	20.4592	20.1634	
24 / 16	9	8	9	8	9	9	9	9	8	9	8	9	
24 / 9	22	20	22	22	22	21	22	22	22	22	22	22	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	(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	0.9371	0.8837	0.7647	0.5659	0.3692	0.1925	0.0947	0.1106	0.3207	0.6634	0.8808	0.9491	(89)
Tweekday	17.9796	18.3383	18.8390	19.2255	19.3713	19.4104	19.4120	19.4143	19.3972	19.1732	18.5456	17.8988	
Tweekend	17.9796	18.3383	18.8390	19.2255	19.3713	19.4104	19.4120	19.4143	19.3972	19.1732	18.5456	17.8988	
MIT 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	(90)
Living area fraction									fLA = Living area / (4) =			0.1623	(91)
MIT	19.7660	19.7683	19.7683	19.7716	19.7716	19.7756	19.7746	19.7765	19.7756	19.7736	19.7736	19.7705	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7660	19.7683	19.7683	19.7716	19.7716	19.7756	19.7746	19.7765	19.7756	19.7736	19.7736	19.7705	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9395	0.8877	0.7719	0.5764	0.3815	0.2052	0.1084	0.1256	0.3372	0.6759	0.8858	0.9511	(94)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Useful gains	910.4820	1092.8088	1212.4019	1156.9019	858.8006	490.5867	244.9457	257.6679	584.0260	889.3181	911.2476	843.1724 (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												
Month fracti	1934.1328	1864.2614	1627.4176	1294.7401	888.1491	493.2687	245.1427	257.9900	597.7868	1069.8926	1541.1169	1926.1678 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	761.5962	518.4161	308.7716	99.2435	21.8353	0.0000	0.0000	0.0000	0.0000	134.3474	453.5059	805.7486 (98)
Space heating per m2												3103.4647 (98)
											(98) / (4) =	40.4677 (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 %)												320.0408 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												969.7089 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	761.5962	518.4161	308.7716	99.2435	21.8353	0.0000	0.0000	0.0000	0.0000	134.3474	453.5059	805.7486 (98)
Space heating efficiency (main heating system 1)	320.0408	320.0408	320.0408	320.0408	320.0408	0.0000	0.0000	0.0000	0.0000	320.0408	320.0408	320.0408 (210)
Space heating fuel (main heating system)	237.9684	161.9844	96.4788	31.0096	6.8226	0.0000	0.0000	0.0000	0.0000	41.9782	141.7025	251.7643 (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	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250 (216)
(217)m	107.7940	94.9738	99.6582	89.2188	87.3459	77.9239	74.7206	82.1529	82.0583	92.5206	97.9796	105.1606 (219)
Fuel for water heating, kWh/month												1091.5073 (219)
Water heating fuel used												969.7089 (211)
Annual totals kWh/year												0.0000 (215)
Space heating fuel - main system												
Space heating fuel - secondary												
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (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 * 4.84 * 1090 * 1.00) =										-4222.3868		-4222.3868 (233)
Total delivered energy for all uses												-1826.7869 (238)

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

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	969.7089	26.0600	252.7062 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1091.5073	26.0600	284.4468 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	334.3836	26.0600	87.1404 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	-4222.3868	26.0600	-1100.3540 (252)
Total energy cost			-476.0607 (255)

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

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	969.7089	0.5190	503.2789 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1091.5073	0.5190	566.4923 (264)
Space and water heating			1069.7712 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	334.3836	0.5190	173.5451 (268)
Energy saving/generation technologies			
PV Unit	-4222.3868	0.5190	-2191.4188 (269)
Total kg/year			-948.1024 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy	Primary energy factor	Primary energy
	kWh/year	kg CO2/kWh	kWh/year
Space heating - main system 1	969.7089	3.0700	2977.0065 (261)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	1091.5073	3.0700	3350.9275 (264)
Space and water heating			6327.9340 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	334.3836	3.0700	1026.5577 (268)
Energy saving/generation technologies			
PV Unit	-4222.3868	3.0700	-12962.7275 (269)
Primary energy kWh/year			-5608.2359 (272)
Primary energy kWh/m2/year			-73.1286 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: A 109
Current environmental impact rating: A 108

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 2.9	-£ 121	-241 kg (25.5%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£121 3.15 kg/m²	A 112	A 111
Total Savings	£121 3.15 kg/m²		

Potential energy efficiency rating: A 112
Potential environmental impact rating: A 111

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	£624	£503	£121
Space heating	£253	£253	-£0
Water heating	£284	£163	£121
Lighting	£87	£87	£0
Generated (PV)	-£1100	-£1100	£0
Total cost of fuels	-£476	-£597	£121
Total cost of uses	-£476	-£597	£121
Delivered energy	-24 kWh/m²	-30 kWh/m²	6 kWh/m²
Carbon dioxide emissions	-0.9 tonnes	-1.2 tonnes	0.2 tonnes
CO2 emissions per m²	-12 kg/m²	-16 kg/m²	3 kg/m²
Primary energy	-73 kWh/m²	-92 kWh/m²	19 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												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												
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)												
Primary loss 23.2624 21.0112 21.8667 15.7584 10.4681 9.9053 10.2355 11.1660 17.1091 21.8667 22.5120 23.2624 (59)												
Total heat required for water heating calculated for each month												
192.0080 169.1721 176.1205 152.1674 142.7906 126.1952 120.0691 134.2384 140.7635 163.4065 174.5262 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
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												75.0000 (H13)
Daily hot water demand												91.1301 (H14)
Volume ratio Veff/V												0.8230 (H15)
Solar storage volume factor												0.9610 (H16)
Solar input												-837.4314 (H17)
Solar input -24.2838 -40.5228 -69.0149 -92.4935 -114.2680 -112.3436 -110.8590 -96.8580 -75.8593 -51.8030 -28.8041 -20.3214 (63)												
Solar input (sum of months) = Sum (63)m = -837.4314 (63)												
Output from w/h												
167.7242 128.6494 107.1056 59.6739 28.5227 13.8515 9.2101 37.3804 64.9043 111.6036 145.7221 166.9960 (64)												
Total per year (kWh/year) = Sum (64)m = 1041.3436 (64)												
Heat gains from water heating, kWh/month												
84.1090 74.5548 78.1739 67.0509 61.7629 55.6788 54.0992 59.2455 63.8906 73.9465 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)
(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 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 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (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 105.0724 93.1263 83.0146 77.3317 72.7140 79.6310 88.7369 99.3904 107.8368 110.9534 (72)													
Total internal gains													
577.0967 572.9885 550.9758 513.0768 474.1537 444.5211 427.2325 436.1527 461.3990 498.0054 535.2632 562.3295 (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	926.2484	1223.1778	1567.3531	1951.3359	2224.1483	2236.5282	2132.6463	1904.9297	1625.4928	1252.7648	964.0631	854.0043 (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 0.9609 0.9171 0.8294 0.6782 0.5101 0.3648 0.2676 0.3109 0.5151 0.7918 0.9324 0.9686 (86)													
Tweekday 17.7501 18.1782 18.6943 19.1281 19.3250 19.3935 19.4049 19.4046 19.3594 19.0306 18.3051 17.6632													
Tweekend 20.1033 20.3009 20.5484 20.7704 20.8856 20.9292 20.9403 20.9377 20.9001 20.7040 20.3515 20.0616													
24 / 16 9 8 9 8 9 9 9 9 8 9 9													
24 / 9 22 20 22 22 22 22 22 22 22 22													
16 / 9 0 0 0 0 0 0 0 0 0 0 0													
MIT 21.0000 21.0000 21.0000 21.0000 21.0000 21.0000 21.0000 21.0000 21.0000 21.0000 21.0000 21.0000 (87)													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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	0.9508	0.8976	0.7936	0.6229	0.4411	0.2854	0.1798	0.2144	0.4203	0.7345	0.9126	0.9603 (89)
Tuesday	17.7501	18.1782	18.6943	19.1281	19.3250	19.3935	19.4049	19.4046	19.3594	19.0306	18.3051	17.6632
Tuesday	17.7501	18.1782	18.6943	19.1281	19.3250	19.3935	19.4049	19.4046	19.3594	19.0306	18.3051	17.6632
MIT 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 (90)
Living area fraction									fLA = Living area / (4) =			0.1623 (91)
MIT	19.7541	19.7555	19.7569	19.7635	19.7647	19.7705	19.7705	19.7716	19.7683	19.7647	19.7622	19.7596 (92)
Temperature adjustment												0.0000
adjusted MIT	19.7541	19.7555	19.7569	19.7635	19.7647	19.7705	19.7705	19.7716	19.7683	19.7647	19.7622	19.7596 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9526	0.9011	0.7999	0.6324	0.4527	0.2985	0.1943	0.2303	0.4365	0.7449	0.9162	0.9618 (94)
Useful gains	882.3829	1102.2141	1253.7784	1234.0931	1006.9599	667.6968	414.3132	438.7904	709.5168	933.1815	883.3177	821.4176 (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	2061.6712	1979.0806	1763.7176	1436.0792	1064.8222	678.8631	416.2726	442.2106	745.8325	1210.0598	1675.9155	2064.6240 (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	877.3905	589.2543	379.3948	145.4299	43.0496	0.0000	0.0000	0.0000	0.0000	205.9975	570.6704	924.9456 (98)
Space heating												3736.1326 (98)
Space heating per m2										(98) / (4) =		48.7173 (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 %)													320.1634 (206)
Efficiency of secondary/supplementary heating system, %													100.0000 (208)
Space heating requirement													1166.9457 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	877.3905	589.2543	379.3948	145.4299	43.0496	0.0000	0.0000	0.0000	0.0000	205.9975	570.6704	924.9456	(98)
Space heating efficiency (main heating system 1)	320.1634	320.1634	320.1634	320.1634	320.1634	0.0000	0.0000	0.0000	0.0000	320.1634	320.1634	320.1634	(210)
Space heating fuel (main heating system)	274.0447	184.0480	118.5004	45.4237	13.4461	0.0000	0.0000	0.0000	0.0000	64.3414	178.2435	288.8980	(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	167.7242	128.6494	107.1056	59.6739	28.5227	13.8515	9.2101	37.3804	64.9043	111.6036	145.7221	166.9960	(64)
Efficiency of water heater	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	(216)
(217)m	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	(217)
Fuel for water heating, kWh/month	94.1610	72.2242	60.1295	33.5011	16.0127	7.7763	5.1706	20.9855	36.4375	62.6546	81.8089	93.7521	(219)
Water heating fuel used													(219)
Annual totals kWh/year													
Space heating fuel - main system													1166.9457 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													50.0000 (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 * 4.84 * 1029 * 1.00) =										-3985.0110			-3985.0110 (233)
Total delivered energy for all uses													-1849.0677 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1166.9457	13.1900	153.9201 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	584.6140	13.1900	77.1106 (247)	
Pumps and fans for heating	0.0000	0.0000	0.0000 (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			0.0000 (251)	
Energy saving/generation technologies				
PV Unit	-3985.0110	13.1900	-525.6229 (252)	
Total energy cost			-243.8920 (255)	

11a. SAP rating - Individual heating systems

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy cost deflator (Table 12):
 Energy cost factor (ECF) $[(255) \times (256)] / [(4) + 45.0] = 0.4200$ (256)
 SAP value -0.8418 (257)
 SAP rating (Section 12) 111.7427
 SAP band 112 (258)
 A

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	1166.9457	0.5190	605.6448 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	584.6140	0.5190	303.4146 (264)
Space and water heating			909.0595 (265)
Pumps and fans	50.0000	0.5190	25.9500 (267)
Energy for lighting	334.3836	0.5190	173.5451 (268)
Energy saving/generation technologies			
PV Unit	-3985.0110	0.5190	-2068.2207 (269)
Total kg/year			-959.6661 (272)
CO2 emissions per m2			-12.5100 (273)
EI value			110.5674
EI rating			111 (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												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												
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)												
Primary loss 23.2624 21.0112 21.8667 15.7584 10.4681 9.9053 10.2355 11.1660 17.1091 21.8667 22.5120 23.2624 (59)												
Total heat required for water heating calculated for each month												
192.0080 169.1721 176.1205 152.1674 142.7906 126.1952 120.0691 134.2384 140.7635 163.4065 174.5262 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												
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												75.0000 (H13)
Daily hot water demand												91.1301 (H14)
Volume ratio Veff/V												0.8230 (H15)
Solar storage volume factor												0.9610 (H16)
Solar input												-852.9275 (H17)
Solar input -26.2527 -39.4577 -66.4518 -91.8567 -110.6264 -116.4295 -113.6338 -101.4757 -79.2021 -53.8797 -31.9108 -21.7505 (63)												
Solar input (sum of months) = Sum(63)m =												-852.9275 (63)
Output from w/h												
165.7554 129.7144 109.6687 60.3107 32.1642 9.7657 6.4353 32.7627 61.5614 109.5268 142.6154 165.5669 (64)												
Total per year (kWh/year) = Sum(64)m =												1025.8476 (64)
Heat gains from water heating, kWh/month												
84.1090 74.5548 78.1739 67.0509 61.7629 55.6788 54.0992 59.2455 63.8906 73.9465 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 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 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (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 105.0724 93.1263 83.0146 77.3317 72.7140 79.6310 88.7369 99.3904 107.8368 110.9534 (72)													
Total internal gains													
577.0967 572.9885 550.9758 513.0768 474.1537 444.5211 427.2325 436.1527 461.3990 498.0054 535.2632 562.3295 (73)													

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	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	969.1295	1231.0244	1569.0865	1999.7261	2237.2049	2376.6724	2246.1198	2037.7217	1726.1586	1314.2476	1028.7591	886.5012 (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	0.9502	0.9062	0.8059	0.6285	0.4450	0.2715	0.1798	0.2039	0.4201	0.7337	0.9077	0.9600 (86)	
Tweekday	17.9796	18.3383	18.8382	19.2240	19.3707	19.4103	19.4120	19.4143	19.3970	19.1727	18.5456	17.8988	
Tweekend	20.2026	20.3695	20.6132	20.8190	20.9108	20.9398	20.9439	20.9435	20.9242	20.7765	20.4592	20.1634	
24 / 16	9	8	9	8	9	9	9	9	8	9	8	9	
24 / 9	22	20	22	22	22	21	22	22	22	22	22	22	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000 (87)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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	0.9371	0.8837	0.7650	0.5675	0.3713	0.1936	0.0953	0.1113	0.3217	0.6639	0.8808	0.9491 (89)
Tuesday	17.9796	18.3383	18.8382	19.2240	19.3707	19.4103	19.4120	19.4143	19.3970	19.1727	18.5456	17.8988
Tuesday	17.9796	18.3383	18.8382	19.2240	19.3707	19.4103	19.4120	19.4143	19.3970	19.1727	18.5456	17.8988
MIT 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 (90)
Living area fraction									fLA = Living area / (4) =			0.1623 (91)
MIT	19.7660	19.7683	19.7683	19.7716	19.7716	19.7756	19.7746	19.7765	19.7756	19.7736	19.7736	19.7705 (92)
Temperature adjustment												0.0000
adjusted MIT	19.7660	19.7683	19.7683	19.7716	19.7716	19.7756	19.7746	19.7765	19.7756	19.7736	19.7736	19.7705 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9395	0.8877	0.7723	0.5780	0.3837	0.2064	0.1091	0.1264	0.3383	0.6764	0.8858	0.9511	(94)
Useful gains	910.4820	1092.8088	1211.7972	1155.7960	858.3317	490.5406	244.9419	257.6617	583.8973	888.9358	911.2476	843.1724	(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	1934.1328	1864.2614	1627.4176	1294.7401	888.1491	493.2687	245.1427	257.9900	597.7868	1069.8926	1541.1169	1926.1678	(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	761.5962	518.4161	309.2216	100.0397	22.1841	0.0000	0.0000	0.0000	0.0000	134.6319	453.5059	805.7486	(98)
Space heating												3105.3442	(98)
Space heating per m2											(98) / (4) =	40.4922	(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 %)													320.0408 (206)
Efficiency of secondary/supplementary heating system, %													100.0000 (208)
Space heating requirement													970.2962 (211)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
761.5962	518.4161	309.2216	100.0397	22.1841	0.0000	0.0000	0.0000	0.0000	0.0000	134.6319	453.5059	805.7486 (98)	
Space heating efficiency (main heating system 1)	320.0408	320.0408	320.0408	320.0408	320.0408	0.0000	0.0000	0.0000	0.0000	320.0408	320.0408	320.0408 (210)	
Space heating fuel (main heating system)	237.9684	161.9844	96.6194	31.2584	6.9317	0.0000	0.0000	0.0000	0.0000	42.0671	141.7025	251.7643 (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	165.7554	129.7144	109.6687	60.3107	32.1642	9.7657	6.4353	32.7627	61.5614	109.5268	142.6154	165.5669 (64)	
Efficiency of water heater	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250 (216)	
Fuel for water heating, kWh/month	93.0556	72.8221	61.5684	33.8586	18.0571	5.4825	3.6128	18.3931	34.5608	61.4887	80.0648	92.9498 (219)	
Water heating fuel used												575.9144 (219)	
Annual totals kWh/year												970.2962 (211)	
Space heating fuel - main system												0.0000 (215)	
Space heating fuel - secondary													
Electricity for pumps and fans:													
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													50.0000 (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 * 4.84 * 1090 * 1.00) =										-4222.3868			-4222.3868 (233)
Total delivered energy for all uses													-2291.7926 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	970.2962	26.0600	252.8592 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	575.9144	26.0600	150.0833 (247)	
Pumps and fans for heating	0.0000	0.0000	0.0000 (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			0.0000 (251)	
Energy saving/generation technologies				
PV Unit	-4222.3868	26.0600	-1100.3540 (252)	
Total energy cost			-597.2411 (255)	

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	970.2962	0.5190	503.5837 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	575.9144	0.5190	298.8996 (264)
Space and water heating			802.4833 (265)
Pumps and fans	50.0000	0.5190	25.9500 (267)
Energy for lighting	334.3836	0.5190	173.5451 (268)
Energy saving/generation technologies			
PV Unit	-4222.3868	0.5190	-2191.4188 (269)
Total kg/year			-1189.4404 (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	970.2962	3.0700	2978.8093 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	575.9144	3.0700	1768.0573 (264)
Space and water heating			4746.8666 (265)
Pumps and fans	50.0000	3.0700	153.5000 (267)
Energy for lighting	334.3836	3.0700	1026.5577 (268)
Energy saving/generation technologies			
PV Unit	-4222.3868	3.0700	-12962.7275 (269)
Primary energy kWh/year			-7035.8032 (272)
Primary energy kWh/m2/year			-91.7434 (273)