

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

Property Reference	The Hall P04		Issued on Date	17/11/2020
Assessment Reference	Plot 04	Prop Type Ref		
Property	Plot 4, The Hall, Leatherhead Road, Chessington, KT9 2NB			

SAP Rating	102 A	DER	-0.03	TER	17.60
Environmental	102 A	% DER<TER	100.17		
CO <sub>2</sub> Emissions (t/year)	-0.50	DFEE	52.88	TTEE	57.17
General Requirements Compliance	Pass	% DFEE<TFEE	7.50		

Assessor Details	Mr. Steven Leahy, County Inspections, Tel: 01455883250, info@countyinspections.co.uk	Assessor ID	A593-0001
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Client	Prunus Developments, 8899
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### 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 <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	52.1900 (1b)	2.4000 (2b)	125.2560 (1b) - (3b)
First floor	52.1900 (1c)	2.6000 (2c)	135.6940 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	104.3800		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 260.9500 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m <sup>3</sup> 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				4 * 10 =	40.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1533 (8)							
Pressure test				Yes								
Measured/design AP50				5.0000								
Infiltration rate				0.4033 (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) =		0.3428 (21)							
Wind speed	Jan 3.8000	Feb 3.6000	Mar 3.6000	Apr 3.3000	May 3.2000	Jun 3.0000	Jul 3.1000	Aug 2.9000	Sep 2.9000	Oct 3.1000	Nov 3.1000	Dec 3.4000 (22)
Wind factor	0.9500	0.9000	0.9000	0.8250	0.8000	0.7500	0.7750	0.7250	0.7250	0.7750	0.7750	0.8500 (22a)
Adj infiltr rate	0.3257	0.3085	0.3085	0.2828	0.2742	0.2571	0.2657	0.2485	0.2485	0.2657	0.2657	0.2914 (22b)
Effective ac	0.5530	0.5476	0.5476	0.5400	0.5376	0.5330	0.5353	0.5309	0.5309	0.5353	0.5353	0.5424 (25)

#### 3. Heat losses and heat loss parameter

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K					
Entrance Door			2.1000	1.2000	2.5200		(26a)					
Windows (Uw = 1.40)			20.4000	1.3258	27.0455		(27)					
Ground Floor			52.1900	0.1300	6.7847		(28a)					
Cavity Walls	156.0000	22.5000	133.5000	0.1800	24.0300		(29a)					
Roof	52.1900		52.1900	0.1300	6.7847		(30)					
Total net area of external elements Aum(A, m <sup>2</sup> )			260.3800				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	67.1649	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							21.7320 (36)					
Total fabric heat loss						(33) + (36) =	88.8969 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 47.6229	Feb 47.1549	Mar 47.1549	Apr 46.5004	May 46.2948	Jun 45.9027	Jul 46.0956	Aug 45.7161	Sep 45.7161	Oct 46.0956	Nov 46.0956	Dec 46.7122 (38)
Heat transfer coeff	136.5198	136.0518	136.0518	135.3972	135.1917	134.7996	134.9925	134.6130	134.6130	134.9925	134.9925	135.6091 (39)
Average = Sum(39)m / 12 =												135.3187 (39)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3079	1.3034	1.3034	1.2972	1.2952	1.2914	1.2933	1.2896	1.2896	1.2933	1.2933	1.2992 (40)
HLP (average)												1.2964 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

#### 4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.7765 (42)
Average daily hot water use (litres/day)												100.1429 (43)
Daily hot water use	110.1572	106.1514	102.1457	98.1400	94.1343	90.1286	90.1286	94.1343	98.1400	102.1457	106.1514	110.1572 (44)
Energy content (annual)	163.3599	142.8756	147.4348	128.5372	123.3345	106.4283	98.6215	113.1696	114.5212	133.4634	145.6858	158.2053 (45)
Energy content (annual)												Total = Sum(45)m = 1575.6372 (45)
Distribution loss (46)m = 0.15 x (45)m	24.5040	21.4313	22.1152	19.2806	18.5002	15.9642	14.7932	16.9754	17.1782	20.0195	21.8529	23.7308 (46)
Water storage loss:												210.0000 (47)
Store volume												2.3000 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												1.2420 (55)
Enter (49) or (54) in (55)												
Total storage loss	38.5020	34.7760	38.5020	37.2600	38.5020	37.2600	38.5020	38.5020	37.2600	38.5020	37.2600	38.5020 (56)
If cylinder contains dedicated solar storage	38.5020	34.7760	38.5020	37.2600	38.5020	37.2600	38.5020	38.5020	37.2600	38.5020	37.2600	38.5020 (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	225.1243	198.6628	209.1992	188.3092	185.0989	166.2003	160.3859	174.9340	174.2932	195.2278	205.4578	219.9697 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	225.1243	198.6628	209.1992	188.3092	185.0989	166.2003	160.3859	174.9340	174.2932	195.2278	205.4578	219.9697 (64)
Total per year (kWh/year) = Sum(64)m =												2302.8632 (64)
RHI water heating demand												2303 (64)
Heat gains from water heating, kWh/month	103.7287	92.1359	98.4336	90.5562	90.4203	83.2050	82.2032	87.0404	85.8959	93.7881	96.2581	102.0148 (65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Metabolic gains (Table 5), Watts												
(66)m	166.5925	166.5925	166.5925	166.5925	166.5925	166.5925	166.5925	166.5925	166.5925	166.5925	166.5925	166.5925 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	59.2311	52.6085	42.7841	32.3904	24.2122	20.4409	22.0871	28.7097	38.5341	48.9279	57.1061	60.8773 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	392.8663	396.9430	386.6698	364.7993	337.1918	311.2447	293.9104	289.8336	300.1068	321.9773	349.5848	375.5320 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.4358	54.4358	54.4358	54.4358	54.4358	54.4358	54.4358	54.4358	54.4358	54.4358	54.4358	54.4358 (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)	-111.0617	-111.0617	-111.0617	-111.0617	-111.0617	-111.0617	-111.0617	-111.0617	-111.0617	-111.0617	-111.0617	-111.0617 (71)
Water heating gains (Table 5)	139.4203	137.1070	132.3032	125.7725	121.5326	115.5625	110.4881	116.9898	119.2999	126.0593	133.6918	137.1166 (72)
Total internal gains	704.4843	699.6251	674.7238	635.9289	595.9032	560.2147	539.4523	548.4998	570.9074	609.9311	653.3494	686.4926 (73)

#### 6. Solar gains

[Jan]	Area m <sup>2</sup>	Solar flux Table 6a W/m <sup>2</sup>	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W				
North	0.6300	12.3515	0.7600	0.7000	0.7700	2.8688 (74)						
East	4.9500	23.0403	0.7600	0.7000	0.7700	42.0472 (76)						
South	2.8800	52.3706	0.7600	0.7000	0.7700	55.6065 (78)						
West	11.9400	23.0403	0.7600	0.7000	0.7700	101.4230 (80)						
Solar gains	201.9455	322.3782	509.5368	729.3751	850.1471	923.9579	877.3353	775.5096	623.0925	417.6929	246.1656	161.4463 (83)
Total gains	906.4298	1022.0034	1184.2605	1365.3039	1446.0504	1484.1727	1416.7876	1324.0093	1194.0000	1027.6241	899.5149	847.9389 (84)

#### 7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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	53.0957	53.2783	53.2783	53.5359	53.6173	53.7733	53.6964	53.8478	53.8478	53.6964	53.6964	53.4523
alpha	4.5397	4.5519	4.5519	4.5691	4.5745	4.5849	4.5798	4.5899	4.5899	4.5798	4.5798	4.5635
util living area	0.9883	0.9796	0.9472	0.8542	0.6794	0.4389	0.2758	0.3141	0.6097	0.8889	0.9759	0.9912 (86)
MIT	19.9089	20.0543	20.3742	20.7168	20.9250	20.9921	20.9993	20.9987	20.9655	20.7120	20.2428	19.8594 (87)
Th 2	19.8346	19.8381	19.8381	19.8431	19.8446	19.8476	19.8461	19.8490	19.8490	19.8461	19.8461	19.8415 (88)
util rest of house	0.9843	0.9728	0.9297	0.8104	0.6000	0.3388	0.1663	0.1981	0.5009	0.8427	0.9663	0.9881 (89)
MIT 2	18.4357	18.6468	19.0976	19.5526	19.7878	19.8445	19.8460	19.8488	19.8306	19.5634	18.9260	18.3691 (90)

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Living area fraction									FLA = Living area / (4) =	0.1650 (91)		
MIT	18.6788	18.8790	19.3082	19.7447	19.9754	20.0338	20.0363	20.0385	20.0178	19.7529	19.1432	18.6149 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6788	18.8790	19.3082	19.7447	19.9754	20.0338	20.0363	20.0385	20.0178	19.7529	19.1432	18.6149 (93)

#### 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9786	0.9652	0.9196	0.8061	0.6095	0.3552	0.1844	0.2173	0.5177	0.8383	0.9583	0.9834 (94)
Useful gains	887.0546	986.4196	1089.0747	1100.6116	881.4340	527.2235	261.2925	287.6661	618.1915	861.4089	861.9917	833.8387 (95)
Ext temp.	5.3000	5.7000	7.5000	10.0000	13.1000	16.1000	18.1000	17.9000	15.3000	11.8000	8.1000	5.2000 (96)
Heat loss rate W												
Month fracti	1826.4663	1793.0307	1606.5293	1319.4040	929.4972	530.2752	261.3852	287.8708	635.0839	1073.5768	1490.7537	1819.1848 (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	698.9223	542.0427	384.9863	157.5305	35.7590	0.0000	0.0000	0.0000	0.0000	157.8529	452.7087	733.0975 (98)
RHI space heating demand												3162.8998 (98)
												3163 (98)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### 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 <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	52.1900 (1b)	2.4000 (2b)	125.2560 (1b) - (3b)
First floor	52.1900 (1c)	2.6000 (2c)	135.6940 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	104.3800		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 260.9500 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m <sup>3</sup> 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				4 * 10 =	40.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1533 (8)							
Pressure test				Yes								
Measured/design AP50				5.0000								
Infiltration rate					0.4033 (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) =		0.3428 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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	0.4371	0.4285	0.4199	0.3771	0.3685	0.3257	0.3257	0.3171	0.3428	0.3685	0.3856	0.4028 (22b)
Effective ac	0.5955	0.5918	0.5882	0.5711	0.5679	0.5530	0.5530	0.5503	0.5588	0.5679	0.5744	0.5811 (25)

#### 3. Heat losses and heat loss parameter

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K					
Entrance Door			2.1000	1.2000	2.5200		(26a)					
Windows (Uw = 1.40)			20.4000	1.3258	27.0455		(27)					
Ground Floor			52.1900	0.1300	6.7847		(28a)					
Cavity Walls	156.0000	22.5000	133.5000	0.1800	24.0300		(29a)					
Roof	52.1900		52.1900	0.1300	6.7847		(30)					
Total net area of external elements Aum(A, m <sup>2</sup> )			260.3800				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.1649		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							21.7320 (36)					
Total fabric heat loss						(33) + (36) =	88.8969 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 51.2816	Feb 50.9622	Mar 50.6491	Apr 49.1787	May 48.9036	Jun 47.6229	Jul 47.6229	Aug 47.3858	Sep 48.1162	Oct 48.9036	Nov 49.4601	Dec 50.0420 (38)
Heat transfer coeff	140.1784	139.8590	139.5460	138.0756	137.8005	136.5198	136.5198	136.2826	137.0131	137.8005	138.3570	138.9388 (39)
Average = Sum(39)m / 12 =												138.0743 (39)
HLP	Jan 1.3430	Feb 1.3399	Mar 1.3369	Apr 1.3228	May 1.3202	Jun 1.3079	Jul 1.3079	Aug 1.3056	Sep 1.3126	Oct 1.3202	Nov 1.3255	Dec 1.3311 (40)
HLP (average)												1.3228 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

#### 4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.7765 (42)
Average daily hot water use (litres/day)												100.1429 (43)
Daily hot water use	110.1572	106.1514	102.1457	98.1400	94.1343	90.1286	90.1286	94.1343	98.1400	102.1457	106.1514	110.1572 (44)
Energy conte	163.3599	142.8756	147.4348	128.5372	123.3345	106.4283	98.6215	113.1696	114.5212	133.4634	145.6858	158.2053 (45)
Energy content (annual)												Total = Sum(45)m = 1575.6372 (45)
Distribution loss (46)m = 0.15 x (45)m	24.5040	21.4313	22.1152	19.2806	18.5002	15.9642	14.7932	16.9754	17.1782	20.0195	21.8529	23.7308 (46)
Water storage loss:												210.0000 (47)
Store volume												2.3000 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												

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### CALCULATION OF ENERGY RATINGS 09 Jan 2014

Enter (49) or (54) in (55)												1.2420 (55)
Total storage loss	38.5020	34.7760	38.5020	37.2600	38.5020	37.2600	38.5020	38.5020	37.2600	38.5020	37.2600	38.5020 (56)
If cylinder contains dedicated solar storage	38.5020	34.7760	38.5020	37.2600	38.5020	37.2600	38.5020	38.5020	37.2600	38.5020	37.2600	38.5020 (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	225.1243	198.6628	209.1992	188.3092	185.0989	166.2003	160.3859	174.9340	174.2932	195.2278	205.4578	219.9697 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	225.1243	198.6628	209.1992	188.3092	185.0989	166.2003	160.3859	174.9340	174.2932	195.2278	205.4578	219.9697 (64)
Heat gains from water heating, kWh/month	103.7287	92.1359	98.4336	90.5562	90.4203	83.2050	82.2032	87.0404	85.8959	93.7881	96.2581	102.0148 (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	166.5925	166.5925	166.5925	166.5925	166.5925	166.5925	166.5925	166.5925	166.5925	166.5925	166.5925	166.5925 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	59.2311	52.6085	42.7841	32.3904	24.2122	20.4409	22.0871	28.7097	38.5341	48.9279	57.1061	60.8773 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	392.8663	396.9430	386.6698	364.7993	337.1918	311.2447	293.9104	289.8336	300.1068	321.9773	349.5848	375.5320 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.4358	54.4358	54.4358	54.4358	54.4358	54.4358	54.4358	54.4358	54.4358	54.4358	54.4358	54.4358 (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)	-111.0617	-111.0617	-111.0617	-111.0617	-111.0617	-111.0617	-111.0617	-111.0617	-111.0617	-111.0617	-111.0617	-111.0617 (71)
Water heating gains (Table 5)	139.4203	137.1070	132.3032	125.7725	121.5326	115.5625	110.4881	116.9898	119.2999	126.0593	133.6918	137.1166 (72)
Total internal gains	704.4843	699.6251	674.7238	635.9289	595.9032	560.2147	539.4523	548.4998	570.9074	609.9311	653.3494	686.4926 (73)

#### 6. Solar gains

[Jan]	Area m <sup>2</sup>	Solar flux Table 6a W/m <sup>2</sup>	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	0.6300	10.6334	0.7600	0.7000	0.7700	2.4698 (74)
East	4.9500	19.6403	0.7600	0.7000	0.7700	35.8424 (76)
South	2.8800	46.7521	0.7600	0.7000	0.7700	49.6407 (78)
West	11.9400	19.6403	0.7600	0.7000	0.7700	86.4563 (80)
Solar gains	174.4092	325.2608	505.5782	704.5503	843.5438	856.8518
Total gains	878.8935	1024.8859	1180.3020	1340.4791	1439.4470	1417.0666
						1357.8049
						1263.1769
						1146.9669
						377.1877
						214.3801
						145.5256 (83)
						832.0182 (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)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	51.7099	51.8280	51.9442	52.4974	52.6022	53.0957	53.0957	53.1881	52.9045	52.6022	52.3906	52.1712
alpha	4.4473	4.4552	4.4629	4.4998	4.5068	4.5397	4.5397	4.5459	4.5270	4.5068	4.4927	4.4781
util living area	0.9920	0.9834	0.9603	0.8955	0.7679	0.5883	0.4362	0.4857	0.7323	0.9335	0.9844	0.9936 (86)
MIT	19.7230	19.9183	20.2256	20.5897	20.8462	20.9650	20.9927	20.9883	20.9078	20.5535	20.0680	19.6870 (87)
Th 2	19.8073	19.8097	19.8120	19.8230	19.8251	19.8346	19.8346	19.8364	19.8309	19.8251	19.8209	19.8166 (88)
util rest of house	0.9893	0.9781	0.9474	0.8629	0.7035	0.4929	0.3239	0.3682	0.6403	0.9049	0.9784	0.9915 (89)
MIT 2	18.1469	18.4304	18.8697	19.3739	19.6883	19.8139	19.8323	19.8323	19.7659	19.3419	18.6575	18.1010 (90)
Living area fraction	18.4069	18.6759	19.0934	19.5745	19.8793	20.0038	20.0237	20.0230	19.9543	19.5418	18.8902	18.3626 (92)
Temperature adjustment	18.4069	18.6759	19.0934	19.5745	19.8793	20.0038	20.0237	20.0230	19.9543	19.5418	18.8902	0.0000
adjusted MIT	18.4069	18.6759	19.0934	19.5745	19.8793	20.0038	20.0237	20.0230	19.9543	19.5418	18.8902	18.3626 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9847	0.9710	0.9373	0.8547	0.7068	0.5074	0.3425	0.3875	0.6510	0.8962	0.9717	0.9877 (94)
Ext temp.	865.4754	995.1175	1106.2979	1145.7391	1017.3601	718.9554	464.9813	489.5209	746.6546	884.6284	843.1354	821.7550 (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	1977.4813	1926.6813	1757.3595	1473.8827	1127.1167	737.7242	467.4084	493.7482	802.1148	1232.1854	1631.2597	1967.7385 (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 per m2	827.3323	626.0108	484.3898	236.2634	81.6589	0.0000	0.0000	0.0000	0.0000	258.5824	567.4495	852.6117 (98)
												3934.2990 (98)
												(98) / (4) =
												37.6921 (99)

#### 8c. Space cooling requirement

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF ENERGY RATINGS 09 Jan 2014

Not applicable

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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 %)													92.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4253.2962 (211)
Space heating requirement	827.3323	626.0108	484.3898	236.2634	81.6589	0.0000	0.0000	0.0000	0.0000	258.5824	567.4495	852.6117	(98)
Space heating efficiency (main heating system 1)	92.5000	92.5000	92.5000	92.5000	92.5000	0.0000	0.0000	0.0000	0.0000	92.5000	92.5000	92.5000	(210)
Space heating fuel (main heating system)	894.4133	676.7685	523.6647	255.4199	88.2799	0.0000	0.0000	0.0000	0.0000	279.5486	613.4590	921.7424	(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	225.1243	198.6628	209.1992	188.3092	185.0989	166.2003	160.3859	174.9340	174.2932	195.2278	205.4578	219.9697	(64)
Efficiency of water heater (217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(216)
Fuel for water heating, kWh/month	251.5355	221.9696	233.7421	210.4014	206.8145	185.6987	179.2021	195.4570	194.7410	218.1317	229.5618	245.7762	(219)
Water heating fuel used													2573.0315 (219)
Annual totals kWh/year													
Space heating fuel - main system													4253.2962 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													75.0000 (231)
Electricity for lighting (calculated in Appendix L)													418.4160 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 5.05 * 908 * 1.00) =										-3667.7311			-3667.7311 (233)
Total delivered energy for all uses													3652.0126 (238)

#### 10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4253.2962	3.4800	148.0147	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2573.0315	3.4800	89.5415	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	418.4160	13.1900	55.1891	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-3667.7311	13.1900	-483.7737	(252)
Total energy cost			-61.1360	(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] =	-0.1719 (257)
SAP value		102.3979
SAP rating (Section 12)		102 (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	4253.2962	0.2160	918.7120	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2573.0315	0.2160	555.7748	(264)
Space and water heating			1474.4868	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	418.4160	0.5190	217.1579	(268)
Energy saving/generation technologies				
PV Unit	-3667.7311	0.5190	-1903.5525	(269)
Total kg/year			-172.9828	(272)
CO2 emissions per m2			-1.6600	(273)
EI value			101.5517	
EI rating			102	(274)
EI band			A	

#### Calculation of stars for heating and DHW

Main heating energy efficiency  $3.48 \times (1 + 0.29 \times 0.00) / 0.8950 = 3.888$ , stars = 4

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating environmental impact  $0.216 \times (1 + 0.29 \times 0.00) / 0.8950 = 0.2413$ , stars = 4  
Water heating energy efficiency  $3.48 / 0.8950 = 3.888$ , stars = 4  
Water heating environmental impact  $0.216 / 0.8950 = 0.2413$ , stars = 4

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# 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 (m2)	Storey height (m)	Volume (m3)
Ground floor	52.1900 (1b)	2.4000 (2b)	125.2560 (1b) - (3b)
First floor	52.1900 (1c)	2.6000 (2c)	135.6940 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	104.3800		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 260.9500 (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				4 * 10 =	40.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1533 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.4033 (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) =		0.3428 (21)							
Wind speed	Jan 3.8000	Feb 3.6000	Mar 3.6000	Apr 3.3000	May 3.2000	Jun 3.0000	Jul 3.1000	Aug 2.9000	Sep 2.9000	Oct 3.1000	Nov 3.1000	Dec 3.4000 (22)
Wind factor	0.9500	0.9000	0.9000	0.8250	0.8000	0.7500	0.7750	0.7250	0.7250	0.7750	0.7750	0.8500 (22a)
Adj infilt rate	0.3257	0.3085	0.3085	0.2828	0.2742	0.2571	0.2657	0.2485	0.2485	0.2657	0.2657	0.2914 (22b)
Effective ac	0.5530	0.5476	0.5476	0.5400	0.5376	0.5330	0.5353	0.5309	0.5309	0.5353	0.5353	0.5424 (25)

#### 3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Entrance Door			2.1000	1.2000	2.5200		(26a)					
Windows (Uw = 1.40)			20.4000	1.3258	27.0455		(27)					
Ground Floor			52.1900	0.1300	6.7847		(28a)					
Cavity Walls	156.0000	22.5000	133.5000	0.1800	24.0300		(29a)					
Roof	52.1900		52.1900	0.1300	6.7847		(30)					
Total net area of external elements Aum(A, m2)			260.3800				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.1649		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							21.7320 (36)					
Total fabric heat loss						(33) + (36) =	88.8969 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 47.6229	Feb 47.1549	Mar 47.1549	Apr 46.5004	May 46.2948	Jun 45.9027	Jul 46.0956	Aug 45.7161	Sep 45.7161	Oct 46.0956	Nov 46.0956	Dec 46.7122 (38)
Heat transfer coeff	136.5198	136.0518	136.0518	135.3972	135.1917	134.7996	134.9925	134.6130	134.6130	134.9925	134.9925	135.6091 (39)
Average = Sum(39)m / 12 =												135.3187 (39)
HLP	Jan 1.3079	Feb 1.3034	Mar 1.3034	Apr 1.2972	May 1.2952	Jun 1.2914	Jul 1.2933	Aug 1.2896	Sep 1.2896	Oct 1.2933	Nov 1.2933	Dec 1.2992 (40)
HLP (average)												1.2964 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

#### 4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.7765 (42)
Average daily hot water use (litres/day)												100.1429 (43)
Daily hot water use	110.1572	106.1514	102.1457	98.1400	94.1343	90.1286	90.1286	94.1343	98.1400	102.1457	106.1514	110.1572 (44)
Energy conte	163.3599	142.8756	147.4348	128.5372	123.3345	106.4283	98.6215	113.1696	114.5212	133.4634	145.6858	158.2053 (45)
Energy content (annual)												Total = Sum(45)m = 1575.6372 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	24.5040	21.4313	22.1152	19.2806	18.5002	15.9642	14.7932	16.9754	17.1782	20.0195	21.8529	23.7308 (46)
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.3000 (48)
Temperature factor from Table 2b												0.5400 (49)



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Enter (49) or (54) in (55)												1.2420 (55)
Total storage loss	38.5020	34.7760	38.5020	37.2600	38.5020	37.2600	38.5020	38.5020	37.2600	38.5020	37.2600	38.5020 (56)
If cylinder contains dedicated solar storage	38.5020	34.7760	38.5020	37.2600	38.5020	37.2600	38.5020	38.5020	37.2600	38.5020	37.2600	38.5020 (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	225.1243	198.6628	209.1992	188.3092	185.0989	166.2003	160.3859	174.9340	174.2932	195.2278	205.4578	219.9697 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	225.1243	198.6628	209.1992	188.3092	185.0989	166.2003	160.3859	174.9340	174.2932	195.2278	205.4578	219.9697 (64)
Heat gains from water heating, kWh/month	103.7287	92.1359	98.4336	90.5562	90.4203	83.2050	82.2032	87.0404	85.8959	93.7881	96.2581	102.0148 (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	166.5925	166.5925	166.5925	166.5925	166.5925	166.5925	166.5925	166.5925	166.5925	166.5925	166.5925	166.5925 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	59.2311	52.6085	42.7841	32.3904	24.2122	20.4409	22.0871	28.7097	38.5341	48.9279	57.1061	60.8773 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	392.8663	396.9430	386.6698	364.7993	337.1918	311.2447	293.9104	289.8336	300.1068	321.9773	349.5848	375.5320 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.4358	54.4358	54.4358	54.4358	54.4358	54.4358	54.4358	54.4358	54.4358	54.4358	54.4358	54.4358 (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)	-111.0617	-111.0617	-111.0617	-111.0617	-111.0617	-111.0617	-111.0617	-111.0617	-111.0617	-111.0617	-111.0617	-111.0617 (71)
Water heating gains (Table 5)	139.4203	137.1070	132.3032	125.7725	121.5326	115.5625	110.4881	116.9898	119.2999	126.0593	133.6918	137.1166 (72)
Total internal gains	704.4843	699.6251	674.7238	635.9289	595.9032	560.2147	539.4523	548.4998	570.9074	609.9311	653.3494	686.4926 (73)

#### 6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m <sup>2</sup>	Table 6a	Specific data	Specific data	factor	W						
		W/m <sup>2</sup>	or Table 6b	or Table 6c	Table 6d							
North	0.6300	12.3515	0.7600	0.7000	0.7700	2.8688 (74)						
East	4.9500	23.0403	0.7600	0.7000	0.7700	42.0472 (76)						
South	2.8800	52.3706	0.7600	0.7000	0.7700	55.6065 (78)						
West	11.9400	23.0403	0.7600	0.7000	0.7700	101.4230 (80)						
Solar gains	201.9455	322.3782	509.5368	729.3751	850.1471	923.9579	877.3353	775.5096	623.0925	417.6929	246.1656	161.4463 (83)
Total gains	906.4298	1022.0034	1184.2605	1365.3039	1446.0504	1484.1727	1416.7876	1324.0093	1194.0000	1027.6241	899.5149	847.9389 (84)

#### 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, T <sub>hl</sub> (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	53.0957	53.2783	53.2783	53.5359	53.6173	53.7733	53.6964	53.8478	53.8478	53.6964	53.6964	53.4523
alpha	4.5397	4.5519	4.5519	4.5691	4.5745	4.5849	4.5798	4.5899	4.5899	4.5798	4.5798	4.5635
util living area	0.9883	0.9796	0.9472	0.8542	0.6794	0.4389	0.2758	0.3141	0.6097	0.8889	0.9759	0.9912 (86)
MIT	19.9089	20.0543	20.3742	20.7168	20.9250	20.9921	20.9993	20.9987	20.9655	20.7120	20.2428	19.8594 (87)
Th 2	19.8346	19.8381	19.8381	19.8431	19.8446	19.8476	19.8461	19.8490	19.8490	19.8461	19.8461	19.8415 (88)
util rest of house	0.9843	0.9728	0.9297	0.8104	0.6000	0.3388	0.1663	0.1981	0.5009	0.8427	0.9663	0.9881 (89)
MIT 2	18.4357	18.6468	19.0976	19.5526	19.7878	19.8445	19.8460	19.8488	19.8306	19.5634	18.9260	18.3691 (90)
Living area fraction	18.6788	18.8790	19.3082	19.7447	19.9754	20.0338	20.0363	20.0385	20.0178	19.7529	19.1432	18.6149 (92)
Temperature adjustment	18.6788	18.8790	19.3082	19.7447	19.9754	20.0338	20.0363	20.0385	20.0178	19.7529	19.1432	0.0000
adjusted MIT	18.6788	18.8790	19.3082	19.7447	19.9754	20.0338	20.0363	20.0385	20.0178	19.7529	19.1432	18.6149 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9786	0.9652	0.9196	0.8061	0.6095	0.3552	0.1844	0.2173	0.5177	0.8383	0.9583	0.9834 (94)
Ext temp.	887.0546	986.4196	1089.0747	1100.6116	881.4340	527.2235	261.2925	287.6661	618.1915	861.4089	861.9917	833.8387 (95)
Heat loss rate W	5.3000	5.7000	7.5000	10.0000	13.1000	16.1000	18.1000	17.9000	15.3000	11.8000	8.1000	5.2000 (96)
Month fracti	1826.4663	1793.0307	1606.5293	1319.4040	929.4972	530.2752	261.3852	287.8708	635.0839	1073.5768	1490.7537	1819.1848 (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 per m <sup>2</sup>	698.9223	542.0427	384.9863	157.5305	35.7590	0.0000	0.0000	0.0000	0.0000	157.8529	452.7087	733.0975 (98)
												3162.8998 (98)
												(98) / (4) = 30.3018 (99)

#### 8c. Space cooling requirement

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Not applicable

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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 %)													92.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3419.3512 (211)
Space heating requirement	698.9223	542.0427	384.9863	157.5305	35.7590	0.0000	0.0000	0.0000	0.0000	157.8529	452.7087	733.0975	(98)
Space heating efficiency (main heating system 1)	92.5000	92.5000	92.5000	92.5000	92.5000	0.0000	0.0000	0.0000	0.0000	92.5000	92.5000	92.5000	(210)
Space heating fuel (main heating system)	755.5917	585.9921	416.2014	170.3033	38.6584	0.0000	0.0000	0.0000	0.0000	170.6518	489.4148	792.5379	(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	225.1243	198.6628	209.1992	188.3092	185.0989	166.2003	160.3859	174.9340	174.2932	195.2278	205.4578	219.9697	(64)
Efficiency of water heater (217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(216)
Fuel for water heating, kWh/month	251.5355	221.9696	233.7421	210.4014	206.8145	185.6987	179.2021	195.4570	194.7410	218.1317	229.5618	245.7762	(219)
Water heating fuel used													2573.0315 (219)
Annual totals kWh/year													
Space heating fuel - main system													3419.3512 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													75.0000 (231)
Electricity for lighting (calculated in Appendix L)													418.4160 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 5.05 * 976 * 1.00) =										-3943.9006			-3943.9006 (233)
Total delivered energy for all uses													2541.8981 (238)

#### 10a. Fuel costs - using BEDF prices (467)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3419.3512	3.9500	135.0644 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2573.0315	3.9500	101.6347 (247)
Pumps and fans for heating	75.0000	18.7000	14.0250 (249)
Energy for lighting	418.4160	18.7000	78.2438 (250)
Additional standing charges			91.0000 (251)
Energy saving/generation technologies			
PV Unit	-3943.9006	18.7000	-737.5094 (252)
Total energy cost			-317.5415 (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	3419.3512	0.2160	738.5799 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2573.0315	0.2160	555.7748 (264)
Space and water heating			1294.3547 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	418.4160	0.5190	217.1579 (268)
Energy saving/generation technologies			
PV Unit	-3943.9006	0.5190	-2046.8844 (269)
Total kg/year			-496.4468 (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	3419.3512	1.2200	4171.6084 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2573.0315	1.2200	3139.0985 (264)
Space and water heating			7310.7069 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	418.4160	3.0700	1284.5371 (268)
Energy saving/generation technologies			
PV Unit	-3943.9006	3.0700	-12107.7748 (269)
Primary energy kWh/year			-3282.2808 (272)
Primary energy kWh/m2/year			-31.4455 (273)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: A 102  
 Current environmental impact rating: A 102

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.4	-£ 40	-245 kg (49.4%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£40	2.35 kg/m <sup>2</sup>	A 104
<b>Total Savings</b>	<b>£40</b>	<b>2.35 kg/m<sup>2</sup></b>	<b>A 104</b>

Potential energy efficiency rating: A 104  
 Potential environmental impact rating: A 104

Fuel prices for cost data on this page from database revision number 467 TEST (29 Oct 2020)  
 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	£92	£102	-£9
Mains gas	£328	£278	£50
Space heating	£240	£242	-£2
Water heating	£102	£59	£42
Lighting	£78	£78	£0
Generated (PV)	-£738	-£738	£0
<b>Total cost of fuels</b>	<b>-£318</b>	<b>-£358</b>	<b>£41</b>
<b>Total cost of uses</b>	<b>-£318</b>	<b>-£359</b>	<b>£40</b>
Delivered energy	24 kWh/m <sup>2</sup>	13 kWh/m <sup>2</sup>	12 kWh/m <sup>2</sup>
Carbon dioxide emissions	-0.5 tonnes	-0.7 tonnes	0.2 tonnes
CO2 emissions per m <sup>2</sup>	-5 kg/m <sup>2</sup>	-7 kg/m <sup>2</sup>	2 kg/m <sup>2</sup>
Primary energy	-31 kWh/m <sup>2</sup>	-45 kWh/m <sup>2</sup>	13 kWh/m <sup>2</sup>

# 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 (m2)	Storey height (m)	Volume (m3)
Ground floor	52.1900 (1b)	2.4000 (2b)	125.2560 (1b) - (3b)
First floor	52.1900 (1c)	2.6000 (2c)	135.6940 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	104.3800		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 260.9500 (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				4 * 10 =	40.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1533 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.4033 (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) =	0.3428 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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	0.4371	0.4285	0.4199	0.3771	0.3685	0.3257	0.3257	0.3171	0.3428	0.3685	0.3856	0.4028 (22b)
Effective ac	0.5955	0.5918	0.5882	0.5711	0.5679	0.5530	0.5530	0.5503	0.5588	0.5679	0.5744	0.5811 (25)

#### 3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Entrance Door			2.1000	1.2000	2.5200		(26a)					
Windows (Uw = 1.40)			20.4000	1.3258	27.0455		(27)					
Ground Floor			52.1900	0.1300	6.7847		(28a)					
Cavity Walls	156.0000	22.5000	133.5000	0.1800	24.0300		(29a)					
Roof	52.1900		52.1900	0.1300	6.7847		(30)					
Total net area of external elements Aum(A, m2)			260.3800				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 67.1649		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							21.7320 (36)					
Total fabric heat loss							(33) + (36) = 88.8969 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 51.2816	Feb 50.9622	Mar 50.6491	Apr 49.1787	May 48.9036	Jun 47.6229	Jul 47.6229	Aug 47.3858	Sep 48.1162	Oct 48.9036	Nov 49.4601	Dec 50.0420 (38)
Heat transfer coeff	140.1784	139.8590	139.5460	138.0756	137.8005	136.5198	136.5198	136.2826	137.0131	137.8005	138.3570	138.9388 (39)
Average = Sum(39)m / 12 =												138.0743 (39)
HLP	Jan 1.3430	Feb 1.3399	Mar 1.3369	Apr 1.3228	May 1.3202	Jun 1.3079	Jul 1.3079	Aug 1.3056	Sep 1.3126	Oct 1.3202	Nov 1.3255	Dec 1.3311 (40)
HLP (average)												1.3228 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

#### 4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.7765 (42)
Average daily hot water use (litres/day)												100.1429 (43)
Daily hot water use	110.1572	106.1514	102.1457	98.1400	94.1343	90.1286	90.1286	94.1343	98.1400	102.1457	106.1514	110.1572 (44)
Energy conte	163.3599	142.8756	147.4348	128.5372	123.3345	106.4283	98.6215	113.1696	114.5212	133.4634	145.6858	158.2053 (45)
Energy content (annual)												Total = Sum(45)m = 1575.6372 (45)
Distribution loss (46)m = 0.15 x (45)m	24.5040	21.4313	22.1152	19.2806	18.5002	15.9642	14.7932	16.9754	17.1782	20.0195	21.8529	23.7308 (46)
Water storage loss:												210.0000 (47)
Store volume												2.3000 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Enter (49) or (54) in (55)													1.2420 (55)	
Total storage loss														
	38.5020	34.7760	38.5020	37.2600	38.5020	37.2600	38.5020	38.5020	37.2600	38.5020	37.2600	38.5020	37.2600	38.5020 (56)
If cylinder contains dedicated solar storage														
	24.7513	22.3560	24.7513	23.9529	24.7513	23.9529	24.7513	24.7513	23.9529	24.7513	23.9529	24.7513	23.9529	24.7513 (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	23.2624	(59)
Total heat required for water heating calculated for each month														
	211.3736	186.2428	194.0528	168.2485	158.5539	140.2865	133.6082	149.0868	155.5832	180.0814	192.1506	206.2190	206.2190	(62)
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													1.1510 (H8)	
Utilisation factor													0.5805 (H9)	
Collector performance factor													0.8793 (H10)	
Dedicated solar storage volume													75.0000 (H11)	
Effective solar volume													115.5000 (H13)	
Daily hot water demand													100.1429 (H14)	
Volume ratio Veff/V													1.1534 (H15)	
Solar storage volume factor													1.0000 (H16)	
Solar input													-925.7814 (H17)	
Solar input	-26.8458	-44.7979	-76.2960	-102.2517	-126.3234	-124.1960	-122.5547	-107.0767	-83.8625	-57.2682	-31.8430	-22.4654	-22.4654	(63)
Solar input (sum of months) = Sum(63)m =													-925.7814 (63)	
Output from w/h														
	184.5277	141.4448	117.7567	65.9968	32.2305	16.0905	11.0535	42.0102	71.7207	122.8131	160.3076	183.7536	183.7536	(64)
Total per year (kWh/year) = Sum(64)m =													1149.7058 (64)	
Heat gains from water heating, kWh/month														
	92.7281	82.1999	86.3164	74.5076	69.1842	62.4739	60.7810	66.3627	70.9279	81.6709	85.6124	91.0142	91.0142	(65)

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

Metabolic gains (Table 5), Watts														
(66)m	166.5925	166.5925	166.5925	166.5925	166.5925	166.5925	166.5925	166.5925	166.5925	166.5925	166.5925	166.5925	166.5925	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5														
	59.2311	52.6085	42.7841	32.3904	24.2122	20.4409	22.0871	28.7097	38.5341	48.9279	57.1061	60.8773	60.8773	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5														
	392.8663	396.9430	386.6698	364.7993	337.1918	311.2447	293.9104	289.8336	300.1068	321.9773	349.5848	375.5320	375.5320	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5														
	54.4358	54.4358	54.4358	54.4358	54.4358	54.4358	54.4358	54.4358	54.4358	54.4358	54.4358	54.4358	54.4358	(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	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)														
	-111.0617	-111.0617	-111.0617	-111.0617	-111.0617	-111.0617	-111.0617	-111.0617	-111.0617	-111.0617	-111.0617	-111.0617	-111.0617	(71)
Water heating gains (Table 5)														
	124.6346	122.3213	116.0167	103.4828	92.9896	86.7693	81.6949	89.1972	98.5110	109.7728	118.9061	122.3309	122.3309	(72)
Total internal gains	689.6986	684.8394	658.4373	613.6391	567.3602	531.4216	510.6591	520.7071	550.1185	593.6446	638.5636	671.7069	671.7069	(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				
North	0.6300		10.6334		0.7600		0.7000		0.7700		2.4698 (74)		
East	4.9500		19.6403		0.7600		0.7000		0.7700		35.8424 (76)		
South	2.8800		46.7521		0.7600		0.7000		0.7700		49.6407 (78)		
West	11.9400		19.6403		0.7600		0.7000		0.7700		86.4563 (80)		
Solar gains	174.4092	325.2608	505.5782	704.5503	843.5438	856.8518	818.3526	714.6771	576.0595	377.1877	214.3801	145.5256	145.5256 (83)
Total gains	864.1078	1010.1002	1164.0154	1318.1894	1410.9039	1388.2734	1329.0117	1235.3842	1126.1780	970.8323	852.9437	817.2324	817.2324 (84)

#### 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, T <sub>hl</sub> (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	51.7099	51.8280	51.9442	52.4974	52.6022	53.0957	53.0957	53.1881	52.9045	52.6022	52.3906	52.1712	
alpha	4.4473	4.4552	4.4629	4.4998	4.5068	4.5397	4.5397	4.5459	4.5270	4.5068	4.4927	4.4781	
util living area	0.9925	0.9843	0.9621	0.9003	0.7770	0.5985	0.4452	0.4957	0.7410	0.9368	0.9854	0.9941	(86)
MIT	19.7106	19.9064	20.2139	20.5778	20.8383	20.9625	20.9921	20.9873	20.9031	20.5430	20.0560	19.6745	(87)
Th 2	19.8073	19.8097	19.8120	19.8230	19.8251	19.8346	19.8346	19.8364	19.8309	19.8251	19.8209	19.8166	(88)
util rest of house	0.9900	0.9792	0.9497	0.8686	0.7133	0.5022	0.3308	0.3762	0.6495	0.9093	0.9797	0.9921	(89)
MIT 2	18.1290	18.4134	18.8535	19.3590	19.6803	19.8123	19.8321	19.8319	19.7621	19.3286	18.6405	18.0829	(90)
Living area fraction													fLA = Living area / (4) = 0.1650 (91)
MIT	18.3899	18.6597	19.0779	19.5601	19.8714	20.0020	20.0235	20.0225	19.9503	19.5290	18.8740	18.3454	(92)
Temperature adjustment													0.0000
adjusted MIT	18.3899	18.6597	19.0779	19.5601	19.8714	20.0020	20.0235	20.0225	19.9503	19.5290	18.8740	18.3454	(93)

#### 8. Space heating requirement

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9856	0.9723	0.9397	0.8602	0.7161	0.5167	0.3497	0.3959	0.6598	0.9005	0.9732	0.9884	(94)	
Useful gains	851.6672	982.1046	1093.8688	1133.9246	1010.3350	717.3099	464.7257	489.0722	743.0684	874.2310	830.0862	807.7726	(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	1975.1019	1924.4244	1755.1965	1471.8949	1126.0201	737.4852	467.3703	493.6821	801.5728	1230.4142	1629.0172	1965.3515	(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	835.8354	633.2389	492.0278	243.3386	86.0698	0.0000	0.0000	0.0000	0.0000	265.0003	575.2303	861.2387	(98)	
Space heating												3991.9798	(98)	
Space heating per m2												(98) / (4) =	38.2447	(99)

#### 8c. Space cooling requirement

Not applicable

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
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 %)													92.5000	(206)	
Efficiency of secondary/supplementary heating system, %													0.0000	(208)	
Space heating requirement													4315.6539	(211)	
Space heating requirement	835.8354	633.2389	492.0278	243.3386	86.0698	0.0000	0.0000	0.0000	0.0000	265.0003	575.2303	861.2387	(98)		
Space heating efficiency (main heating system 1)	92.5000	92.5000	92.5000	92.5000	92.5000	0.0000	0.0000	0.0000	0.0000	92.5000	92.5000	92.5000	(210)		
Space heating fuel (main heating system)	903.6059	684.5826	531.9219	263.0688	93.0484	0.0000	0.0000	0.0000	0.0000	286.4868	621.8706	931.0689	(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	184.5277	141.4448	117.7567	65.9968	32.2305	16.0905	11.0535	42.0102	71.7207	122.8131	160.3076	183.7536	(64)		
Efficiency of water heater (217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(216)		
Fuel for water heating, kWh/month	206.1762	158.0389	131.5717	73.7394	36.0118	17.9782	12.3503	46.9387	80.1348	137.2214	179.1147	205.3113	(219)		
Water heating fuel used												1284.5875	(219)		
Annual totals kWh/year															
Space heating fuel - main system													4315.6539	(211)	
Space heating fuel - secondary													0.0000	(215)	
Electricity for pumps and fans:															
central heating pump														30.0000	(230c)
main heating flue fan														45.0000	(230e)
pump for solar water heating														50.0000	(230g)
Total electricity for the above, kWh/year														125.0000	(231)
Electricity for lighting (calculated in Appendix L)														418.4160	(232)
Energy saving/generation technologies (Appendices M ,N and Q)															
PV Unit 0 (0.80 * 5.05 * 908 * 1.00) =										-3667.7311				-3667.7311	(233)
Total delivered energy for all uses														2475.9263	(238)

#### 10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year		
Space heating - main system 1	4315.6539	3.4800	150.1848	(240)	
Space heating - secondary	0.0000	0.0000	0.0000	(242)	
Water heating (other fuel)	1284.5875	3.4800	44.7036	(247)	
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)	
Pump for solar water heating	50.0000	13.1900	6.5950	(249)	
Energy for lighting	418.4160	13.1900	55.1891	(250)	
Additional standing charges			120.0000	(251)	
Energy saving/generation technologies					
PV Unit		-3667.7311	13.1900	-483.7737	(252)
Total energy cost				-97.2088	(255)

#### 11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)		-0.2733	(257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	103.8127	
SAP rating (Section 12)		104	(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
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# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Space heating - main system 1	4315.6539	0.2160	932.1812 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1284.5875	0.2160	277.4709 (264)
Space and water heating			1209.6521 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	418.4160	0.5190	217.1579 (268)
Energy saving/generation technologies			
PV Unit			
Total kg/year	-3667.7311	0.5190	-1903.5525 (269)
CO2 emissions per m2			-411.8674 (272)
EI value			-3.9500 (273)
EI rating			103.6946
EI band			104 (274)
			A

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# 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 (m2)	Storey height (m)	Volume (m3)
Ground floor	52.1900 (1b)	2.4000 (2b)	125.2560 (1b) - (3b)
First floor	52.1900 (1c)	2.6000 (2c)	135.6940 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	104.3800		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 260.9500 (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				4 * 10 =	40.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1533 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.4033 (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) =		0.3428 (21)							
Wind speed	Jan 3.8000	Feb 3.6000	Mar 3.6000	Apr 3.3000	May 3.2000	Jun 3.0000	Jul 3.1000	Aug 2.9000	Sep 2.9000	Oct 3.1000	Nov 3.1000	Dec 3.4000 (22)
Wind factor	0.9500	0.9000	0.9000	0.8250	0.8000	0.7500	0.7750	0.7250	0.7250	0.7750	0.7750	0.8500 (22a)
Adj infilt rate	0.3257	0.3085	0.3085	0.2828	0.2742	0.2571	0.2657	0.2485	0.2485	0.2657	0.2657	0.2914 (22b)
Effective ac	0.5530	0.5476	0.5476	0.5400	0.5376	0.5330	0.5353	0.5309	0.5309	0.5353	0.5353	0.5424 (25)

#### 3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Entrance Door			2.1000	1.2000	2.5200		(26a)					
Windows (Uw = 1.40)			20.4000	1.3258	27.0455		(27)					
Ground Floor			52.1900	0.1300	6.7847		(28a)					
Cavity Walls	156.0000	22.5000	133.5000	0.1800	24.0300		(29a)					
Roof	52.1900		52.1900	0.1300	6.7847		(30)					
Total net area of external elements Aum(A, m2)			260.3800				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 67.1649		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							21.7320 (36)					
Total fabric heat loss							(33) + (36) = 88.8969 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 47.6229	Feb 47.1549	Mar 47.1549	Apr 46.5004	May 46.2948	Jun 45.9027	Jul 46.0956	Aug 45.7161	Sep 45.7161	Oct 46.0956	Nov 46.0956	Dec 46.7122 (38)
Heat transfer coeff	136.5198	136.0518	136.0518	135.3972	135.1917	134.7996	134.9925	134.6130	134.6130	134.9925	134.9925	135.6091 (39)
Average = Sum(39)m / 12 =												135.3187 (39)
HLP	Jan 1.3079	Feb 1.3034	Mar 1.3034	Apr 1.2972	May 1.2952	Jun 1.2914	Jul 1.2933	Aug 1.2896	Sep 1.2896	Oct 1.2933	Nov 1.2933	Dec 1.2992 (40)
HLP (average)												1.2964 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

#### 4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.7765 (42)
Average daily hot water use (litres/day)												100.1429 (43)
Daily hot water use	110.1572	106.1514	102.1457	98.1400	94.1343	90.1286	90.1286	94.1343	98.1400	102.1457	106.1514	110.1572 (44)
Energy conte	163.3599	142.8756	147.4348	128.5372	123.3345	106.4283	98.6215	113.1696	114.5212	133.4634	145.6858	158.2053 (45)
Energy content (annual)												Total = Sum(45)m = 1575.6372 (45)
Distribution loss (46)m = 0.15 x (45)m												23.7308 (46)
Water storage loss:												210.0000 (47)
Store volume												2.3000 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												





# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9798	0.9668	0.9226	0.8126	0.6192	0.3621	0.1882	0.2219	0.5258	0.8439	0.9604	0.9844	(94)
Useful gains	873.6219	973.7490	1077.6026	1091.3455	877.7778	526.9311	261.2817	287.6422	616.9271	853.4968	849.6925	820.1280	(95)
Ext temp.	5.3000	5.7000	7.5000	10.0000	13.1000	16.1000	18.1000	17.9000	15.3000	11.8000	8.1000	5.2000	(96)
Heat loss rate W	1824.1892	1790.8760	1604.5784	1317.9065	928.9568	530.2327	261.3831	287.8665	634.9014	1072.2855	1488.6731	1816.8798	(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	707.2220	549.1093	392.0700	163.1240	38.0772	0.0000	0.0000	0.0000	0.0000	162.7788	460.0660	741.5834	(98)
Space heating												3214.0307	(98)
Space heating per m2												(98) / (4) =	30.7916 (99)

#### 8c. Space cooling requirement

Not applicable

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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 %)													92.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3474.6278 (211)
Space heating requirement	707.2220	549.1093	392.0700	163.1240	38.0772	0.0000	0.0000	0.0000	0.0000	162.7788	460.0660	741.5834	(98)
Space heating efficiency (main heating system 1)	92.5000	92.5000	92.5000	92.5000	92.5000	0.0000	0.0000	0.0000	0.0000	92.5000	92.5000	92.5000	(210)
Space heating fuel (main heating system)	764.5643	593.6317	423.8595	176.3503	41.1645	0.0000	0.0000	0.0000	0.0000	175.9771	497.3687	801.7118	(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	181.5110	143.5727	120.1013	66.3487	35.9244	11.2639	7.0379	37.2049	68.3110	119.1203	157.0208	182.2770	(64)
Efficiency of water heater (217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(216)
Fuel for water heating, kWh/month	202.8056	160.4164	134.1913	74.1326	40.1390	12.5854	7.8636	41.5697	76.3251	133.0954	175.4422	203.6614	(219)
Water heating fuel used												1262.2278	(219)
Annual totals kWh/year													
Space heating fuel - main system													3474.6278 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													125.0000 (231)
Electricity for lighting (calculated in Appendix L)													418.4160 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 5.05 * 976 * 1.00) =										-3943.9006			-3943.9006 (233)
Total delivered energy for all uses													1336.3711 (238)

#### 10a. Fuel costs - using BEDF prices (467)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3474.6278	3.9500	137.2478	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1262.2278	3.9500	49.8590	(247)
Pumps and fans for heating	75.0000	18.7000	14.0250	(249)
Pump for solar water heating	50.0000	18.7000	9.3500	(249)
Energy for lighting	418.4160	18.7000	78.2438	(250)
Additional standing charges			91.0000	(251)
Energy saving/generation technologies				
PV Unit		-3943.9006	18.7000	-737.5094 (252)
Total energy cost				-357.7848 (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	3474.6278	0.2160	750.5196	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1262.2278	0.2160	272.6412	(264)
Space and water heating			1023.1608	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	418.4160	0.5190	217.1579	(268)
Energy saving/generation technologies				
PV Unit		-3943.9006	0.5190	-2046.8844 (269)
Total kg/year				-741.6907 (272)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

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 13a. Primary energy - Individual heating systems including micro-CHP  
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	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3474.6278	1.2200	4239.0460 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1262.2278	1.2200	1539.9179 (264)
Space and water heating			5778.9639 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	418.4160	3.0700	1284.5371 (268)
Energy saving/generation technologies			
PV Unit	-3943.9006	3.0700	-12107.7748 (269)
Primary energy kWh/year			-4660.5238 (272)
Primary energy kWh/m2/year			-44.6496 (273)