

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	Q12433 P2		Issued on Date	30/10/2023	
Assessment Reference	Baseline	Prop Type Ref	New Build		
Property	Plot 2, 31, Beech Hill Avenue, Barnet, Hertfordshire, EN4 0LU				
SAP Rating	87 B	DER	12.95	TER	12.96
Environmental	85 B	% DER<TER	0.06		
CO₂ Emissions (t/year)	4.21	DFEE	49.25	TFEE	56.06
General Requirements Compliance	Pass	% DFEE<TFEE	12.15		
Assessor Details	Mr. Joe Cantwell Dillon, Joe Dillon, Tel: , joe.dillon@atspaceltd.com			Assessor ID	BL89-0001
Client	Town & Country Planning Ltd, Q-02404				

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS DESIGNED

Detached House, total floor area 379 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 12.96 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.95 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)56.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.22 (max. 0.30)	0.30 (max. 0.70)	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.20 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 5.00 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from manufacturer
Design Stage Gas boiler

Efficiency: 90.0% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 2.86 kWh/day
Permitted by DBSCG 2.86 OK
Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

Cylinderstat OK
Independent timer for DHW OK

Boiler interlock

Yes OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Medium OK

Based on:

Overshading: Average
Windows facing North East: 26.92 m², No overhang
Windows facing South East: 1.05 m², No overhang
Windows facing South West: 40.68 m², No overhang
Windows facing North West: 4.20 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

External wall U-value 0.13 W/m²K

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	178.4800 (1b)	x 2.8500 (2b)	= 508.6680 (1b) - (3b)
First floor	133.5100 (1c)	x 2.9400 (2c)	= 392.5194 (1c) - (3c)
Second floor	67.3700 (1d)	x 1.9100 (2d)	= 128.6767 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	379.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 1029.8641 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					7 * 10 = 70.0000 (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) =					Air changes per hour 70.0000 / (5) = 0.0680 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3180 (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) =	0.2703 (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	0.3446	0.3378	0.3311	0.2973	0.2905	0.2568	0.2568	0.2500	0.2703	0.2905	0.3041	0.3176 (22b)
Effective ac	0.5594	0.5571	0.5548	0.5442	0.5422	0.5330	0.5330	0.5313	0.5365	0.5422	0.5462	0.5504 (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					
Glazing (Uw = 1.40)			72.8500	1.3258	96.5814		(27)					
Solid Door			2.0000	1.4000	2.8000		(26)					
Rooflight (Uw = 1.40)			14.2400	1.3258	18.8788		(27a)					
Heat Loss Floor 1			190.3800	0.1500	28.5570	110.0000	20941.8000 (28a)					
External Wall 1	325.2500	71.4700	253.7800	0.2300	58.3694	9.0000	2284.0200 (29a)					
Dormer Cheeks	16.6100	3.3800	13.2300	0.3000	3.9690	9.0000	119.0700 (29a)					
Ashlar Wall	29.6900		29.6900	0.1300	3.8597	9.0000	267.2100 (29a)					
Flat Roof	48.0200	9.5000	38.5200	0.1600	6.1632	9.0000	346.6800 (30)					
Slope Roof	68.2900	4.7400	63.5500	0.1800	11.4390	9.0000	571.9500 (30)					
Dormer Roof	6.9500		6.9500	0.2000	1.3900	9.0000	62.5500 (30)					
Ashlar Ceiling	66.1400		66.1400	0.1300	8.5982	9.0000	595.2600 (30)					
Total net area of external elements Aum(A, m2)			751.3300				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	240.6057		(33)					
Stud			311.0800			9.0000	2799.7200 (32c)					
Block			222.2200			75.0000	16666.5000 (32c)					
Internal Floor 1			133.5100			18.0000	2403.1800 (32d)					
Internal Floor 2			67.3700			18.0000	1212.6600 (32d)					
Internal Ceiling 1			133.5100			18.0000	2403.1800 (32e)					
Internal Ceiling 2			67.3700			18.0000	1212.6600 (32e)					
Heat capacity Cm = Sum(A x k)							(28) ... (30) + (32) + (32a) ... (32e) = 51886.4400 (34)					
Thermal mass parameter (TMP) = Cm / TFA in kJ/m2K							136.7736 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							46.1083 (36)					
Total fabric heat loss							(33) + (36) = 286.7140 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 190.1063	Feb 189.3228	Mar 188.5547	Apr 184.9472	May 184.2723	Jun 181.1302	Jul 181.1302	Aug 180.5484	Sep 182.3405	Oct 184.2723	Nov 185.6377	Dec 187.0652 (38)
Heat transfer coeff	476.8204	476.0368	475.2688	471.6613	470.9863	467.8443	467.8443	467.2624	469.0545	470.9863	472.3517	473.7792 (39)
Average = Sum(39)m / 12 =												471.6580 (39)
HLP	Jan 1.2569	Feb 1.2548	Mar 1.2528	Apr 1.2433	May 1.2415	Jun 1.2332	Jul 1.2332	Aug 1.2317	Sep 1.2364	Oct 1.2415	Nov 1.2451	Dec 1.2489 (40)
HLP (average)												1.2433 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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Assumed occupancy 3.2351 (42)
Average daily hot water use (litres/day) 111.0336 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	122.1369	117.6956	113.2542	108.8129	104.3716	99.9302	99.9302	104.3716	108.8129	113.2542	117.6956	122.1369 (44)
Energy content (annual)	181.1255	158.4136	163.4686	142.5159	136.7474	118.0026	109.3468	125.4770	126.9756	147.9778	161.5294	175.4104 (45)
Energy content (annual)	Total = Sum(45)m = 1746.9905 (45)											
Distribution loss (46)m = 0.15 x (45)m	27.1688	23.7620	24.5203	21.3774	20.5121	17.7004	16.4020	18.8216	19.0463	22.1967	24.2294	26.3116 (46)
Water storage loss:												
Store volume	300.0000 (47)											
a) If manufacturer declared loss factor is known (kWh/day):	2.8600 (48)											
Temperature factor from Table 2b	0.5400 (49)											
Enter (49) or (54) in (55)	1.5444 (55)											
Total storage loss	47.8764	43.2432	47.8764	46.3320	47.8764	46.3320	47.8764	47.8764	46.3320	47.8764	46.3320	47.8764 (56)
If cylinder contains dedicated solar storage	47.8764	43.2432	47.8764	46.3320	47.8764	46.3320	47.8764	47.8764	46.3320	47.8764	46.3320	47.8764 (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	252.2643	222.6680	234.6074	211.3599	207.8862	186.8466	180.4856	196.6158	195.8196	219.1166	230.3734	246.5492 (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	252.2643	222.6680	234.6074	211.3599	207.8862	186.8466	180.4856	196.6158	195.8196	219.1166	230.3734	246.5492 (64)
Total per year (kWh/year) = Sum(64)m =	2584.5925 (64)											
Heat gains from water heating, kWh/month	117.1353	104.0760	111.2644	102.4617	102.3795	94.3111	93.2688	98.6321	97.2946	106.1137	108.7837	115.2350 (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	161.7549	161.7549	161.7549	161.7549	161.7549	161.7549	161.7549	161.7549	161.7549	161.7549	161.7549	161.7549 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.3368	41.1560	33.4703	25.3391	18.9413	15.9911	17.2789	22.4598	30.1454	38.2766	44.6744	47.6247 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	519.7581	525.1516	511.5603	482.6259	446.1014	411.7736	388.8405	383.4470	397.0384	425.9727	462.4972	496.8250 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	39.1755	39.1755	39.1755	39.1755	39.1755	39.1755	39.1755	39.1755	39.1755	39.1755	39.1755	39.1755 (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)	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039 (71)
Water heating gains (Table 5)	157.4399	154.8750	149.5489	142.3080	137.6069	130.9876	125.3613	132.5701	135.1314	142.6259	151.0885	154.8858 (72)
Total internal gains	798.0613	795.7091	769.1059	724.7995	677.1761	633.2787	606.0072	613.0033	636.8416	681.4017	732.7866	773.8619 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
Northeast	26.9200	11.2829	0.5500	0.0000	0.7700	0.7700	128.6325 (75)	
Southeast	1.0500	36.7938	0.5500	0.0000	0.7700	0.7700	16.3613 (77)	
Southwest	40.6800	36.7938	0.5500	0.0000	0.7700	0.7700	633.8834 (79)	
Northwest	4.2000	11.2829	0.5500	0.0000	0.7700	0.7700	20.0690 (81)	
Northeast	1.5800	17.4137	0.6300	0.7000	1.0000	1.0000	10.9202 (82)	
Southeast	1.5800	38.2331	0.6300	0.7000	1.0000	1.0000	23.9760 (82)	
Northwest	1.5800	17.4137	0.6300	0.7000	1.0000	1.0000	10.9202 (82)	
Horizontal	9.5000	26.0000	0.6300	0.7000	1.0000	1.0000	98.0343 (82)	

Solar gains 942.7969 1704.5126 2578.4722 3582.2342 4347.5815 4458.6625 4239.6781 3650.1566 2924.8684 1951.7575 1147.5831 794.7727 (83)
Total gains 1740.8582 2500.2217 3347.5780 4307.0336 5024.7576 5091.9411 4845.6853 4263.1599 3561.7101 2633.1592 1880.3697 1568.6346 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	30.2271	30.2769	30.3258	30.5577	30.6015	30.8070	30.8070	30.8454	30.7276	30.6015	30.5131	30.4211 (85)
alpha	3.0151	3.0185	3.0217	3.0372	3.0401	3.0538	3.0538	3.0564	3.0485	3.0401	3.0342	3.0281
util living area	0.9920	0.9768	0.9386	0.8463	0.6987	0.5339	0.4064	0.4713	0.7159	0.9237	0.9838	0.9941 (86)
MIT	19.1602	19.4442	19.8573	20.3304	20.6664	20.8339	20.8866	20.8723	20.7178	20.2163	19.5832	19.1106 (87)
Th 2	19.8747	19.8764	19.8780	19.8855	19.8869	19.8935	19.8935	19.8947	19.8910	19.8869	19.8841	19.8811 (88)
util rest of house	0.9903	0.9721	0.9263	0.8169	0.6459	0.4571	0.3114	0.3702	0.6437	0.9024	0.9798	0.9929 (89)
MIT 2	17.3996	17.8128	18.4068	19.0695	19.5052	19.7028	19.7511	19.7431	19.5865	18.9323	18.0233	17.3314 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.6765	18.0695	18.6350	19.2679	19.6879	19.8808	19.9298	19.9207	19.7645	19.1343	18.2687	17.6113 (92)
Temperature adjustment	-0.1500											
adjusted MIT	17.5265	17.9195	18.4850	19.1179	19.5379	19.7308	19.7798	19.7707	19.6145	18.9843	18.1187	17.4613 (93)

8. Space heating requirement

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9850	0.9605	0.9062	0.7928	0.6275	0.4451	0.3012	0.3581	0.6230	0.8793	0.9704	0.9887	(94)
Useful gains	1714.7135	2401.3496	3033.6070	3414.7879	3152.9375	2266.3990	1459.4083	1526.8183	2218.8127	2315.4295	1824.7573	1550.9513	(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													
	6306.6835	6197.7458	5696.0825	4819.3641	3691.5269	2400.4091	1487.6374	1575.0140	2586.5808	3948.8975	5204.7219	6282.9188	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	3416.4257	2551.1782	1980.8817	1011.2949	400.7105	0.0000	0.0000	0.0000	0.0000	1215.3002	2433.5745	3520.5838	(98)
Space heating												16529.9495	(98)
Space heating per m2												(98) / (4) =	43.5733 (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 %)													93.3000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													17716.9877 (211)
Space heating requirement	3416.4257	2551.1782	1980.8817	1011.2949	400.7105	0.0000	0.0000	0.0000	0.0000	1215.3002	2433.5745	3520.5838	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	3661.7639	2734.3818	2123.1316	1083.9173	429.4861	0.0000	0.0000	0.0000	0.0000	1302.5725	2608.3328	3773.4017	(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	252.2643	222.6680	234.6074	211.3599	207.8862	186.8466	180.4856	196.6158	195.8196	219.1166	230.3734	246.5492	(64)
Efficiency of water heater	90.1254	89.9969	89.7125	88.9773	87.1777	80.8000	80.8000	80.8000	80.8000	89.1968	89.9279	90.1624	(217)
Fuel for water heating, kWh/month	279.9039	247.4172	261.5103	237.5436	238.4626	231.2458	223.3732	243.3364	242.3510	245.6552	256.1756	273.4502	(219)
Water heating fuel used												2980.4249	(219)
Annual totals kWh/year													
Space heating fuel - main system													17716.9877 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
Total electricity for the above, kWh/year													30.0000 (231)
Electricity for lighting (calculated in Appendix L)													818.3227 (232)
Total delivered energy for all uses													21545.7353 (238)

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	17716.9877	0.2160	3826.8693	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2980.4249	0.2160	643.7718	(264)
Space and water heating			4470.6411	(265)
Pumps and fans	30.0000	0.5190	15.5700	(267)
Energy for lighting	818.3227	0.5190	424.7095	(268)
Total CO2, kg/year			4910.9206	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.9500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

	DER	TFA	N	EF	
Total Floor Area		379.3600			
Assumed number of occupants			3.2351		
CO2 emission factor in Table 12 for electricity displaced from grid				0.5190	
CO2 emissions from appliances, equation (L14)				8.1189	ZC2
CO2 emissions from cooking, equation (L16)				0.5184	ZC3
Total CO2 emissions				21.5872	ZC4
Residual CO2 emissions offset from biofuel CHP				0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year				0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation				0.0000	ZC7
Net CO2 emissions				21.5872	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	178.4800 (1b)	x 2.8500 (2b)	= 508.6680 (1b) - (3b)
First floor	133.5100 (1c)	x 2.9400 (2c)	= 392.5194 (1c) - (3c)
Second floor	67.3700 (1d)	x 1.9100 (2d)	= 128.6767 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	379.3600		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 1029.8641 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.0388 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.2888 (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) =	0.2455 (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												
Effective ac	0.3130	0.3069	0.3008	0.2701	0.2639	0.2332	0.2332	0.2271	0.2455	0.2639	0.2762	0.2885 (22b)
	0.5490	0.5471	0.5452	0.5365	0.5348	0.5272	0.5272	0.5258	0.5301	0.5348	0.5381	0.5416 (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
TER Opaque door			2.0000	1.0000	2.0000		(26)
TER Opening Type (Uw = 1.40)			72.8500	1.3258	96.5814		(27)
TER Room Window (Uw = 1.70)			14.2400	1.5918	22.6667		(27a)
Heat Loss Floor 1			190.3800	0.1300	24.7494		(28a)
External Wall 1	325.2500	71.4700	253.7800	0.1800	45.6804		(29a)
Dormer Cheeks	16.6100	3.3800	13.2300	0.1800	2.3814		(29a)
Ashlar Wall	29.6900		29.6900	0.1800	5.3442		(29a)
Flat Roof	48.0200	9.5000	38.5200	0.1300	5.0076		(30)
Slope Roof	68.2900	4.7400	63.5500	0.1300	8.2615		(30)
Dormer Roof	6.9500		6.9500	0.1300	0.9035		(30)
Ashlar Ceiling	66.1400		66.1400	0.1300	8.5982		(30)
Total net area of external elements Aum(A, m2)			751.3300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	222.1743	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							28.2408 (36)
Total fabric heat loss							(33) + (36) = 250.4151 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	186.5784	185.9319	185.2981	182.3213	181.7644	179.1717	179.1717	178.6915	180.1703	181.7644	182.8911	184.0690 (38)
Average = Sum(39)m / 12 =	436.9936	436.3470	435.7132	432.7364	432.1795	429.5868	429.5868	429.1066	430.5854	432.1795	433.3062	434.4841 (39)
												432.7337 (39)
HLP	1.1519	1.1502	1.1485	1.1407	1.1392	1.1324	1.1324	1.1311	1.1350	1.1392	1.1422	1.1453 (40)
HLP (average)												1.1407 (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												3.2351 (42)
Average daily hot water use (litres/day)												111.0336 (43)
Daily hot water use	122.1369	117.6956	113.2542	108.8129	104.3716	99.9302	99.9302	104.3716	108.8129	113.2542	117.6956	122.1369 (44)
Energy conte	181.1255	158.4136	163.4686	142.5159	136.7474	118.0026	109.3468	125.4770	126.9756	147.9778	161.5294	175.4104 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Energy content (annual)													Total = Sum(45)m =	1746.9905 (45)
Distribution loss (46)m = 0.15 x (45)m														
	27.1688	23.7620	24.5203	21.3774	20.5121	17.7004	16.4020	18.8216	19.0463	22.1967	24.2294	26.3116	26.3116	(46)
Water storage loss:														
Store volume														300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):														2.1127 (48)
Temperature factor from Table 2b														0.5400 (49)
Enter (49) or (54) in (55)														1.1409 (55)
Total storage loss	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	(56)
If cylinder contains dedicated solar storage	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	(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	23.2624	(59)
Total heat required for water heating calculated for each month	239.7544	211.3686	222.0974	199.2535	195.3762	174.7402	167.9756	184.1058	183.7132	206.6066	218.2669	234.0392	234.0392	(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	0.0000	(63)
Solar input (sum of months) = Sum(63)m =													0.0000 (63)	
Output from w/h	239.7544	211.3686	222.0974	199.2535	195.3762	174.7402	167.9756	184.1058	183.7132	206.6066	218.2669	234.0392	234.0392	(64)
Total per year (kWh/year) = Sum(64)m =													2437.2975 (64)	
Heat gains from water heating, kWh/month	107.1273	95.0366	101.2564	92.7766	92.3716	84.6259	83.2608	88.6242	87.6094	96.1057	99.0986	105.2270	105.2270	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	161.7549	161.7549	161.7549	161.7549	161.7549	161.7549	161.7549	161.7549	161.7549	161.7549	161.7549	161.7549	161.7549 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.3368	41.1560	33.4703	25.3391	18.9413	15.9911	17.2789	22.4598	30.1454	38.2766	44.6744	47.6247	47.6247 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	519.7581	525.1516	511.5603	482.6259	446.1014	411.7736	388.8405	383.4470	397.0384	425.9727	462.4972	496.8250	496.8250 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	39.1755	39.1755	39.1755	39.1755	39.1755	39.1755	39.1755	39.1755	39.1755	39.1755	39.1755	39.1755	39.1755 (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)	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039 (71)
Water heating gains (Table 5)	143.9883	141.4234	136.0973	128.8564	124.1553	117.5360	111.9097	119.1185	121.6798	129.1743	137.6369	141.4342	141.4342 (72)
Total internal gains	784.6097	782.2575	755.6543	711.3479	663.7245	619.8271	592.5556	599.5517	623.3900	667.9501	719.3350	760.4103	760.4103 (73)

6. Solar gains

[Jan]													
	Area	Solar flux		g		FF		Access		Gains			
	m ²	Table 6a		Specific data		Specific data		factor		W			
		W/m ²		or Table 6b		or Table 6c		Table 6d					
Northeast	26.9200	11.2829		0.6300		0.7000		0.7700		92.8259		(75)	
Southeast	1.0500	36.7938		0.6300		0.7000		0.7700		11.8069		(77)	
Southwest	40.6800	36.7938		0.6300		0.7000		0.7700		457.4333		(79)	
Northwest	4.2000	11.2829		0.6300		0.7000		0.7700		14.4825		(81)	
Northeast	1.5800	17.4137		0.6300		0.7000		1.0000		10.9202		(82)	
Southeast	1.5800	38.2331		0.6300		0.7000		1.0000		23.9760		(82)	
Northwest	1.5800	17.4137		0.6300		0.7000		1.0000		10.9202		(82)	
Horizontal	9.5000	26.0000		0.6300		0.7000		1.0000		98.0343		(82)	
Solar gains	720.3993	1311.9382	2004.8146	2810.2313	3427.0014	3520.1630	3345.0921	2870.1732	2283.1147	1508.0324	878.6983	606.0669	(83)
Total gains	1505.0090	2094.1957	2760.4689	3521.5792	4090.7259	4139.9900	3937.6476	3469.7250	2906.5047	2175.9824	1598.0332	1366.4772	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.2857	60.3750	60.4628	60.8787	60.9572	61.3251	61.3251	61.3937	61.1829	60.9572	60.7987	60.6339	60.6339 (86)
alpha	5.0190	5.0250	5.0309	5.0586	5.0638	5.0883	5.0883	5.0929	5.0789	5.0638	5.0532	5.0423	5.0423 (86)
util living area	0.9997	0.9984	0.9912	0.9516	0.8276	0.6338	0.4740	0.5546	0.8445	0.9867	0.9991	0.9998	0.9998 (86)
MIT	19.5663	19.7785	20.1131	20.5326	20.8428	20.9688	20.9941	20.9876	20.8718	20.4177	19.9026	19.5299	19.5299 (87)
Th 2	19.9587	19.9600	19.9614	19.9677	19.9689	19.9745	19.9745	19.9755	19.9723	19.9689	19.9665	19.9640	19.9640 (88)
util rest of house	0.9996	0.9978	0.9879	0.9339	0.7740	0.5447	0.3667	0.4383	0.7723	0.9796	0.9987	0.9998	0.9998 (89)
MIT 2	18.0237	18.3350	18.8232	19.4226	19.8209	19.9549	19.9724	19.9706	19.8692	19.2723	18.5216	17.9742	17.9742 (90)
Living area fraction													fLA = Living area / (4) = 0.1573 (91)
MIT	18.2664	18.5621	19.0261	19.5973	19.9817	20.1144	20.1331	20.1306	20.0269	19.4525	18.7389	18.2189	18.2189 (92)
Temperature adjustment													0.0000
adjusted MIT	18.2664	18.5621	19.0261	19.5973	19.9817	20.1144	20.1331	20.1306	20.0269	19.4525	18.7389	18.2189	18.2189 (93)

8. Space heating requirement

Utilisation	0.9993	0.9966	0.9837	0.9259	0.7748	0.5574	0.3836	0.4565	0.7768	0.9744	0.9979	0.9996	0.9996 (94)
Useful gains	1504.0021	2087.1025	2715.5146	3260.5037	3169.2938	2307.6909	1510.4670	1583.8895	2257.8128	2120.2911	1594.7498	1365.9117	1365.9117 (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	4.2000 (96)
Heat loss rate W	6103.2147	5961.4218	5457.7973	4629.0901	3579.1701	2368.9079	1517.7846	1600.8161	2552.0406	3825.8617	5043.2043	6090.9994	6090.9994 (97)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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	3421.8142	2603.5426	2040.2584	985.3822	304.9480	0.0000	0.0000	0.0000	0.0000	1268.9445	2482.8872	3515.4652	(98)
Space heating												16623.2423	(98)
Space heating per m2												(98) / (4) =	43.8192 (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 %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													17778.8688 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	3421.8142	2603.5426	2040.2584	985.3822	304.9480	0.0000	0.0000	0.0000	0.0000	1268.9445	2482.8872	3515.4652	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	3659.6943	2784.5375	2182.0945	1053.8847	326.1476	0.0000	0.0000	0.0000	0.0000	1357.1599	2655.4944	3759.8559	(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	239.7544	211.3686	222.0974	199.2535	195.3762	174.7402	167.9756	184.1058	183.7132	206.6066	218.2669	234.0392	(64)
Efficiency of water heater (217)m	89.7124	89.5979	89.3242	88.5040	85.9972	79.8000	79.8000	79.8000	79.8000	88.8322	89.5300	79.8000	(216)
Fuel for water heating, kWh/month	267.2479	235.9080	248.6419	225.1350	227.1891	218.9726	210.4957	230.7090	230.2170	232.5808	243.7920	260.7713	(219)
Water heating fuel used												2831.6603	(219)
Annual totals kWh/year													
Space heating fuel - main system													17778.8688 (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)													818.3227 (232)
Total delivered energy for all uses													21503.8518 (238)

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	17778.8688	0.2160	3840.2357 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2831.6603	0.2160	611.6386 (264)
Space and water heating			4451.8743 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	818.3227	0.5190	424.7095 (268)
Total CO2, kg/m2/year			4915.5088 (272)
Emissions per m2 for space and water heating			11.7352 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.1195 (272b)
Emissions per m2 for pumps and fans			0.1026 (272c)
Target Carbon Dioxide Emission Rate (TER) = (11.7352 * 1.00) + 1.1195 + 0.1026, rounded to 2 d.p.			12.9600 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	178.4800 (1b)	x 2.8500 (2b)	= 508.6680 (1b) - (3b)
First floor	133.5100 (1c)	x 2.9400 (2c)	= 392.5194 (1c) - (3c)
Second floor	67.3700 (1d)	x 1.9100 (2d)	= 128.6767 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	379.3600		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 1029.8641 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)							
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)							
Number of intermittent fans					4 * 10 = 40.0000 (7a)							
Number of passive vents					0 * 10 = 0.0000 (7b)							
Number of flueless gas fires					0 * 40 = 0.0000 (7c)							
					Air changes per hour							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.0388 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.2888 (18)							
Number of sides sheltered					2 (19)							
					Shelter factor							
Infiltration rate adjusted to include shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20) (21) = (18) x (20) = 0.2455 (21)							
Wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec												
Wind factor	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)
Adj infilt rate	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)
Effective ac	0.3130	0.3069	0.3008	0.2701	0.2639	0.2332	0.2332	0.2271	0.2455	0.2639	0.2762	0.2885 (22b)
	0.5490	0.5471	0.5452	0.5365	0.5348	0.5272	0.5272	0.5258	0.5301	0.5348	0.5381	0.5416 (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					
Glazing (Uw = 1.40)			72.8500	1.3258	96.5814		(27)					
Solid Door			2.0000	1.4000	2.8000		(26)					
Rooflight (Uw = 1.40)			14.2400	1.3258	18.8788		(27a)					
Heat Loss Floor 1			190.3800	0.1500	28.5570	110.0000	20941.8000 (28a)					
External Wall 1	325.2500	71.4700	253.7800	0.2300	58.3694	9.0000	2284.0200 (29a)					
Dormer Cheeks	16.6100	3.3800	13.2300	0.3000	3.9690	9.0000	119.0700 (29a)					
Ashlar Wall	29.6900		29.6900	0.1300	3.8597	9.0000	267.2100 (29a)					
Flat Roof	48.0200	9.5000	38.5200	0.1600	6.1632	9.0000	346.6800 (30)					
Slope Roof	68.2900	4.7400	63.5500	0.1800	11.4390	9.0000	571.9500 (30)					
Dormer Roof	6.9500		6.9500	0.2000	1.3900	9.0000	62.5500 (30)					
Ashlar Ceiling	66.1400		66.1400	0.1300	8.5982	9.0000	595.2600 (30)					
Total net area of external elements Aum(A, m2)			751.3300				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 240.6057		(33)					
Stud			311.0800			9.0000	2799.7200 (32c)					
Block			222.2200			75.0000	16666.5000 (32c)					
Internal Floor 1			133.5100			18.0000	2403.1800 (32d)					
Internal Floor 2			67.3700			18.0000	1212.6600 (32d)					
Internal Ceiling 1			133.5100			9.0000	1201.5900 (32e)					
Internal Ceiling 2			67.3700			9.0000	606.3300 (32e)					
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 50078.5200 (34)					
Thermal mass parameter (TMP) = Cm / TFA in kJ/m2K							132.0079 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							46.1083 (36)					
Total fabric heat loss							(33) + (36) = 286.7140 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	186.5784	185.9319	185.2981	182.3213	181.7644	179.1717	179.1717	178.6915	180.1703	181.7644	182.8911	184.0690 (38)
Average = Sum(39)m / 12 =	473.2925	472.6459	472.0121	469.0353	468.4784	465.8857	465.8857	465.4056	466.8844	468.4784	469.6051	470.7830 (39)
	469.0327 (39)											
HLP												
HLP (average)	1.2476	1.2459	1.2442	1.2364	1.2349	1.2281	1.2281	1.2268	1.2307	1.2349	1.2379	1.2410 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Assumed occupancy												3.2351 (42)
Average daily hot water use (litres/day)												111.0336 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	122.1369	117.6956	113.2542	108.8129	104.3716	99.9302	99.9302	104.3716	108.8129	113.2542	117.6956	122.1369 (44)
Energy conte	181.1255	158.4136	163.4686	142.5159	136.7474	118.0026	109.3468	125.4770	126.9756	147.9778	161.5294	175.4104 (45)
Energy content (annual)												Total = Sum(45)m = 1746.9905 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	38.4892	33.6629	34.7371	30.2846	29.0588	25.0756	23.2362	26.6639	26.9823	31.4453	34.3250	37.2747 (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	161.7549	161.7549	161.7549	161.7549	161.7549	161.7549	161.7549	161.7549	161.7549	161.7549	161.7549	161.7549 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.3368	41.1560	33.4703	25.3391	18.9413	15.9911	17.2789	22.4598	30.1454	38.2766	44.6744	47.6247 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	519.7581	525.1516	511.5603	482.6259	446.1014	411.7736	388.8405	383.4470	397.0384	425.9727	462.4972	496.8250 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	39.1755	39.1755	39.1755	39.1755	39.1755	39.1755	39.1755	39.1755	39.1755	39.1755	39.1755	39.1755 (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)	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039 (71)
Water heating gains (Table 5)	51.7328	50.0936	46.6896	42.0620	39.0576	34.8272	31.2314	35.8385	37.4754	42.2652	47.6736	50.1004 (72)
Total internal gains	689.3542	687.9276	663.2466	621.5535	575.6267	534.1183	508.8773	513.2718	536.1857	578.0409	626.3717	666.0766 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
Northeast	26.9200	11.2829	0.5500	0.0000	0.7700	128.6325 (75)						
Southeast	1.0500	36.7938	0.5500	0.0000	0.7700	16.3613 (77)						
Southwest	40.6800	36.7938	0.5500	0.0000	0.7700	633.8834 (79)						
Northwest	4.2000	11.2829	0.5500	0.0000	0.7700	20.0690 (81)						
Northeast	1.5800	17.4137	0.6300	0.7000	1.0000	10.9202 (82)						
Southeast	1.5800	38.2331	0.6300	0.7000	1.0000	23.9760 (82)						
Northwest	1.5800	17.4137	0.6300	0.7000	1.0000	10.9202 (82)						
Horizontal	9.5000	26.0000	0.6300	0.7000	1.0000	98.0343 (82)						
Solar gains	942.7969	1704.5126	2578.4722	3582.2342	4347.5815	4458.6625	4239.6781	3650.1566	2924.8684	1951.7575	1147.5831	794.7727 (83)
Total gains	1632.1511	2392.4402	3241.7188	4203.7876	4923.2083	4992.7807	4748.5554	4163.4284	3461.0541	2529.7985	1773.9548	1460.8493 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	29.3913	29.4315	29.4711	29.6581	29.6934	29.8586	29.8586	29.8894	29.7947	29.6934	29.6221	29.5480
alpha	2.9594	2.9621	2.9647	2.9772	2.9796	2.9906	2.9906	2.9926	2.9863	2.9796	2.9748	2.9699
util living area	0.9925	0.9775	0.9394	0.8478	0.7013	0.5382	0.4111	0.4775	0.7217	0.9264	0.9848	0.9946 (86)
MIT	18.5868	18.9749	19.5398	20.1866	20.6515	20.8862	20.9622	20.9410	20.7207	20.0255	19.1591	18.5161 (87)
Th 2	19.8821	19.8835	19.8848	19.8910	19.8922	19.8976	19.8976	19.8986	19.8955	19.8922	19.8898	19.8873 (88)
util rest of house	0.9910	0.9730	0.9275	0.8191	0.6494	0.4620	0.3160	0.3764	0.6510	0.9060	0.9811	0.9935 (89)
MIT 2	17.6711	18.0570	18.6121	19.2315	19.6453	19.8352	19.8837	19.8750	19.7208	19.0978	18.2472	17.6043 (90)
Living area fraction												fLA = Living area / (4) = 0.1573 (91)
MIT	17.8152	18.2014	18.7580	19.3818	19.8036	20.0006	20.0534	20.0427	19.8781	19.2438	18.3907	17.7477 (92)
Temperature adjustment												0.0000
adjusted MIT	17.8152	18.2014	18.7580	19.3818	19.8036	20.0006	20.0534	20.0427	19.8781	19.2438	18.3907	17.7477 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9869	0.9638	0.9122	0.8038	0.6449	0.4695	0.3299	0.3903	0.6497	0.8908	0.9740	0.9903 (94)
Useful gains	1610.7089	2305.8382	2957.2287	3379.1055	3174.9171	2344.1283	1566.5154	1625.0747	2248.6936	2253.6064	1727.9161	1446.6611 (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	6396.6432	6286.8409	5785.9335	4916.3242	3796.3469	2516.0537	1608.8781	1695.3227	2697.7032	4049.4146	5302.1545	6378.0466 (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	3560.7351	2675.2338	2104.5564	1106.7975	462.3438	0.0000	0.0000	0.0000	0.0000	1336.0813	2573.4517	3668.9508 (98)
Space heating												17488.1503 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space heating per m2

(98) / (4) = 46.0991 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	4379.3255	3447.5541	3537.0822	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8451	0.8931	0.8565	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	3701.0810	3079.0893	3029.3601	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	5839.6145	5559.3914	4909.8712	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1539.7441	1845.3447	1399.1003	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction													4784.1892 (104)
Intermittency factor (Table 10b)													fC = cooled area / (4) = 1.0000 (105)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	384.9360	461.3362	349.7751	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													1196.0473 (107)
Space cooling per m2													3.1528 (108)
Energy for space heating													46.0991 (99)
Energy for space cooling													3.1528 (108)
Total													49.2519 (109)
Dwelling Fabric Energy Efficiency (DFEE)													49.3 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	178.4800 (1b)	x 2.8500 (2b)	= 508.6680 (1b) - (3b)
First floor	133.5100 (1c)	x 2.9400 (2c)	= 392.5194 (1c) - (3c)
Second floor	67.3700 (1d)	x 1.9100 (2d)	= 128.6767 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	379.3600		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 1029.8641 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.0388 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.2888 (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) =	0.2455 (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												
Effective ac	0.3130	0.3069	0.3008	0.2701	0.2639	0.2332	0.2332	0.2271	0.2455	0.2639	0.2762	0.2885 (22b)
	0.5490	0.5471	0.5452	0.5365	0.5348	0.5272	0.5272	0.5258	0.5301	0.5348	0.5381	0.5416 (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
TER Opaque door			2.0000	1.0000	2.0000		(26)
TER Opening Type (Uw = 1.40)			72.8500	1.3258	96.5814		(27)
TER Room Window (Uw = 1.70)			14.2400	1.5918	22.6667		(27a)
Heat Loss Floor 1			190.3800	0.1300	24.7494		(28a)
External Wall 1	325.2500	71.4700	253.7800	0.1800	45.6804		(29a)
Dormer Cheeks	16.6100	3.3800	13.2300	0.1800	2.3814		(29a)
Ashlar Wall	29.6900		29.6900	0.1800	5.3442		(29a)
Flat Roof	48.0200	9.5000	38.5200	0.1300	5.0076		(30)
Slope Roof	68.2900	4.7400	63.5500	0.1300	8.2615		(30)
Dormer Roof	6.9500		6.9500	0.1300	0.9035		(30)
Ashlar Ceiling	66.1400		66.1400	0.1300	8.5982		(30)
Total net area of external elements Aum(A, m2)			751.3300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	222.1743	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							28.2408 (36)
Total fabric heat loss							(33) + (36) = 250.4151 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	186.5784	185.9319	185.2981	182.3213	181.7644	179.1717	179.1717	178.6915	180.1703	181.7644	182.8911	184.0690 (38)
Average = Sum(39)m / 12 =	436.9936	436.3470	435.7132	432.7364	432.1795	429.5868	429.5868	429.1066	430.5854	432.1795	433.3062	434.4841 (39)
												432.7337 (39)
HLP	1.1519	1.1502	1.1485	1.1407	1.1392	1.1324	1.1324	1.1311	1.1350	1.1392	1.1422	1.1453 (40)
HLP (average)												1.1407 (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												3.2351 (42)
Average daily hot water use (litres/day)												111.0336 (43)
Daily hot water use	122.1369	117.6956	113.2542	108.8129	104.3716	99.9302	99.9302	104.3716	108.8129	113.2542	117.6956	122.1369 (44)
Energy conte	181.1255	158.4136	163.4686	142.5159	136.7474	118.0026	109.3468	125.4770	126.9756	147.9778	161.5294	175.4104 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)													Total = Sum(45)m =	1746.9905 (45)					
Distribution loss (46)m = 0.15 x (45)m																			
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water storage loss:																			
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
If cylinder contains dedicated solar storage																			
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Heat gains from water heating, kWh/month	38.4892	33.6629	34.7371	30.2846	29.0588	25.0756	23.2362	26.6639	26.9823	31.4453	34.3250	37.2747	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	161.7549	161.7549	161.7549	161.7549	161.7549	161.7549	161.7549	161.7549	161.7549	161.7549	161.7549	161.7549	161.7549
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.3368	41.1560	33.4703	25.3391	18.9413	15.9911	17.2789	22.4598	30.1454	38.2766	44.6744	47.6247	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	519.7581	525.1516	511.5603	482.6259	446.1014	411.7736	388.8405	383.4470	397.0384	425.9727	462.4972	496.8250	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	39.1755	39.1755	39.1755	39.1755	39.1755	39.1755	39.1755	39.1755	39.1755	39.1755	39.1755	39.1755	(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)	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	(71)
Water heating gains (Table 5)	51.7328	50.0936	46.6896	42.0620	39.0576	34.8272	31.2314	35.8385	37.4754	42.2652	47.6736	50.1004	(72)
Total internal gains	689.3542	687.9276	663.2466	621.5535	575.6267	534.1183	508.8773	513.2718	536.1857	578.0409	626.3717	666.0766	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	(83)						
Northeast	26.9200	11.2829	0.6300	0.7000	0.7700	92.8259	(75)						
Southeast	1.0500	36.7938	0.6300	0.7000	0.7700	11.8069	(77)						
Southwest	40.6800	36.7938	0.6300	0.7000	0.7700	457.4333	(79)						
Northwest	4.2000	11.2829	0.6300	0.7000	0.7700	14.4825	(81)						
Northeast	1.5800	17.4137	0.6300	0.7000	1.0000	10.9202	(82)						
Southeast	1.5800	38.2331	0.6300	0.7000	1.0000	23.9760	(82)						
Northwest	1.5800	17.4137	0.6300	0.7000	1.0000	10.9202	(82)						
Horizontal	9.5000	26.0000	0.6300	0.7000	1.0000	98.0343	(82)						
Solar gains	720.3993	1311.9382	2004.8146	2810.2313	3427.0014	3520.1630	3345.0921	2870.1732	2283.1147	1508.0324	878.6983	606.0669	(83)
Total gains	1409.7535	1999.8658	2668.0612	3431.7848	4002.6281	4054.2812	3853.9693	3383.4450	2819.3004	2086.0733	1505.0699	1272.1435	(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	(86)
tau	60.2857	60.3750	60.4628	60.8787	60.9572	61.3251	61.3251	61.3937	61.1829	60.9572	60.7987	60.6339	(86)
alpha	5.0190	5.0250	5.0309	5.0586	5.0638	5.0883	5.0883	5.0929	5.0789	5.0638	5.0532	5.0423	(86)
util living area	0.9998	0.9987	0.9924	0.9559	0.8368	0.6448	0.4837	0.5672	0.8566	0.9889	0.9993	0.9999	(86)
MIT	19.5428	19.7553	20.0912	20.5151	20.8339	20.9664	20.9935	20.9864	20.8620	20.3968	19.8797	19.5066	(87)
Th 2	19.9587	19.9600	19.9614	19.9677	19.9689	19.9745	19.9745	19.9755	19.9723	19.9689	19.9665	19.9640	(88)
util rest of house	0.9997	0.9982	0.9895	0.9395	0.7844	0.5550	0.3745	0.4490	0.7869	0.9828	0.9990	0.9998	(89)
MIT 2	18.6140	18.8275	19.1627	19.5795	19.8613	19.9599	19.9729	19.9717	19.8954	19.4731	18.9571	18.5821	(90)
Living area fraction	18.7601	18.9734	19.3088	19.7267	20.0143	20.1183	20.1335	20.1314	20.0474	19.6184	19.1023	18.7275	(91)
MIT	18.7601	18.9734	19.3088	19.7267	20.0143	20.1183	20.1335	20.1314	20.0474	19.6184	19.1023	18.7275	(92)
Temperature adjustment													0.0000
adjusted MIT	18.7601	18.9734	19.3088	19.7267	20.0143	20.1183	20.1335	20.1314	20.0474	19.6184	19.1023	18.7275	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(94)
Useful gains	1409.1652	1995.0569	2633.6695	3207.7188	3150.0621	2303.8605	1509.8729	1582.2814	2235.3847	2044.2087	1503.0364	1271.8278	(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	6318.9806	6140.8959	5580.9652	4685.1130	3593.2629	2370.5700	1517.9322	1601.1528	2560.8808	3897.5790	5200.6495	6311.9778	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	3652.9027	2786.0038	2192.7880	1063.7238	329.7414	0.0000	0.0000	0.0000	0.0000	1378.9075	2662.2814	3749.8716	(98)
Space heating													17816.2202 (98)
Space heating per m2													(98) / (4) = 46.9639 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
Heat loss rate W												
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	4038.1156	3178.9421	3261.2104	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8950	0.9437	0.9082	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	3614.2372	2999.8336	2961.6795	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	4742.6670	4513.7713	3998.2023	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	812.4695	1126.3697	771.1730	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												2710.0122 (104)
Intermittency factor (Table 10b)									fC = cooled area / (4) =			1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	203.1174	281.5924	192.7932	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												677.5030 (107)
Energy for space heating												1.7859 (108)
Energy for space cooling												46.9639 (99)
Total												1.7859 (108)
Target Fabric Energy Efficiency (TFEE)												48.7498 (109)
												56.1 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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 (m2)	Storey height (m)	Volume (m3)
Ground floor	178.4800 (1b)	2.8500 (2b)	508.6680 (1b) - (3b)
First floor	133.5100 (1c)	2.9400 (2c)	392.5194 (1c) - (3c)
Second floor	67.3700 (1d)	1.9100 (2d)	128.6767 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	379.3600		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 1029.8641 (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				7 * 10 =	70.0000 (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) =					70.0000 / (5) = 0.0680 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3180 (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) =	0.2703 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.7000	4.4000	4.5000	4.0000	4.1000	3.5000	3.7000	3.9000	3.8000	4.1000	4.0000	4.4000 (22)
Wind factor	1.1750	1.1000	1.1250	1.0000	1.0250	0.8750	0.9250	0.9750	0.9500	1.0250	1.0000	1.1000 (22a)
Adj infiltr rate	0.3176	0.2973	0.3041	0.2703	0.2770	0.2365	0.2500	0.2635	0.2568	0.2770	0.2703	0.2973 (22b)
Effective ac	0.5504	0.5442	0.5462	0.5365	0.5384	0.5280	0.5313	0.5347	0.5330	0.5384	0.5365	0.5442 (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					
Glazing (Uw = 1.40)			72.8500	1.3258	96.5814		(27)					
Solid Door			2.0000	1.4000	2.8000		(26)					
Rooflight (Uw = 1.40)			14.2400	1.3258	18.8788		(27a)					
Heat Loss Floor 1			190.3800	0.1500	28.5570	110.0000	20941.8000 (28a)					
External Wall 1	325.2500	71.4700	253.7800	0.2300	58.3694	9.0000	2284.0200 (29a)					
Dormer Cheeks	16.6100	3.3800	13.2300	0.3000	3.9690	9.0000	119.0700 (29a)					
Ashlar Wall	29.6900		29.6900	0.1300	3.8597	9.0000	267.2100 (29a)					
Flat Roof	48.0200	9.5000	38.5200	0.1600	6.1632	9.0000	346.6800 (30)					
Slope Roof	68.2900	4.7400	63.5500	0.1800	11.4390	9.0000	571.9500 (30)					
Dormer Roof	6.9500		6.9500	0.2000	1.3900	9.0000	62.5500 (30)					
Ashlar Ceiling	66.1400		66.1400	0.1300	8.5982	9.0000	595.2600 (30)					
Total net area of external elements Aum(A, m2)			751.3300				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 240.6057		(33)					
Stud			311.0800			9.0000	2799.7200 (32c)					
Block			222.2200			75.0000	16666.5000 (32c)					
Internal Floor 1			133.5100			18.0000	2403.1800 (32d)					
Internal Floor 2			67.3700			18.0000	1212.6600 (32d)					
Internal Ceiling 1			133.5100			18.0000	2403.1800 (32e)					
Internal Ceiling 2			67.3700			18.0000	1212.6600 (32e)					
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 51886.4400 (34)					
Thermal mass parameter (TMP) = Cm / TFA in kJ/m2K							136.7736 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							46.1083 (36)					
Total fabric heat loss							(33) + (36) = 286.7140 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 187.0652	Feb 184.9472	Mar 185.6377	Apr 182.3405	May 182.9689	Jun 179.4312	Jul 180.5484	Aug 181.7276	Sep 181.1302	Oct 182.9689	Nov 182.3405	Dec 184.9472 (38)
Heat transfer coeff	473.7792	471.6613	472.3517	469.0545	469.6829	466.1453	467.2624	468.4416	467.8443	469.6829	469.0545	471.6613 (39)
Average = Sum(39)m / 12 =												469.7185 (39)
HLP	Jan 1.2489	Feb 1.2433	Mar 1.2451	Apr 1.2364	May 1.2381	Jun 1.2288	Jul 1.2317	Aug 1.2348	Sep 1.2332	Oct 1.2381	Nov 1.2364	Dec 1.2433 (40)
HLP (average)												1.2382 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Assumed occupancy												3.2351 (42)
Average daily hot water use (litres/day)												111.0336 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	122.1369	117.6956	113.2542	108.8129	104.3716	99.9302	99.9302	104.3716	108.8129	113.2542	117.6956	122.1369 (44)
Energy content (annual)	181.1255	158.4136	163.4686	142.5159	136.7474	118.0026	109.3468	125.4770	126.9756	147.9778	161.5294	175.4104 (45)
Distribution loss (46)m = 0.15 x (45)m	27.1688	23.7620	24.5203	21.3774	20.5121	17.7004	16.4020	18.8216	19.0463	22.1967	24.2294	26.3116 (46)
Water storage loss:												
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.8600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.5444 (55)
Total storage loss	47.8764	43.2432	47.8764	46.3320	47.8764	46.3320	47.8764	47.8764	46.3320	47.8764	46.3320	47.8764 (56)
If cylinder contains dedicated solar storage	47.8764	43.2432	47.8764	46.3320	47.8764	46.3320	47.8764	47.8764	46.3320	47.8764	46.3320	47.8764 (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	252.2643	222.6680	234.6074	211.3599	207.8862	186.8466	180.4856	196.6158	195.8196	219.1166	230.3734	246.5492 (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	252.2643	222.6680	234.6074	211.3599	207.8862	186.8466	180.4856	196.6158	195.8196	219.1166	230.3734	246.5492 (64)
RHI water heating demand												2584.5925 (64)
Heat gains from water heating, kWh/month	117.1353	104.0760	111.2644	102.4617	102.3795	94.3111	93.2688	98.6321	97.2946	106.1137	108.7837	115.2350 (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	194.1059	194.1059	194.1059	194.1059	194.1059	194.1059	194.1059	194.1059	194.1059	194.1059	194.1059	194.1059 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	115.8420	102.8899	83.6757	63.3479	47.3533	39.9776	43.1972	56.1494	75.3636	95.6914	111.6860	119.0617 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	775.7584	783.8084	763.5228	720.3371	665.8230	614.5874	580.3589	572.3090	592.5946	635.7802	690.2943	741.5299 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	57.6457	57.6457	57.6457	57.6457	57.6457	57.6457	57.6457	57.6457	57.6457	57.6457	57.6457	57.6457 (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)	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039 (71)
Water heating gains (Table 5)	157.4399	154.8750	149.5489	142.3080	137.6069	130.9876	125.3613	132.5701	135.1314	142.6259	151.0885	154.8858 (72)
Total internal gains	1174.3880	1166.9209	1122.0949	1051.3406	976.1308	910.9003	874.2651	886.3761	928.4372	999.4452	1078.4165	1140.8250 (73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m2	Table 6a	Specific data	Specific data	factor	W						
		W/m2	or Table 6b	or Table 6c	Table 6d							
Northeast	26.9200	12.9280	0.5500	0.0000	0.7700	147.3876 (75)						
Southeast	1.0500	40.5720	0.5500	0.0000	0.7700	18.0414 (77)						
Southwest	40.6800	40.5720	0.5500	0.0000	0.7700	698.9738 (79)						
Northwest	4.2000	12.9280	0.5500	0.0000	0.7700	22.9951 (81)						
Northeast	1.5800	20.0673	0.6300	0.7000	1.0000	12.5843 (82)						
Southeast	1.5800	43.0800	0.6300	0.7000	1.0000	27.0155 (82)						
Northwest	1.5800	20.0673	0.6300	0.7000	1.0000	12.5843 (82)						
Horizontal	9.5000	30.0000	0.6300	0.7000	1.0000	113.1165 (82)						
Solar gains	1052.6985	1685.9542	2548.6749	3653.3290	4316.3688	4769.2607	4526.9074	3980.5893	3171.2188	2072.8042	1313.5466	878.3413 (83)
Total gains	2227.0865	2852.8751	3670.7698	4704.6696	5292.4997	5680.1609	5401.1725	4866.9654	4099.6560	3072.2494	2391.9631	2019.1663 (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	30.4211	30.5577	30.5131	30.7276	30.6864	30.9193	30.8454	30.7678	30.8070	30.6864	30.7276	30.5577
alpha	3.0281	3.0372	3.0342	3.0485	3.0458	3.0613	3.0564	3.0512	3.0538	3.0458	3.0485	3.0372
util living area	0.9826	0.9642	0.9124	0.7897	0.6185	0.4011	0.2647	0.3021	0.5838	0.8690	0.9648	0.9866 (86)
MIT	19.3941	19.6265	20.0454	20.4908	20.7618	20.8841	20.9066	20.9037	20.8214	20.4192	19.8286	19.3463 (87)
Th 2	19.8811	19.8855	19.8841	19.8910	19.8896	19.8971	19.8947	19.8922	19.8935	19.8896	19.8910	19.8855 (88)
util rest of house	0.9789	0.9570	0.8949	0.7515	0.5560	0.3207	0.1719	0.2002	0.4955	0.8337	0.9562	0.9837 (89)
MIT 2	17.7441	18.0823	18.6768	19.2859	19.6196	19.7510	19.7643	19.7606	19.6963	19.2097	18.3818	17.6780 (90)
Living area fraction												fLA = Living area / (4) = 0.1573 (91)
MIT	18.0037	18.3252	18.8921	19.4755	19.7993	19.9293	19.9440	19.9404	19.8733	19.4000	18.6094	17.9404 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8537	18.1752	18.7421	19.3255	19.6493	19.7793	19.7940	19.7904	19.7233	19.2500	18.4594	17.7904 (93)

8. Space heating requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9693	0.9418	0.8722	0.7291	0.5413	0.3118	0.1633	0.1906	0.4806	0.8083	0.9407	0.9758 (94)
Useful gains	2158.7303	2686.8227	3201.7814	3430.2311	2864.7936	1770.8619	882.0347	927.5297	1970.3040	2483.2800	2250.0367	1970.2168 (95)
Ext temp.	5.0000	5.5000	7.4000	9.9000	12.9000	15.9000	17.9000	17.8000	15.2000	11.6000	7.9000	5.0000 (96)
Heat loss rate W												
	6089.8208	5978.4203	5357.4466	4421.0501	3170.0106	1808.2960	884.9761	932.4060	2116.1951	3593.0590	4952.9420	6032.7578 (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												
	2924.7314	2211.9536	1603.8149	713.3897	227.0814	0.0000	0.0000	0.0000	0.0000	825.6756	1946.0919	3022.5305 (98)
Space heating												13475.2690 (98)
RHI space heating demand												13475 (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 (m2)	Storey height (m)	Volume (m3)
Ground floor	178.4800 (1b)	x 2.8500 (2b)	= 508.6680 (1b) - (3b)
First floor	133.5100 (1c)	x 2.9400 (2c)	= 392.5194 (1c) - (3c)
Second floor	67.3700 (1d)	x 1.9100 (2d)	= 128.6767 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	379.3600		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 1029.8641 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	+	0	+	0 * 40 = 0.0000 (6a)							
Number of open flues	0	+	0	+	0 * 20 = 0.0000 (6b)							
Number of intermittent fans					7 * 10 = 70.0000 (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) =					70.0000 / (5) = 0.0680 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3180 (18)							
Number of sides sheltered					2 (19)							
					Shelter factor							
Infiltration rate adjusted to include shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20) (21) = (18) x (20) = 0.2703 (21)							
Wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec												
Wind factor	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)
Adj infilt rate	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)
Effective ac	0.3446	0.3378	0.3311	0.2973	0.2905	0.2568	0.2568	0.2500	0.2703	0.2905	0.3041	0.3176 (22b)
	0.5594	0.5571	0.5548	0.5442	0.5422	0.5330	0.5330	0.5313	0.5365	0.5422	0.5462	0.5504 (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					
Glazing (Uw = 1.40)			72.8500	1.3258	96.5814		(27)					
Solid Door			2.0000	1.4000	2.8000		(26)					
Rooflight (Uw = 1.40)			14.2400	1.3258	18.8788		(27a)					
Heat Loss Floor 1			190.3800	0.1500	28.5570	110.0000	20941.8000 (28a)					
External Wall 1	325.2500	71.4700	253.7800	0.2300	58.3694	9.0000	2284.0200 (29a)					
Dormer Cheeks	16.6100	3.3800	13.2300	0.3000	3.9690	9.0000	119.0700 (29a)					
Ashlar Wall	29.6900		29.6900	0.1300	3.8597	9.0000	267.2100 (29a)					
Flat Roof	48.0200	9.5000	38.5200	0.1600	6.1632	9.0000	346.6800 (30)					
Slope Roof	68.2900	4.7400	63.5500	0.1800	11.4390	9.0000	571.9500 (30)					
Dormer Roof	6.9500		6.9500	0.2000	1.3900	9.0000	62.5500 (30)					
Ashlar Ceiling	66.1400		66.1400	0.1300	8.5982	9.0000	595.2600 (30)					
Total net area of external elements Aum(A, m2)			751.3300				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 240.6057		(33)					
Stud			311.0800			9.0000	2799.7200 (32c)					
Block			222.2200			75.0000	16666.5000 (32c)					
Internal Floor 1			133.5100			18.0000	2403.1800 (32d)					
Internal Floor 2			67.3700			18.0000	1212.6600 (32d)					
Internal Ceiling 1			133.5100			18.0000	2403.1800 (32e)					
Internal Ceiling 2			67.3700			18.0000	1212.6600 (32e)					
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 51886.4400 (34)					
Thermal mass parameter (TMP) = Cm / TFA in kJ/m2K							136.7736 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							46.1083 (36)					
Total fabric heat loss							(33) + (36) = 286.7140 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	190.1063	189.3228	188.5547	184.9472	184.2723	181.1302	181.1302	180.5484	182.3405	184.2723	185.6377	187.0652 (38)
Average = Sum(39)m / 12 =	476.8204	476.0368	475.2688	471.6613	470.9863	467.8443	467.8443	467.2624	469.0545	470.9863	472.3517	473.7792 (39)
												471.6580 (39)
HLP												
HLP (average)	1.2569	1.2548	1.2528	1.2433	1.2415	1.2332	1.2332	1.2317	1.2364	1.2415	1.2451	1.2489 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Assumed occupancy 3.2351 (42)
Average daily hot water use (litres/day) 111.0336 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	122.1369	117.6956	113.2542	108.8129	104.3716	99.9302	99.9302	104.3716	108.8129	113.2542	117.6956	122.1369	(44)
Energy content (annual)	181.1255	158.4136	163.4686	142.5159	136.7474	118.0026	109.3468	125.4770	126.9756	147.9778	161.5294	175.4104	(45)
Energy content (annual)	Total = Sum(45)m = 1746.9905 (45)												
Distribution loss (46)m = 0.15 x (45)m	27.1688	23.7620	24.5203	21.3774	20.5121	17.7004	16.4020	18.8216	19.0463	22.1967	24.2294	26.3116	(46)
Water storage loss:													
Store volume													
a) If manufacturer declared loss factor is known (kWh/day):													
Temperature factor from Table 2b													
Enter (49) or (54) in (55)													
Total storage loss													
47.8764	43.2432	47.8764	46.3320	47.8764	46.3320	47.8764	47.8764	46.3320	47.8764	46.3320	47.8764	46.3320	(56)
If cylinder contains dedicated solar storage													
47.8764	43.2432	47.8764	46.3320	47.8764	46.3320	47.8764	47.8764	46.3320	47.8764	46.3320	47.8764	46.3320	(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													
252.2643	222.6680	234.6074	211.3599	207.8862	186.8466	180.4856	180.4856	196.6158	195.8196	219.1166	230.3734	246.5492	(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													
252.2643	222.6680	234.6074	211.3599	207.8862	186.8466	180.4856	180.4856	196.6158	195.8196	219.1166	230.3734	246.5492	(64)
Total per year (kWh/year) = Sum(64)m =	2584.5925 (64)												
Heat gains from water heating, kWh/month													
117.1353	104.0760	111.2644	102.4617	102.3795	94.3111	93.2688	98.6321	97.2946	106.1137	108.7837	115.2350	115.2350	(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	194.1059	194.1059	194.1059	194.1059	194.1059	194.1059	194.1059	194.1059	194.1059	194.1059	194.1059	194.1059	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	115.8420	102.8899	83.6757	63.3479	47.3533	39.9776	43.1972	56.1494	75.3636	95.6914	111.6860	119.0617	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	775.7584	783.8084	763.5228	720.3371	665.8230	614.5874	580.3589	572.3090	592.5946	635.7802	690.2943	741.5299	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	57.6457	57.6457	57.6457	57.6457	57.6457	57.6457	57.6457	57.6457	57.6457	57.6457	57.6457	57.6457	(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)													
-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	(71)
Water heating gains (Table 5)													
157.4399	154.8750	149.5489	142.3080	137.6069	130.9876	125.3613	132.5701	135.1314	142.6259	151.0885	154.8858	154.8858	(72)
Total internal gains	1174.3880	1166.9209	1122.0949	1051.3406	976.1308	910.9003	874.2651	886.3761	928.4372	999.4452	1078.4165	1140.8250	(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	26.9200	11.2829	0.5500	0.0000	0.7700	128.6325 (75)
Southeast	1.0500	36.7938	0.5500	0.0000	0.7700	16.3613 (77)
Southwest	40.6800	36.7938	0.5500	0.0000	0.7700	633.8834 (79)
Northwest	4.2000	11.2829	0.5500	0.0000	0.7700	20.0690 (81)
Northeast	1.5800	17.4137	0.6300	0.7000	1.0000	10.9202 (82)
Southeast	1.5800	38.2331	0.6300	0.7000	1.0000	23.9760 (82)
Northwest	1.5800	17.4137	0.6300	0.7000	1.0000	10.9202 (82)
Horizontal	9.5000	26.0000	0.6300	0.7000	1.0000	98.0343 (82)

Solar gains 942.7969 1704.5126 2578.4722 3582.2342 4347.5815 4458.6625 4239.6781 3650.1566 2924.8684 1951.7575 1147.5831 794.7727 (83)
Total gains 2117.1849 2871.4336 3700.5671 4633.5748 5323.7123 5369.5627 5113.9432 4536.5327 3853.3056 2951.2027 2225.9996 1935.5976 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	30.2271	30.2769	30.3258	30.5577	30.6015	30.8070	30.8070	30.8454	30.7276	30.6015	30.5131	30.4211	(85)
alpha	3.0151	3.0185	3.0217	3.0372	3.0401	3.0538	3.0538	3.0564	3.0485	3.0401	3.0342	3.0281	
util living area	0.9864	0.9671	0.9229	0.8244	0.6750	0.5119	0.3872	0.4471	0.6840	0.9022	0.9749	0.9895	(86)
MIT	19.2617	19.5381	19.9341	20.3796	20.6897	20.8425	20.8897	20.8777	20.7421	20.2812	19.6734	19.2107	(87)
Th 2	19.8747	19.8764	19.8780	19.8855	19.8869	19.8935	19.8935	19.8947	19.8910	19.8869	19.8841	19.8811	(88)
util rest of house	0.9836	0.9606	0.9081	0.7926	0.6215	0.4368	0.2959	0.3496	0.6103	0.8764	0.9689	0.9874	(89)
MIT 2	17.5470	17.9477	18.5138	19.1331	19.5312	19.7101	19.7529	19.7464	19.6109	19.0192	18.1530	17.4771	(90)
Living area fraction	fLA = Living area / (4) =												
MIT	17.8167	18.1979	18.7372	19.3292	19.7135	19.8882	19.9317	19.9244	19.7889	19.2178	18.3922	17.7498	(92)
Temperature adjustment													
adjusted MIT	17.6667	18.0479	18.5872	19.1792	19.5635	19.7382	19.7817	19.7744	19.6389	19.0678	18.2422	17.5998	(93)

8. Space heating requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9756	0.9461	0.8864	0.7691	0.6043	0.4256	0.2863	0.3385	0.5914	0.8521	0.9562	0.9808	(94)
Useful gains	2065.5982	2716.7564	3280.2474	3563.5475	3217.3540	2285.2403	1464.0447	1535.4516	2278.8239	2514.6913	2128.6051	1898.4055	(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													
Month fracti	6373.5258	6258.8810	5744.6690	4848.2952	3703.5870	2403.8959	1488.5629	1576.7109	2598.0387	3988.2076	5263.0179	6348.5608	(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	3205.0982	2380.3077	1833.5297	925.0183	361.7573	0.0000	0.0000	0.0000	0.0000	1096.2961	2256.7773	3310.9155	(98)
Space heating per m2												15369.7001	(98)
												(98) / (4) =	40.5148 (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 %)													93.3000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													16473.4192 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	3205.0982	2380.3077	1833.5297	925.0183	361.7573	0.0000	0.0000	0.0000	0.0000	1096.2961	2256.7773	3310.9155	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	3435.2606	2551.2409	1965.1979	991.4451	387.7356	0.0000	0.0000	0.0000	0.0000	1175.0226	2418.8395	3548.6769	(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	252.2643	222.6680	234.6074	211.3599	207.8862	186.8466	180.4856	196.6158	195.8196	219.1166	230.3734	246.5492	(64)
Efficiency of water heater (217)m	90.0784	89.9383	89.6291	88.8347	86.9343	80.8000	80.8000	80.8000	80.8000	89.0459	89.8596	90.1193	(217)
Fuel for water heating, kWh/month	280.0497	247.5786	261.7537	237.9250	239.1303	231.2458	223.3732	243.3364	242.3510	246.0716	256.3704	273.5810	(219)
Water heating fuel used												2982.7666	(219)
Annual totals kWh/year													
Space heating fuel - main system													16473.4192 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans: central heating pump													30.0000 (230c)
Total electricity for the above, kWh/year													30.0000 (231)
Electricity for lighting (calculated in Appendix L)													818.3227 (232)
Total delivered energy for all uses													20304.5085 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	16473.4192	3.4800	573.2750	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2982.7666	3.4800	103.8003	(247)
Pumps and fans for heating	30.0000	13.1900	3.9570	(249)
Energy for lighting	818.3227	13.1900	107.9368	(250)
Additional standing charges			120.0000	(251)
Total energy cost			908.9690	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.8996 (257)
SAP value		87.4502
SAP rating (Section 12)		87 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	16473.4192	0.2160	3558.2586	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2982.7666	0.2160	644.2776	(264)
Space and water heating			4202.5361	(265)
Pumps and fans	30.0000	0.5190	15.5700	(267)
Energy for lighting	818.3227	0.5190	424.7095	(268)
Total kg/year			4642.8156	(272)
CO2 emissions per m2			12.2400	(273)
EI value			85.3394	
EI rating			85	(274)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

EI band

B

Calculation of stars for heating and DHW

Main heating energy efficiency $3.48 \times (1 + 0.29 \times 0.25) / 0.9090 = 4.106$, stars = 4
Main heating environmental impact $0.216 \times (1 + 0.29 \times 0.25) / 0.9090 = 0.2549$, stars = 4
Water heating energy efficiency $3.48 / 0.8647 = 4.025$, stars = 4
Water heating environmental impact $0.216 / 0.8647 = 0.2498$, stars = 4

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	178.4800 (1b)	x 2.8500 (2b)	= 508.6680 (1b) - (3b)
First floor	133.5100 (1c)	x 2.9400 (2c)	= 392.5194 (1c) - (3c)
Second floor	67.3700 (1d)	x 1.9100 (2d)	= 128.6767 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	379.3600		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 1029.8641 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	+	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	+	0 * 20 = 0.0000 (6b)
Number of intermittent fans					7 * 10 = 70.0000 (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) =					Air changes per hour 70.0000 / (5) = 0.0680 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3180 (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) = 0.2703 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.7000	4.4000	4.5000	4.0000	4.1000	3.5000	3.7000	3.9000	3.8000	4.1000	4.0000	4.4000 (22)
Wind factor	1.1750	1.1000	1.1250	1.0000	1.0250	0.8750	0.9250	0.9750	0.9500	1.0250	1.0000	1.1000 (22a)
Adj infilt rate	0.3176	0.2973	0.3041	0.2703	0.2770	0.2365	0.2500	0.2635	0.2568	0.2770	0.2703	0.2973 (22b)
Effective ac	0.5504	0.5442	0.5462	0.5365	0.5384	0.5280	0.5313	0.5347	0.5330	0.5384	0.5365	0.5442 (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
Glazing (Uw = 1.40)			72.8500	1.3258	96.5814		(27)
Solid Door			2.0000	1.4000	2.8000		(26)
Rooflight (Uw = 1.40)			14.2400	1.3258	18.8788		(27a)
Heat Loss Floor 1			190.3800	0.1500	28.5570	110.0000	20941.8000 (28a)
External Wall 1	325.2500	71.4700	253.7800	0.2300	58.3694	9.0000	2284.0200 (29a)
Dormer Cheeks	16.6100	3.3800	13.2300	0.3000	3.9690	9.0000	119.0700 (29a)
Ashlar Wall	29.6900		29.6900	0.1300	3.8597	9.0000	267.2100 (29a)
Flat Roof	48.0200	9.5000	38.5200	0.1600	6.1632	9.0000	346.6800 (30)
Slope Roof	68.2900	4.7400	63.5500	0.1800	11.4390	9.0000	571.9500 (30)
Dormer Roof	6.9500		6.9500	0.2000	1.3900	9.0000	62.5500 (30)
Ashlar Ceiling	66.1400		66.1400	0.1300	8.5982	9.0000	595.2600 (30)
Total net area of external elements Aum(A, m2)			751.3300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 240.6057		(33)
Stud			311.0800			9.0000	2799.7200 (32c)
Block			222.2200			75.0000	16666.5000 (32c)
Internal Floor 1			133.5100			18.0000	2403.1800 (32d)
Internal Floor 2			67.3700			18.0000	1212.6600 (32d)
Internal Ceiling 1			133.5100			18.0000	2403.1800 (32e)
Internal Ceiling 2			67.3700			18.0000	1212.6600 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 51886.4400 (34)
Thermal mass parameter (TMP) = Cm / TFA in kJ/m2K							136.7736 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							46.1083 (36)
Total fabric heat loss							(33) + (36) = 286.7140 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	187.0652	184.9472	185.6377	182.3405	182.9689	179.4312	180.5484	181.7276	181.1302	182.9689	182.3405	184.9472 (38)
Average = Sum(39)m / 12 =	473.7792	471.6613	472.3517	469.0545	469.6829	466.1453	467.2624	468.4416	467.8443	469.6829	469.0545	471.6613 (39)
HLP	1.2489	1.2433	1.2451	1.2364	1.2381	1.2288	1.2317	1.2348	1.2332	1.2381	1.2364	1.2433 (40)
HLP (average)												1.2382 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Assumed occupancy 3.2351 (42)
Average daily hot water use (litres/day) 111.0336 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	122.1369	117.6956	113.2542	108.8129	104.3716	99.9302	99.9302	104.3716	108.8129	113.2542	117.6956	122.1369 (44)
Energy content (annual)	181.1255	158.4136	163.4686	142.5159	136.7474	118.0026	109.3468	125.4770	126.9756	147.9778	161.5294	175.4104 (45)
Energy content (annual)	Total = Sum(45)m = 1746.9905 (45)											
Distribution loss (46)m = 0.15 x (45)m	27.1688	23.7620	24.5203	21.3774	20.5121	17.7004	16.4020	18.8216	19.0463	22.1967	24.2294	26.3116 (46)
Water storage loss:												
Store volume	300.0000 (47)											
a) If manufacturer declared loss factor is known (kWh/day):	2.8600 (48)											
Temperature factor from Table 2b	0.5400 (49)											
Enter (49) or (54) in (55)	1.5444 (55)											
Total storage loss	47.8764	43.2432	47.8764	46.3320	47.8764	46.3320	47.8764	47.8764	46.3320	47.8764	46.3320	47.8764 (56)
If cylinder contains dedicated solar storage	47.8764	43.2432	47.8764	46.3320	47.8764	46.3320	47.8764	47.8764	46.3320	47.8764	46.3320	47.8764 (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	252.2643	222.6680	234.6074	211.3599	207.8862	186.8466	180.4856	196.6158	195.8196	219.1166	230.3734	246.5492 (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	252.2643	222.6680	234.6074	211.3599	207.8862	186.8466	180.4856	196.6158	195.8196	219.1166	230.3734	246.5492 (64)
Heat gains from water heating, kWh/month	117.1353	104.0760	111.2644	102.4617	102.3795	94.3111	93.2688	98.6321	97.2946	106.1137	108.7837	115.2350 (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	194.1059	194.1059	194.1059	194.1059	194.1059	194.1059	194.1059	194.1059	194.1059	194.1059	194.1059	194.1059 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	115.8420	102.8899	83.6757	63.3479	47.3533	39.9776	43.1972	56.1494	75.3636	95.6914	111.6860	119.0617 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	775.7584	783.8084	763.5228	720.3371	665.8230	614.5874	580.3589	572.3090	592.5946	635.7802	690.2943	741.5299 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	57.6457	57.6457	57.6457	57.6457	57.6457	57.6457	57.6457	57.6457	57.6457	57.6457	57.6457	57.6457 (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)	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039 (71)
Water heating gains (Table 5)	157.4399	154.8750	149.5489	142.3080	137.6069	130.9876	125.3613	132.5701	135.1314	142.6259	151.0885	154.8858 (72)
Total internal gains	1174.3880	1166.9209	1122.0949	1051.3406	976.1308	910.9003	874.2651	886.3761	928.4372	999.4452	1078.4165	1140.8250 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
Northeast	26.9200	12.9280	0.5500	0.0000	0.7700	147.3876 (75)		
Southeast	1.0500	40.5720	0.5500	0.0000	0.7700	18.0414 (77)		
Southwest	40.6800	40.5720	0.5500	0.0000	0.7700	698.9738 (79)		
Northwest	4.2000	12.9280	0.5500	0.0000	0.7700	22.9951 (81)		
Northeast	1.5800	20.0673	0.6300	0.7000	1.0000	12.5843 (82)		
Southeast	1.5800	43.0800	0.6300	0.7000	1.0000	27.0155 (82)		
Northwest	1.5800	20.0673	0.6300	0.7000	1.0000	12.5843 (82)		
Horizontal	9.5000	30.0000	0.6300	0.7000	1.0000	113.1165 (82)		

Solar gains 1052.6985 1685.9542 2548.6749 3653.3290 4316.3688 4769.2607 4526.9074 3980.5893 3171.2188 2072.8042 1313.5466 878.3413 (83)
Total gains 2227.0865 2852.8751 3670.7698 4704.6696 5292.4997 5680.1609 5401.1725 4866.9654 4099.6560 3072.2494 2391.9631 2019.1663 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	30.4211	30.5577	30.5131	30.7276	30.6864	30.9193	30.8454	30.7678	30.8070	30.6864	30.7276	30.5577 (85)
alpha	3.0281	3.0372	3.0342	3.0485	3.0458	3.0613	3.0564	3.0512	3.0538	3.0458	3.0485	3.0372
util living area	0.9826	0.9642	0.9124	0.7897	0.6185	0.4011	0.2647	0.3021	0.5838	0.8690	0.9648	0.9866 (86)
MIT	19.3941	19.6265	20.0454	20.4908	20.7618	20.8841	20.9066	20.9037	20.8214	20.4192	19.8286	19.3463 (87)
Th 2	19.8811	19.8855	19.8841	19.8910	19.8896	19.8971	19.8947	19.8922	19.8935	19.8896	19.8910	19.8855 (88)
util rest of house	0.9789	0.9570	0.8949	0.7515	0.5560	0.3207	0.1719	0.2002	0.4955	0.8337	0.9562	0.9837 (89)
MIT 2	17.7441	18.0823	18.6768	19.2859	19.6196	19.7510	19.7643	19.7606	19.6963	19.2097	18.3818	17.6780 (90)
Living area fraction	fLA = Living area / (4) = 0.1573 (91)											
MIT	18.0037	18.3252	18.8921	19.4755	19.7993	19.9293	19.9440	19.9404	19.8733	19.4000	18.6094	17.9404 (92)
Temperature adjustment	-0.1500											
adjusted MIT	17.8537	18.1752	18.7421	19.3255	19.6493	19.7793	19.7940	19.7904	19.7233	19.2500	18.4594	17.7904 (93)

8. Space heating requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9693	0.9418	0.8722	0.7291	0.5413	0.3118	0.1633	0.1906	0.4806	0.8083	0.9407	0.9758	(94)
Useful gains	2158.7303	2686.8227	3201.7814	3430.2311	2864.7936	1770.8619	882.0347	927.5297	1970.3040	2483.2800	2250.0367	1970.2168	(95)
Ext temp.	5.0000	5.5000	7.4000	9.9000	12.9000	15.9000	17.9000	17.8000	15.2000	11.6000	7.9000	5.0000	(96)
Heat loss rate W													
Month fracti	6089.8208	5978.4203	5357.4466	4421.0501	3170.0106	1808.2960	884.9761	932.4060	2116.1951	3593.0590	4952.9420	6032.7578	(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	2924.7314	2211.9536	1603.8149	713.3897	227.0814	0.0000	0.0000	0.0000	0.0000	825.6756	1946.0919	3022.5305	(98)
Space heating per m2												13475.2690	(98)
												(98) / (4) =	35.5211 (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 %)													93.3000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													14442.9464 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	2924.7314	2211.9536	1603.8149	713.3897	227.0814	0.0000	0.0000	0.0000	0.0000	825.6756	1946.0919	3022.5305	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	3134.7603	2370.7970	1718.9870	764.6192	243.3885	0.0000	0.0000	0.0000	0.0000	884.9685	2085.8434	3239.5826	(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	252.2643	222.6680	234.6074	211.3599	207.8862	186.8466	180.4856	196.6158	195.8196	219.1166	230.3734	246.5492	(64)
Efficiency of water heater (217)m	90.0066	89.8725	89.4728	88.3751	85.7756	80.8000	80.8000	80.8000	80.8000	88.5779	89.7130	90.0511	(217)
Fuel for water heating, kWh/month	280.2730	247.7597	262.2110	239.1622	242.3605	231.2458	223.3732	243.3364	242.3510	247.3716	256.7892	273.7882	(219)
Water heating fuel used													2990.0219 (219)
Annual totals kWh/year													
Space heating fuel - main system													14442.9464 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans: central heating pump													30.0000 (230c)
Total electricity for the above, kWh/year													30.0000 (231)
Electricity for lighting (calculated in Appendix L)													818.3227 (232)
Total delivered energy for all uses													18281.2910 (238)

10a. Fuel costs - using BEDF prices (528)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	14442.9464	10.2300	1477.5134	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2990.0219	10.2300	305.8792	(247)
Pumps and fans for heating	30.0000	36.7200	11.0160	(249)
Energy for lighting	818.3227	36.7200	300.4881	(250)
Additional standing charges			103.0000	(251)
Total energy cost			2197.8967	(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	14442.9464	0.2160	3119.6764	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2990.0219	0.2160	645.8447	(264)
Space and water heating			3765.5212	(265)
Pumps and fans	30.0000	0.5190	15.5700	(267)
Energy for lighting	818.3227	0.5190	424.7095	(268)
Total kg/year			4205.8006	(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	14442.9464	1.2200	17620.3946	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2990.0219	1.2200	3647.8267	(264)
Space and water heating			21268.2213	(265)
Pumps and fans	30.0000	3.0700	92.1000	(267)
Energy for lighting	818.3227	3.0700	2512.2506	(268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Primary energy kWh/year
Primary energy kWh/m²/year

23872.5719 (272)
62.9285 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 87
Current environmental impact rating: B 85

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 3.1	-£ 666	-941 kg (22.4%)

Measures omitted - SAP change or cost saving too small:			
N Solar water heating	+ 0.6	-£ 124	-275 kg (6.5%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Solar photovoltaic panels	£666	2.48 kg/m ²	B 91 B 88
Total Savings	£666	2.48 kg/m ²	

Potential energy efficiency rating: B 91
Potential environmental impact rating: B 88

Fuel prices for cost data on this page from database revision number 528 TEST (04 Oct 2023)
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	£312	£312	£0
Mains gas	£1886	£1886	£0
Space heating	£1592	£1592	£0
Water heating	£306	£306	£0
Lighting	£300	£300	£0
Generated (PV)	-£0	-£666	£666
Total cost of fuels	£2198	£1532	£666
Total cost of uses	£2198	£1532	£666
Delivered energy	48 kWh/m ²	43 kWh/m ²	5 kWh/m ²
Carbon dioxide emissions	4.2 tonnes	3.3 tonnes	0.9 tonnes
CO2 emissions per m ²	11 kg/m ²	9 kg/m ²	2 kg/m ²
Primary energy	63 kWh/m ²	48 kWh/m ²	15 kWh/m ²

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	178.4800 (1b)	x 2.8500 (2b)	= 508.6680 (1b) - (3b)
First floor	133.5100 (1c)	x 2.9400 (2c)	= 392.5194 (1c) - (3c)
Second floor	67.3700 (1d)	x 1.9100 (2d)	= 128.6767 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	379.3600		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 1029.8641 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	+	0	+	0 * 40 = 0.0000 (6a)							
Number of open flues	0	+	0	+	0 * 20 = 0.0000 (6b)							
Number of intermittent fans					7 * 10 = 70.0000 (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) =					Air changes per hour 70.0000 / (5) = 0.0680 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3180 (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) = 0.2703 (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	0.3446	0.3378	0.3311	0.2973	0.2905	0.2568	0.2568	0.2500	0.2703	0.2905	0.3041	0.3176 (22b)
Effective ac	0.5594	0.5571	0.5548	0.5442	0.5422	0.5330	0.5330	0.5313	0.5365	0.5422	0.5462	0.5504 (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					
Glazing (Uw = 1.40)			72.8500	1.3258	96.5814		(27)					
Solid Door			2.0000	1.4000	2.8000		(26)					
Rooflight (Uw = 1.40)			14.2400	1.3258	18.8788		(27a)					
Heat Loss Floor 1			190.3800	0.1500	28.5570	110.0000	20941.8000 (28a)					
External Wall 1	325.2500	71.4700	253.7800	0.2300	58.3694	9.0000	2284.0200 (29a)					
Dormer Cheeks	16.6100	3.3800	13.2300	0.3000	3.9690	9.0000	119.0700 (29a)					
Ashlar Wall	29.6900		29.6900	0.1300	3.8597	9.0000	267.2100 (29a)					
Flat Roof	48.0200	9.5000	38.5200	0.1600	6.1632	9.0000	346.6800 (30)					
Slope Roof	68.2900	4.7400	63.5500	0.1800	11.4390	9.0000	571.9500 (30)					
Dormer Roof	6.9500		6.9500	0.2000	1.3900	9.0000	62.5500 (30)					
Ashlar Ceiling	66.1400		66.1400	0.1300	8.5982	9.0000	595.2600 (30)					
Total net area of external elements Aum(A, m2)			751.3300				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 240.6057		(33)					
Stud			311.0800			9.0000	2799.7200 (32c)					
Block			222.2200			75.0000	16666.5000 (32c)					
Internal Floor 1			133.5100			18.0000	2403.1800 (32d)					
Internal Floor 2			67.3700			18.0000	1212.6600 (32d)					
Internal Ceiling 1			133.5100			18.0000	2403.1800 (32e)					
Internal Ceiling 2			67.3700			18.0000	1212.6600 (32e)					
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 51886.4400 (34)					
Thermal mass parameter (TMP) = Cm / TFA in kJ/m2K							136.7736 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							46.1083 (36)					
Total fabric heat loss							(33) + (36) = 286.7140 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 190.1063	Feb 189.3228	Mar 188.5547	Apr 184.9472	May 184.2723	Jun 181.1302	Jul 181.1302	Aug 180.5484	Sep 182.3405	Oct 184.2723	Nov 185.6377	Dec 187.0652 (38)
Heat transfer coeff	476.8204	476.0368	475.2688	471.6613	470.9863	467.8443	467.8443	467.2624	469.0545	470.9863	472.3517	473.7792 (39)
Average = Sum(39)m / 12 =												471.6580 (39)
HLP	Jan 1.2569	Feb 1.2548	Mar 1.2528	Apr 1.2433	May 1.2415	Jun 1.2332	Jul 1.2332	Aug 1.2317	Sep 1.2364	Oct 1.2415	Nov 1.2451	Dec 1.2489 (40)
HLP (average)												1.2433 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Assumed occupancy												3.2351 (42)
Average daily hot water use (litres/day)												111.0336 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	122.1369	117.6956	113.2542	108.8129	104.3716	99.9302	99.9302	104.3716	108.8129	113.2542	117.6956	122.1369 (44)
Energy content (annual)	181.1255	158.4136	163.4686	142.5159	136.7474	118.0026	109.3468	125.4770	126.9756	147.9778	161.5294	175.4104 (45)
Distribution loss (46)m = 0.15 x (45)m	27.1688	23.7620	24.5203	21.3774	20.5121	17.7004	16.4020	18.8216	19.0463	22.1967	24.2294	26.3116 (46)
Water storage loss:												
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.8600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.5444 (55)
Total storage loss	47.8764	43.2432	47.8764	46.3320	47.8764	46.3320	47.8764	47.8764	46.3320	47.8764	46.3320	47.8764 (56)
If cylinder contains dedicated solar storage	47.8764	43.2432	47.8764	46.3320	47.8764	46.3320	47.8764	47.8764	46.3320	47.8764	46.3320	47.8764 (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	252.2643	222.6680	234.6074	211.3599	207.8862	186.8466	180.4856	196.6158	195.8196	219.1166	230.3734	246.5492 (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	252.2643	222.6680	234.6074	211.3599	207.8862	186.8466	180.4856	196.6158	195.8196	219.1166	230.3734	246.5492 (64)
Total per year (kWh/year) = Sum(64)m =												2584.5925 (64)
Heat gains from water heating, kWh/month	117.1353	104.0760	111.2644	102.4617	102.3795	94.3111	93.2688	98.6321	97.2946	106.1137	108.7837	115.2350 (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	194.1059	194.1059	194.1059	194.1059	194.1059	194.1059	194.1059	194.1059	194.1059	194.1059	194.1059	194.1059 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	115.8420	102.8899	83.6757	63.3479	47.3533	39.9776	43.1972	56.1494	75.3636	95.6914	111.6860	119.0617 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	775.7584	783.8084	763.5228	720.3371	665.8230	614.5874	580.3589	572.3090	592.5946	635.7802	690.2943	741.5299 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	57.6457	57.6457	57.6457	57.6457	57.6457	57.6457	57.6457	57.6457	57.6457	57.6457	57.6457	57.6457 (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)	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039 (71)
Water heating gains (Table 5)	157.4399	154.8750	149.5489	142.3080	137.6069	130.9876	125.3613	132.5701	135.1314	142.6259	151.0885	154.8858 (72)
Total internal gains	1174.3880	1166.9209	1122.0949	1051.3406	976.1308	910.9003	874.2651	886.3761	928.4372	999.4452	1078.4165	1140.8250 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
Northeast	26.9200	11.2829	0.5500	0.0000	0.7700	128.6325 (75)						
Southeast	1.0500	36.7938	0.5500	0.0000	0.7700	16.3613 (77)						
Southwest	40.6800	36.7938	0.5500	0.0000	0.7700	633.8834 (79)						
Northwest	4.2000	11.2829	0.5500	0.0000	0.7700	20.0690 (81)						
Northeast	1.5800	17.4137	0.6300	0.7000	1.0000	10.9202 (82)						
Southeast	1.5800	38.2331	0.6300	0.7000	1.0000	23.9760 (82)						
Northwest	1.5800	17.4137	0.6300	0.7000	1.0000	10.9202 (82)						
Horizontal	9.5000	26.0000	0.6300	0.7000	1.0000	98.0343 (82)						
Solar gains	942.7969	1704.5126	2578.4722	3582.2342	4347.5815	4458.6625	4239.6781	3650.1566	2924.8684	1951.7575	1147.5831	794.7727 (83)
Total gains	2117.1849	2871.4336	3700.5671	4633.5748	5323.7123	5369.5627	5113.9432	4536.5327	3853.3056	2951.2027	2225.9996	1935.5976 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	30.2271	30.2769	30.3258	30.5577	30.6015	30.8070	30.8070	30.8454	30.7276	30.6015	30.5131	30.4211
alpha	3.0151	3.0185	3.0217	3.0372	3.0401	3.0538	3.0538	3.0564	3.0485	3.0401	3.0342	3.0281
util living area	0.9864	0.9671	0.9229	0.8244	0.6750	0.5119	0.3872	0.4471	0.6840	0.9022	0.9749	0.9895 (86)
MIT	19.2617	19.5381	19.9341	20.3796	20.6897	20.8425	20.8897	20.8777	20.7421	20.2812	19.6734	19.2107 (87)
Th 2	19.8747	19.8764	19.8780	19.8855	19.8869	19.8935	19.8935	19.8947	19.8910	19.8869	19.8841	19.8811 (88)
util rest of house	0.9836	0.9606	0.9081	0.7926	0.6215	0.4368	0.2959	0.3496	0.6103	0.8764	0.9689	0.9874 (89)
MIT 2	17.5470	17.9477	18.5138	19.1331	19.5312	19.7101	19.7529	19.7464	19.6109	19.0192	18.1530	17.4771 (90)
Living area fraction												fLA = Living area / (4) =
MIT	17.8167	18.1979	18.7372	19.3292	19.7135	19.8882	19.9317	19.9244	19.7889	19.2178	18.3922	17.7498 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.6667	18.0479	18.5872	19.1792	19.5635	19.7382	19.7817	19.7744	19.6389	19.0678	18.2422	17.5998 (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	0.9756	0.9461	0.8864	0.7691	0.6043	0.4256	0.2863	0.3385	0.5914	0.8521	0.9562	0.9808	(94)
Useful gains	2065.5982	2716.7564	3280.2474	3563.5475	3217.3540	2285.2403	1464.0447	1535.4516	2278.8239	2514.6913	2128.6051	1898.4055	(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													
Month fracti	6373.5258	6258.8810	5744.6690	4848.2952	3703.5870	2403.8959	1488.5629	1576.7109	2598.0387	3988.2076	5263.0179	6348.5608	(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	3205.0982	2380.3077	1833.5297	925.0183	361.7573	0.0000	0.0000	0.0000	0.0000	1096.2961	2256.7773	3310.9155	(98)
Space heating per m2												15369.7001	(98)
												(98) / (4) =	40.5148 (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 %)													93.3000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													16473.4192 (211)
Space heating requirement	3205.0982	2380.3077	1833.5297	925.0183	361.7573	0.0000	0.0000	0.0000	0.0000	1096.2961	2256.7773	3310.9155	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	3435.2606	2551.2409	1965.1979	991.4451	387.7356	0.0000	0.0000	0.0000	0.0000	1175.0226	2418.8395	3548.6769	(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	252.2643	222.6680	234.6074	211.3599	207.8862	186.8466	180.4856	196.6158	195.8196	219.1166	230.3734	246.5492	(64)
Efficiency of water heater (217)m	90.0784	89.9383	89.6291	88.8347	86.9343	80.8000	80.8000	80.8000	80.8000	89.0459	89.8596	90.1193	(216)
Fuel for water heating, kWh/month	280.0497	247.5786	261.7537	237.9250	239.1303	231.2458	223.3732	243.3364	242.3510	246.0716	256.3704	273.5810	(219)
Water heating fuel used													2982.7666 (219)
Annual totals kWh/year													
Space heating fuel - main system													16473.4192 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans: central heating pump													30.0000 (230c)
Total electricity for the above, kWh/year													30.0000 (231)
Electricity for lighting (calculated in Appendix L)													818.3227 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =										-1727.2394			-1727.2394 (233)
Total delivered energy for all uses													18577.2691 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	16473.4192	3.4800	573.2750 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	2982.7666	3.4800	103.8003 (247)	
Pumps and fans for heating	30.0000	13.1900	3.9570 (249)	
Energy for lighting	818.3227	13.1900	107.9368 (250)	
Additional standing charges			120.0000 (251)	
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229 (252)	
Total energy cost			681.1462 (255)	

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)		0.6741 (257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	90.5956
SAP rating (Section 12)		91 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	16473.4192	0.2160	3558.2586 (261)	
Space heating - secondary	0.0000	0.0000	0.0000 (263)	
Water heating (other fuel)	2982.7666	0.2160	644.2776 (264)	
Space and water heating			4202.5361 (265)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	30.0000	0.5190	15.5700 (267)
Energy for lighting	818.3227	0.5190	424.7095 (268)
Energy saving/generation technologies			
PV Unit			
Total kg/year	-1727.2394	0.5190	-896.4372 (269)
CO2 emissions per m2			3746.3784 (272)
EI value			9.8800 (273)
EI rating			88.1701
EI band			88 (274)
			B

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	178.4800 (1b)	x 2.8500 (2b)	= 508.6680 (1b) - (3b)
First floor	133.5100 (1c)	x 2.9400 (2c)	= 392.5194 (1c) - (3c)
Second floor	67.3700 (1d)	x 1.9100 (2d)	= 128.6767 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	379.3600		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 1029.8641 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)							
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)							
Number of intermittent fans					7 * 10 = 70.0000 (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) =					Air changes per hour 70.0000 / (5) = 0.0680 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3180 (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) =	0.2703 (21)							
Wind speed	Jan 4.7000	Feb 4.4000	Mar 4.5000	Apr 4.0000	May 4.1000	Jun 3.5000	Jul 3.7000	Aug 3.9000	Sep 3.8000	Oct 4.1000	Nov 4.0000	Dec 4.4000 (22)
Wind factor	1.1750	1.1000	1.1250	1.0000	1.0250	0.8750	0.9250	0.9750	0.9500	1.0250	1.0000	1.1000 (22a)
Adj infilt rate	0.3176	0.2973	0.3041	0.2703	0.2770	0.2365	0.2500	0.2635	0.2568	0.2770	0.2703	0.2973 (22b)
Effective ac	0.5504	0.5442	0.5462	0.5365	0.5384	0.5280	0.5313	0.5347	0.5330	0.5384	0.5365	0.5442 (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					
Glazing (Uw = 1.40)			72.8500	1.3258	96.5814		(27)					
Solid Door			2.0000	1.4000	2.8000		(26)					
Rooflight (Uw = 1.40)			14.2400	1.3258	18.8788		(27a)					
Heat Loss Floor 1			190.3800	0.1500	28.5570	110.0000	20941.8000 (28a)					
External Wall 1	325.2500	71.4700	253.7800	0.2300	58.3694	9.0000	2284.0200 (29a)					
Dormer Cheeks	16.6100	3.3800	13.2300	0.3000	3.9690	9.0000	119.0700 (29a)					
Ashlar Wall	29.6900		29.6900	0.1300	3.8597	9.0000	267.2100 (29a)					
Flat Roof	48.0200	9.5000	38.5200	0.1600	6.1632	9.0000	346.6800 (30)					
Slope Roof	68.2900	4.7400	63.5500	0.1800	11.4390	9.0000	571.9500 (30)					
Dormer Roof	6.9500		6.9500	0.2000	1.3900	9.0000	62.5500 (30)					
Ashlar Ceiling	66.1400		66.1400	0.1300	8.5982	9.0000	595.2600 (30)					
Total net area of external elements Aum(A, m2)			751.3300				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 240.6057		(33)					
Stud			311.0800			9.0000	2799.7200 (32c)					
Block			222.2200			75.0000	16666.5000 (32c)					
Internal Floor 1			133.5100			18.0000	2403.1800 (32d)					
Internal Floor 2			67.3700			18.0000	1212.6600 (32d)					
Internal Ceiling 1			133.5100			18.0000	2403.1800 (32e)					
Internal Ceiling 2			67.3700			18.0000	1212.6600 (32e)					
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 51886.4400 (34)					
Thermal mass parameter (TMP) = Cm / TFA in kJ/m2K							136.7736 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							46.1083 (36)					
Total fabric heat loss							(33) + (36) = 286.7140 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 187.0652	Feb 184.9472	Mar 185.6377	Apr 182.3405	May 182.9689	Jun 179.4312	Jul 180.5484	Aug 181.7276	Sep 181.1302	Oct 182.9689	Nov 182.3405	Dec 184.9472 (38)
Heat transfer coeff	473.7792	471.6613	472.3517	469.0545	469.6829	466.1453	467.2624	468.4416	467.8443	469.6829	469.0545	471.6613 (39)
Average = Sum(39)m / 12 =												469.7185 (39)
HLP	Jan 1.2489	Feb 1.2433	Mar 1.2451	Apr 1.2364	May 1.2381	Jun 1.2288	Jul 1.2317	Aug 1.2348	Sep 1.2332	Oct 1.2381	Nov 1.2364	Dec 1.2433 (40)
HLP (average)												1.2382 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Assumed occupancy 3.2351 (42)
Average daily hot water use (litres/day) 111.0336 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	122.1369	117.6956	113.2542	108.8129	104.3716	99.9302	99.9302	104.3716	108.8129	113.2542	117.6956	122.1369	(44)	
Energy content	181.1255	158.4136	163.4686	142.5159	136.7474	118.0026	109.3468	125.4770	126.9756	147.9778	161.5294	175.4104	(45)	
Energy content (annual)	Total = Sum(45)m = 1746.9905												(45)	
Distribution loss (46)m = 0.15 x (45)m	27.1688	23.7620	24.5203	21.3774	20.5121	17.7004	16.4020	18.8216	19.0463	22.1967	24.2294	26.3116	(46)	
Water storage loss:														
Store volume													300.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													2.8600	(48)
Temperature factor from Table 2b													0.5400	(49)
Enter (49) or (54) in (55)													1.5444	(55)
Total storage loss	47.8764	43.2432	47.8764	46.3320	47.8764	46.3320	47.8764	47.8764	46.3320	47.8764	46.3320	47.8764	(56)	
If cylinder contains dedicated solar storage	47.8764	43.2432	47.8764	46.3320	47.8764	46.3320	47.8764	47.8764	46.3320	47.8764	46.3320	47.8764	(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	252.2643	222.6680	234.6074	211.3599	207.8862	186.8466	180.4856	196.6158	195.8196	219.1166	230.3734	246.5492	(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	252.2643	222.6680	234.6074	211.3599	207.8862	186.8466	180.4856	196.6158	195.8196	219.1166	230.3734	246.5492	(64)	
Total per year (kWh/year) = Sum(64)m =													2584.5925	(64)
Heat gains from water heating, kWh/month	117.1353	104.0760	111.2644	102.4617	102.3795	94.3111	93.2688	98.6321	97.2946	106.1137	108.7837	115.2350	(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	194.1059	194.1059	194.1059	194.1059	194.1059	194.1059	194.1059	194.1059	194.1059	194.1059	194.1059	194.1059	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	115.8420	102.8899	83.6757	63.3479	47.3533	39.9776	43.1972	56.1494	75.3636	95.6914	111.6860	119.0617	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	775.7584	783.8084	763.5228	720.3371	665.8230	614.5874	580.3589	572.3090	592.5946	635.7802	690.2943	741.5299	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	57.6457	57.6457	57.6457	57.6457	57.6457	57.6457	57.6457	57.6457	57.6457	57.6457	57.6457	57.6457	(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)	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	-129.4039	(71)
Water heating gains (Table 5)	157.4399	154.8750	149.5489	142.3080	137.6069	130.9876	125.3613	132.5701	135.1314	142.6259	151.0885	154.8858	(72)
Total internal gains	1174.3880	1166.9209	1122.0949	1051.3406	976.1308	910.9003	874.2651	886.3761	928.4372	999.4452	1078.4165	1140.8250	(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	26.9200	12.9280	0.5500	0.0000	0.7700	147.3876 (75)
Southeast	1.0500	40.5720	0.5500	0.0000	0.7700	18.0414 (77)
Southwest	40.6800	40.5720	0.5500	0.0000	0.7700	698.9738 (79)
Northwest	4.2000	12.9280	0.5500	0.0000	0.7700	22.9951 (81)
Northeast	1.5800	20.0673	0.6300	0.7000	1.0000	12.5843 (82)
Southeast	1.5800	43.0800	0.6300	0.7000	1.0000	27.0155 (82)
Northwest	1.5800	20.0673	0.6300	0.7000	1.0000	12.5843 (82)
Horizontal	9.5000	30.0000	0.6300	0.7000	1.0000	113.1165 (82)

Solar gains 1052.6985 1685.9542 2548.6749 3653.3290 4316.3688 4769.2607 4526.9074 3980.5893 3171.2188 2072.8042 1313.5466 878.3413 (83)
Total gains 2227.0865 2852.8751 3670.7698 4704.6696 5292.4997 5680.1609 5401.1725 4866.9654 4099.6560 3072.2494 2391.9631 2019.1663 (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	30.4211	30.5577	30.5131	30.7276	30.6864	30.9193	30.8454	30.7678	30.8070	30.6864	30.7276	30.5577	
alpha	3.0281	3.0372	3.0342	3.0485	3.0458	3.0613	3.0564	3.0512	3.0538	3.0458	3.0485	3.0372	
util living area	0.9826	0.9642	0.9124	0.7897	0.6185	0.4011	0.2647	0.3021	0.5838	0.8690	0.9648	0.9866	(86)
MIT	19.3941	19.6265	20.0454	20.4908	20.7618	20.8841	20.9066	20.9037	20.8214	20.4192	19.8286	19.3463	(87)
Th 2	19.8811	19.8855	19.8841	19.8910	19.8896	19.8971	19.8947	19.8922	19.8935	19.8896	19.8910	19.8855	(88)
util rest of house	0.9789	0.9570	0.8949	0.7515	0.5560	0.3207	0.1719	0.2002	0.4955	0.8337	0.9562	0.9837	(89)
MIT 2	17.7441	18.0823	18.6768	19.2859	19.6196	19.7510	19.7643	19.7606	19.6963	19.2097	18.3818	17.6780	(90)
Living area fraction	fLA = Living area / (4) = 0.1573 (91)												
MIT	18.0037	18.3252	18.8921	19.4755	19.7993	19.9293	19.9440	19.9404	19.8733	19.4000	18.6094	17.9404	(92)
Temperature adjustment	-0.1500												
adjusted MIT	17.8537	18.1752	18.7421	19.3255	19.6493	19.7793	19.7940	19.7904	19.7233	19.2500	18.4594	17.7904	(93)

8. Space heating requirement

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	0.9693	0.9418	0.8722	0.7291	0.5413	0.3118	0.1633	0.1906	0.4806	0.8083	0.9407	0.9758	(94)		
Useful gains	2158.7303	2686.8227	3201.7814	3430.2311	2864.7936	1770.8619	882.0347	927.5297	1970.3040	2483.2800	2250.0367	1970.2168	(95)		
Ext temp.	5.0000	5.5000	7.4000	9.9000	12.9000	15.9000	17.9000	17.8000	15.2000	11.6000	7.9000	5.0000	(96)		
Heat loss rate W															
6089.8208	5978.4203	5357.4466	4421.0501	3170.0106	1808.2960	884.9761	932.4060	2116.1951	3593.0590	4952.9420	6032.7578	(97)			
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)		
Space heating kWh															
2924.7314	2211.9536	1603.8149	713.3897	227.0814	0.0000	0.0000	0.0000	0.0000	0.0000	825.6756	1946.0919	3022.5305	(98)		
Space heating													13475.2690	(98)	
Space heating per m2													(98) / (4) =	35.5211	(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 %)													93.3000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													14442.9464	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	2924.7314	2211.9536	1603.8149	713.3897	227.0814	0.0000	0.0000	0.0000	0.0000	825.6756	1946.0919	3022.5305	(98)	
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)	
Space heating fuel (main heating system)	3134.7603	2370.7970	1718.9870	764.6192	243.3885	0.0000	0.0000	0.0000	0.0000	884.9685	2085.8434	3239.5826	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	252.2643	222.6680	234.6074	211.3599	207.8862	186.8466	180.4856	196.6158	195.8196	219.1166	230.3734	246.5492	(64)	
Efficiency of water heater	90.0066	89.8725	89.4728	88.3751	85.7756	80.8000	80.8000	80.8000	80.8000	88.5779	89.7130	90.0511	(217)	
Fuel for water heating, kWh/month	280.2730	247.7597	262.2110	239.1622	242.3605	231.2458	223.3732	243.3364	242.3510	247.3716	256.7892	273.7882	(219)	
Water heating fuel used													2990.0219	(219)
Annual totals kWh/year														
Space heating fuel - main system													14442.9464	(211)
Space heating fuel - secondary													0.0000	(215)
Electricity for pumps and fans:														
central heating pump													30.0000	(230c)
Total electricity for the above, kWh/year													30.0000	(231)
Electricity for lighting (calculated in Appendix L)													818.3227	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 2.50 * 1133 * 0.80) =										-1812.7461			-1812.7461	(233)
Total delivered energy for all uses													16468.5449	(238)

10a. Fuel costs - using BEDF prices (528)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	14442.9464	10.2300	1477.5134	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2990.0219	10.2300	305.8792	(247)
Pumps and fans for heating	30.0000	36.7200	11.0160	(249)
Energy for lighting	818.3227	36.7200	300.4881	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-1812.7461	36.7200	-665.6404	(252)
Total energy cost			1532.2564	(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	14442.9464	0.2160	3119.6764	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2990.0219	0.2160	645.8447	(264)
Space and water heating			3765.5212	(265)
Pumps and fans	30.0000	0.5190	15.5700	(267)
Energy for lighting	818.3227	0.5190	424.7095	(268)
Energy saving/generation technologies				
PV Unit	-1812.7461	0.5190	-940.8152	(269)
Total kg/year			3264.9854	(272)

13a. Primary energy - 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	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	14442.9464	1.2200	17620.3946 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2990.0219	1.2200	3647.8267 (264)
Space and water heating			21268.2213 (265)
Pumps and fans	30.0000	3.0700	92.1000 (267)
Energy for lighting	818.3227	3.0700	2512.2506 (268)
Energy saving/generation technologies			
PV Unit	-1812.7461	3.0700	-5565.1306 (269)
Primary energy kWh/year			18307.4413 (272)
Primary energy kWh/m2/year			48.2588 (273)