

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



<b>Property Reference</b>	BD23 6RR Plot 43			<b>Issued on Date</b>	20/07/2022
<b>Assessment Reference</b>	001	<b>Prop Type Ref</b>	Type F		
<b>Property</b>	Plot 43, Phase 4, Shires Lane, Embsay, Skipton, BD23 6RR				
<b>SAP Rating</b>	90 B	<b>DER</b>	10.53	<b>TER</b>	14.56
<b>Environmental</b>	89 B	<b>% DER&lt;TER</b>	27.67		
<b>CO<sub>2</sub> Emissions (t/year)</b>	2.37	<b>DFEE</b>	51.87	<b>TFEE</b>	56.85
<b>General Requirements Compliance</b>	Pass	<b>% DFEE&lt;TFEE</b>	8.76		
<b>Assessor Details</b>	Mr. Jake Eaton, Jake Eaton, Tel: 01400283471, jake@eratech.co.uk			<b>Assessor ID</b>	P711-0001
<b>Client</b>					

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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 219 m<sup>2</sup>

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) 14.56 kgCO<sub>2</sub>/m<sup>2</sup>  
Dwelling Carbon Dioxide Emission Rate (DER) 10.53 kgCO<sub>2</sub>/m<sup>2</sup>OK

#### 1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 56.9 kWh/m<sup>2</sup>/yr  
Dwelling Fabric Energy Efficiency (DFEE) 51.9 kWh/m<sup>2</sup>/yrOK

#### 2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.18 (max. 0.70)	OK
Floor	0.15 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.17 (max. 0.35)	OK
Openings	1.61 (max. 2.00)	1.80 (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 rated a

Efficiency: 89%  
Minimum: 88% OK

Secondary heating system: Room heaters - Wood Logs

Closed room heater  
Efficiency: 65%  
Minimum: 65% OK

#### 5 Cylinder insulation

Hot water storage: Nominal cylinder loss: 2.01 kWh/day  
Permitted by DBSCG 2.56 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

Continuous extract system (decentralised)  
Specific fan power: 0.1600 0.1600  
Maximum 0.7 OK

#### 9 Summertime temperature

Overheating risk (North East England): Not significant OK

Based on:  
Overshading: Average  
Windows facing North East: 5.57 m<sup>2</sup>, No overhang  
Windows facing South East: 16.91 m<sup>2</sup>, No overhang  
Windows facing South West: 4.79 m<sup>2</sup>, No overhang  
Windows facing North West: 11.56 m<sup>2</sup>, No overhang  
Air change rate: 2.50 ach  
Blinds/curtains: Light-coloured curtain or roller blind, closed 50% of daylight hours

#### 10 Key features

Secondary heating (wood logs)  
Secondary heating fuel: wood logs  
Photovoltaic array: 2.00 kW

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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	99.9500 (1b)	2.6300 (2b)	262.8685 (1b) - (3b)
First floor	119.1100 (1c)	2.6900 (2c)	320.4059 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	219.0600		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 583.2744 (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				0 * 10 =	0.0000 (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) =				0.0000 / (5) =	0.0000 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.2500 (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) =		0.2125 (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	0.2709	0.2656	0.2603	0.2338	0.2284	0.2019	0.2019	0.1966	0.2125	0.2284	0.2391	0.2497 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5209	0.5156	0.5103	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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					
Opening Type 1			2.1200	1.8000	3.8160		(26)					
Opening Type 2 (Uw = 1.60)			38.8300	1.5038	58.3910		(27)					
Opening Type 3 (Uw = 1.60)			0.8600	1.5038	1.2932		(27a)					
Heat Loss Floor 1			64.6300	0.1300	8.4019	75.0000	4847.2500 (28a)					
Heat Loss Floor 2			35.3200	0.1886	6.6618	20.0000	706.4000 (28b)					
External Wall 1	215.1200	40.9500	174.1700	0.1800	31.3506	110.0000	19158.7000 (29a)					
Wall to Garage	18.6700		18.6700	0.1557	2.9070	110.0000	2053.7000 (29a)					
External Roof 2	119.1100		119.1100	0.1300	15.4843	9.0000	1071.9900 (30)					
External Roof 2	13.9800	0.8600	13.1200	0.1700	2.2304	0.0000	0.0000 (30)					
Total net area of external elements Aum(A, m2)			466.8300				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	130.5362		(33)					
Internal Wall 1			87.3200			75.0000	6549.0000 (32c)					
Internal Wall 2			136.0700			9.0000	1224.6300 (32c)					
Internal Floor 1			83.7900			18.0000	1508.2200 (32d)					
Internal Ceiling 1			83.7900			18.0000	1508.2200 (32e)					
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 38628.1100 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							176.3358 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							35.6719 (36)					
Total fabric heat loss							(33) + (36) = 166.2081 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 100.2703	Feb 99.2478	Mar 98.2252	Apr 96.2403	May 96.2403	Jun 96.2403	Jul 96.2403	Aug 96.2403	Sep 96.2403	Oct 96.2403	Nov 96.2403	Dec 96.2403 (38)
Heat transfer coeff	266.4784	265.4559	264.4333	262.4484	262.4484	262.4484	262.4484	262.4484	262.4484	262.4484	262.4484	262.4484 (39)
Average = Sum(39)m / 12 =												263.2003 (39)
HLP	Jan 1.2165	Feb 1.2118	Mar 1.2071	Apr 1.1981	May 1.1981	Jun 1.1981	Jul 1.1981	Aug 1.1981	Sep 1.1981	Oct 1.1981	Nov 1.1981	Dec 1.1981 (40)
HLP (average)												1.2015 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

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

Assumed occupancy	3.0267 (42)
Average daily hot water use (litres/day)	106.0843 (43)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	116.6927	112.4494	108.2060	103.9626	99.7192	95.4759	95.4759	99.7192	103.9626	108.2060	112.4494	116.6927	(44)	
Energy conte	173.0519	151.3523	156.1821	136.1633	130.6519	112.7427	104.4727	119.8839	121.3157	141.3818	154.3292	167.5916	(45)	
Energy content (annual)	Total = Sum (45)m =												1669.1191	(45)
Distribution loss (46)m = 0.15 x (45)m	25.9578	22.7029	23.4273	20.4245	19.5978	16.9114	15.6709	17.9826	18.1974	21.2073	23.1494	25.1387	(46)	
Water storage loss:														
Store volume													250.0000	(47)
b) If manufacturer declared loss factor is not known :														
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103	(51)
Volume factor from Table 2a													0.7830	(52)
Temperature factor from Table 2b													0.5400	(53)
Enter (49) or (54) in (55)													1.0875	(55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(56)	
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(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	230.0270	202.8137	213.1571	191.3004	187.6270	167.8798	161.4477	176.8590	176.4529	198.3568	209.4664	224.5666	(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	230.0270	202.8137	213.1571	191.3004	187.6270	167.8798	161.4477	176.8590	176.4529	198.3568	209.4664	224.5666	(64)	
Total per year (kWh/year) = Sum (64)m =													2339.9544	(64)
Heat gains from water heating, kWh/month	103.1198	91.4937	97.5106	89.3840	89.0218	81.5967	80.3172	85.4414	84.4472	92.5895	95.4242	101.3042	(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	151.3354	151.3354	151.3354	151.3354	151.3354	151.3354	151.3354	151.3354	151.3354	151.3354	151.3354	151.3354	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	35.3426	31.3910	25.5288	19.3270	14.4471	12.1969	13.1792	17.1308	22.9929	29.1948	34.0746	36.3249	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	388.8180	392.8527	382.6854	361.0403	333.7173	308.0375	290.8818	286.8471	297.0144	318.6595	345.9825	371.6623	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.1335	38.1335	38.1335	38.1335	38.1335	38.1335	38.1335	38.1335	38.1335	38.1335	38.1335	38.1335	(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)	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	(71)
Water heating gains (Table 5)	138.6019	136.1514	131.0626	124.1445	119.6530	113.3287	107.9532	114.8407	117.2878	124.4482	132.5336	136.1616	(72)
Total internal gains	634.1631	631.7957	610.6774	575.9123	539.2180	504.9637	483.4148	490.2191	508.6957	543.7031	583.9913	615.5494	(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	5.5700	11.2829	0.7600	0.7000	0.7700	23.1698 (75)							
Southeast	16.9100	36.7938	0.7600	0.7000	0.7700	229.3842 (77)							
Southwest	4.7900	36.7938	0.7600	0.7000	0.7700	64.9764 (79)							
Northwest	11.5600	11.2829	0.7600	0.7000	0.7700	48.0867 (81)							
Southwest	0.8600	34.0172	0.7600	0.7000	1.0000	14.0072 (82)							
Solar gains	379.6243	673.7108	992.1729	1344.8037	1609.8624	1643.2943	1565.5891	1361.2723	1113.4239	763.7161	459.6692	321.6452	(83)
Total gains	1013.7874	1305.5065	1602.8503	1920.7161	2149.0804	2148.2579	2049.0039	1851.4914	1622.1196	1307.4192	1043.6606	937.1946	(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	40.2660	40.4211	40.5775	40.8843	40.8843	40.8843	40.8843	40.8843	40.8843	40.8843	40.8843	40.8843	(86)
alpha	3.6844	3.6947	3.7052	3.7256	3.7256	3.7256	3.7256	3.7256	3.7256	3.7256	3.7256	3.7256	(86)
util living area	0.9967	0.9913	0.9766	0.9331	0.8354	0.6827	0.5325	0.5989	0.8295	0.9654	0.9932	0.9975	(86)
MIT	19.5072	19.6959	19.9887	20.3541	20.6600	20.8392	20.9011	20.8867	20.7346	20.3193	19.8452	19.4876	(87)
Th 2	19.9069	19.9106	19.9143	19.9215	19.9215	19.9215	19.9215	19.9215	19.9215	19.9215	19.9215	19.9215	(88)
util rest of house	0.9958	0.9891	0.9704	0.9146	0.7900	0.5975	0.4151	0.4797	0.7642	0.9524	0.9912	0.9969	(89)
MIT 2	17.8960	18.1737	18.6010	19.1258	19.5361	19.7467	19.8025	19.7934	19.6403	19.0862	18.4006	17.8778	(90)
Living area fraction	fLA = Living area / (4) =												
MIT	18.0489	18.3182	18.7327	19.2424	19.6428	19.8504	19.9068	19.8972	19.7442	19.2032	18.5377	18.0306	(92)
Temperature adjustment													
adjusted MIT	17.8989	18.1682	18.5827	19.0924	19.4928	19.7004	19.7568	19.7472	19.5942	19.0532	18.3877	17.8806	(93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9934	0.9838	0.9598	0.8962	0.7684	0.5780	0.3960	0.4585	0.7397	0.9376	0.9866	0.9950	(94)

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Useful gains	1007.0845	1284.3097	1538.3380	1721.3984	1651.4235	1241.6314	811.3424	848.8795	1199.8971	1225.8416	1029.6956	932.5388 (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	3623.8046	3522.1237	3195.0744	2674.9682	2045.1957	1338.5953	828.4909	878.4577	1441.9429	2218.5314	2962.4417	3590.4484 (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	1946.8398	1503.8110	1232.6119	686.5703	292.9665	0.0000	0.0000	0.0000	0.0000	738.5612	1391.5772	1977.4847 (98)
Space heating per m2												(98) / (4) = 44.6016 (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)		0.1000 (201)
Fraction of space heat from main system(s)		0.9000 (202)
Efficiency of main space heating system 1 (in %)		89.0000 (206)
Efficiency of secondary/supplementary heating system, %		65.0000 (208)
Space heating requirement		9880.2027 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1946.8398	1503.8110	1232.6119	686.5703	292.9665	0.0000	0.0000	0.0000	0.0000	738.5612	1391.5772	1977.4847 (98)
Space heating efficiency (main heating system 1)	89.0000	89.0000	89.0000	89.0000	89.0000	0.0000	0.0000	0.0000	0.0000	89.0000	89.0000	89.0000 (210)
Space heating fuel (main heating system)	1968.7144	1520.7078	1246.4615	694.2845	296.2583	0.0000	0.0000	0.0000	0.0000	746.8597	1407.2128	1999.7037 (211)
Water heating requirement	299.5138	231.3555	189.6326	105.6262	45.0718	0.0000	0.0000	0.0000	0.0000	113.6248	214.0888	304.2284 (215)
Water heating requirement	230.0270	202.8137	213.1571	191.3004	187.6270	167.8798	161.4477	176.8590	176.4529	198.3568	209.4664	224.5666 (64)
Efficiency of water heater (217)m	89.0000	89.0000	89.0000	89.0000	89.0000	89.0000	89.0000	89.0000	89.0000	89.0000	89.0000	89.0000 (216)
Fuel for water heating, kWh/month	258.4573	227.8805	239.5024	214.9443	210.8168	188.6290	181.4019	198.7179	198.2616	222.8728	235.3555	252.3220 (219)
Water heating fuel used												2629.1623 (219)
Annual totals kWh/year												
Space heating fuel - main system												9880.2027 (211)
Space heating fuel - secondary												1503.1419 (215)

#### Electricity for pumps and fans:

(MEV)Decentralised, Database: total watage = 10.6720, total flow = 58.0000, SFP = 0.1840)		
mechanical ventilation fans (SFP = 0.1840)		130.9334 (230a)
central heating pump		30.0000 (230c)
main heating flue fan		45.0000 (230e)
Total electricity for the above, kWh/year		205.9334 (231)
Electricity for lighting (calculated in Appendix L)		624.1609 (232)

#### Energy saving/generation technologies (Appendices M ,N and Q)

PV Unit 0 (0.80 * 2.00 * 1029 * 1.00) =	-1646.6987	-1646.6987 (233)
Total delivered energy for all uses		13195.9025 (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	9880.2027	0.2160	2134.1238 (261)
Space heating - secondary	1503.1419	0.0190	28.5597 (263)
Water heating (other fuel)	2629.1623	0.2160	567.8991 (264)
Space and water heating			2730.5825 (265)
Pumps and fans	205.9334	0.5190	106.8795 (267)
Energy for lighting	624.1609	0.5190	323.9395 (268)
Energy saving/generation technologies			
PV Unit	-1646.6987	0.5190	-854.6366 (269)
Total CO2, kg/year			2306.7648 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			10.5300 (273)

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

	DER	TFA	N	EF
Total Floor Area		219.0600		
Assumed number of occupants			3.0267	
CO2 emission factor in Table 12 for electricity displaced from grid				0.5190
CO2 emissions from appliances, equation (L14)				10.5179 ZC2
CO2 emissions from cooking, equation (L16)				0.8748 ZC3
Total CO2 emissions				21.9227 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				21.9227 ZC8

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### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

#### 1. Overall dwelling dimensions

	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	99.9500 (1b)	2.6300 (2b)	262.8685 (1b) - (3b)
First floor	119.1100 (1c)	2.6900 (2c)	320.4059 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	219.0600		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 583.2744 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m <sup>3</sup> per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				4 * 10 =	40.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.0686 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate					0.3186 (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) =		0.2708 (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	0.3453	0.3385	0.3317	0.2979	0.2911	0.2573	0.2573	0.2505	0.2708	0.2911	0.3046	0.3182 (22b)
	0.5596	0.5573	0.5550	0.5444	0.5424	0.5331	0.5331	0.5314	0.5367	0.5424	0.5464	0.5506 (25)

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

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			38.8300	1.3258	51.4792		(27)
TER Room Window (Uw = 1.70)			0.8600	1.5918	1.3689		(27a)
Heat Loss Floor 1			64.6300	0.1300	8.4019		(28a)
Heat Loss Floor 2			35.3200	0.1300	4.5916		(28b)
External Wall 1	215.1200	40.9500	174.1700	0.1800	31.3506		(29a)
Wall to Garage	18.6700		18.6700	0.1800	3.3606		(29a)
External Roof 2	119.1100		119.1100	0.1300	15.4843		(30)
External Roof 2	13.9800	0.8600	13.1200	0.1300	1.7056		(30)
Total net area of external elements Aum(A, m <sup>2</sup> )			466.8300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	119.8627		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							23.3176 (36)
Total fabric heat loss						(33) + (36) =	143.1803 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	107.7125	107.2670	106.8304	104.7794	104.3957	102.6093	102.6093	102.2785	103.2974	104.3957	105.1719	105.9835 (38)
Heat transfer coeff	250.8928	250.4473	250.0106	247.9597	247.5759	245.7896	245.7896	245.4588	246.4777	247.5759	248.3522	249.1638 (39)
Average = Sum(39)m / 12 =												247.9578 (39)
HLP	1.1453	1.1433	1.1413	1.1319	1.1302	1.1220	1.1220	1.1205	1.1252	1.1302	1.1337	1.1374 (40)
HLP (average)												1.1319 (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												3.0267 (42)
Average daily hot water use (litres/day)												106.0843 (43)
Daily hot water use	116.6927	112.4494	108.2060	103.9626	99.7192	95.4759	95.4759	99.7192	103.9626	108.2060	112.4494	116.6927 (44)
Energy conte	173.0519	151.3523	156.1821	136.1633	130.6519	112.7427	104.4727	119.8839	121.3157	141.3818	154.3292	167.5916 (45)
Energy content (annual)												Total = Sum(45)m = 1669.1191 (45)
Distribution loss (46)m = 0.15 x (45)m	25.9578	22.7029	23.4273	20.4245	19.5978	16.9114	15.6709	17.9826	18.1974	21.2073	23.1494	25.1387 (46)



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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 %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													10384.6187 (211)
Space heating requirement	1897.1958	1488.9756	1247.5388	706.5987	290.9971	0.0000	0.0000	0.0000	0.0000	756.1650	1381.8319	1940.3156	(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)	2029.0864	1592.4873	1334.2661	755.7205	311.2269	0.0000	0.0000	0.0000	0.0000	808.7326	1477.8951	2075.2039	(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	227.9587	200.9456	211.0888	189.2989	185.5587	165.8783	159.3795	174.7907	174.4513	196.2885	207.4648	222.4984	(64)
Efficiency of water heater (217)m	89.2168	89.0797	88.7773	88.0066	86.0095	79.8000	79.8000	79.8000	79.8000	88.0664	88.9432	79.8000	(216)
Fuel for water heating, kWh/month	255.5110	225.5795	237.7734	215.0962	215.7421	207.8675	199.7236	219.0360	218.6107	222.8869	233.2554	249.2458	(219)
Water heating fuel used												2700.3281	(219)
Annual totals kWh/year													
Space heating fuel - main system													10384.6187 (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)													624.1609 (232)
Total delivered energy for all uses													13784.1077 (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	10384.6187	0.2160	2243.0776	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2700.3281	0.2160	583.2709	(264)
Space and water heating			2826.3485	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	624.1609	0.5190	323.9395	(268)
Total CO2, kg/m2/year			3189.2130	(272)
Emissions per m2 for space and water heating			12.9022	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.4788	(272b)
Emissions per m2 for pumps and fans			0.1777	(272c)
Target Carbon Dioxide Emission Rate (TER) = (12.9022 * 1.00) + 1.4788 + 0.1777, rounded to 2 d.p.			14.5600	(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 (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	99.9500 (1b)	x 2.6300 (2b)	= 262.8685 (1b) - (3b)
First floor	119.1100 (1c)	x 2.6900 (2c)	= 320.4059 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	219.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 583.2744 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m <sup>3</sup> per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				4 * 10 =	40.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.0686 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate					0.3186 (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) =		0.2708 (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	0.3453	0.3385	0.3317	0.2979	0.2911	0.2573	0.2573	0.2505	0.2708	0.2911	0.3046	0.3182 (22b)
	0.5596	0.5573	0.5550	0.5444	0.5424	0.5331	0.5331	0.5314	0.5367	0.5424	0.5464	0.5506 (25)

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

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K
Opening Type 1			2.1200	1.8000	3.8160		(26)
Opening Type 2 (Uw = 1.60)			38.8300	1.5038	58.3910		(27)
Opening Type 3 (Uw = 1.60)			0.8600	1.5038	1.2932		(27a)
Heat Loss Floor 1			64.6300	0.1300	8.4019	75.0000	4847.2500 (28a)
Heat Loss Floor 2			35.3200	0.1886	6.6618	20.0000	706.4000 (28b)
External Wall 1	215.1200	40.9500	174.1700	0.1800	31.3506	110.0000	19158.7000 (29a)
Wall to Garage	18.6700		18.6700	0.1557	2.9070	110.0000	2053.7000 (29a)
External Roof 2	119.1100		119.1100	0.1300	15.4843	9.0000	1071.9900 (30)
External Roof 2	13.9800	0.8600	13.1200	0.1700	2.2304	0.0000	0.0000 (30)
Total net area of external elements Aum(A, m <sup>2</sup> )			466.8300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	130.5362		(33)
Internal Wall 1			87.3200			75.0000	6549.0000 (32c)
Internal Wall 2			136.0700			9.0000	1224.6300 (32c)
Internal Floor 1			83.7900			18.0000	1508.2200 (32d)
Internal Ceiling 1			83.7900			9.0000	754.1100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	37874.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							172.8933 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							35.6719 (36)
Total fabric heat loss						(33) + (36) =	166.2081 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	107.7125	107.2670	106.8304	104.7794	104.3957	102.6093	102.6093	102.2785	103.2974	104.3957	105.1719	105.9835 (38)
Heat transfer coeff	273.9206	273.4751	273.0385	270.9875	270.6038	268.8174	268.8174	268.4866	269.5055	270.6038	271.3800	272.1916 (39)
Average = Sum(39)m / 12 =												270.9856 (39)
HLP	1.2504	1.2484	1.2464	1.2370	1.2353	1.2271	1.2271	1.2256	1.2303	1.2353	1.2388	1.2425 (40)
HLP (average)												1.2370 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

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

Assumed occupancy	3.0267 (42)											
Average daily hot water use (litres/day)	106.0843 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	116.6927	112.4494	108.2060	103.9626	99.7192	95.4759	95.4759	99.7192	103.9626	108.2060	112.4494	116.6927 (44)
173.0519	151.3523	156.1821	136.1633	130.6519	112.7427	104.4727	119.8839	121.3157	141.3818	154.3292	167.5916 (45)	
Energy content (annual)	Total = Sum(45)m = 1669.1191 (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	36.7735	32.1624	33.1887	28.9347	27.7635	23.9578	22.2004	25.4753	25.7796	30.0436	32.7950	35.6132 (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	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	151.3354	151.3354	151.3354	151.3354	151.3354	151.3354	151.3354	151.3354	151.3354	151.3354	151.3354	151.3354	151.3354 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	35.3426	31.3910	25.5288	19.3270	14.4471	12.1969	13.1792	17.1308	22.9929	29.1948	34.0746	36.3249	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	388.8180	392.8527	382.6854	361.0403	333.7173	308.0375	290.8818	286.8471	297.0144	318.6595	345.9825	371.6623	(68)
Pumps, fans	38.1335	38.1335	38.1335	38.1335	38.1335	38.1335	38.1335	38.1335	38.1335	38.1335	38.1335	38.1335	(69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	(71)
Total internal gains	49.4268	47.8607	44.6084	40.1871	37.3166	33.2747	29.8393	34.2410	35.8050	40.3812	45.5486	47.8672	(72)
	541.9880	540.5050	521.2233	488.9550	453.8816	421.9097	402.3009	406.6195	424.2129	456.6361	494.0063	524.2550	(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						
Northeast	5.5700	11.2829	0.7600	0.7000	0.7700	23.1698 (75)						
Southeast	16.9100	36.7938	0.7600	0.7000	0.7700	229.3842 (77)						
Southwest	4.7900	36.7938	0.7600	0.7000	0.7700	64.9764 (79)						
Northwest	11.5600	11.2829	0.7600	0.7000	0.7700	48.0867 (81)						
Southwest	0.8600	34.0172	0.7600	0.7000	1.0000	14.0072 (82)						
Solar gains	379.6243	673.7108	992.1729	1344.8037	1609.8624	1643.2943	1565.5891	1361.2723	1113.4239	763.7161	459.6692	321.6452 (83)
Total gains	921.6123	1214.2158	1513.3962	1833.7587	2063.7440	2065.2040	1967.8900	1767.8918	1537.6368	1220.3522	953.6755	845.9002 (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	38.4073	38.4699	38.5314	38.8230	38.8781	39.1364	39.1364	39.1847	39.0365	38.8781	38.7669	38.6513
alpha	3.5605	3.5647	3.5688	3.5882	3.5919	3.6091	3.6091	3.6123	3.6024	3.5919	3.5845	3.5768
util living area	0.9973	0.9926	0.9798	0.9411	0.8524	0.7067	0.5588	0.6273	0.8503	0.9712	0.9946	0.9980 (86)
MIT	18.9765	19.2290	19.6279	20.1375	20.5792	20.8547	20.9537	20.9299	20.6929	20.0950	19.4326	18.9321 (87)
Th 2	19.8799	19.8815	19.8831	19.8905	19.8919	19.8983	19.8983	19.8996	19.8959	19.8919	19.8891	19.8861 (88)
util rest of house	0.9967	0.9907	0.9743	0.9244	0.8093	0.6213	0.4363	0.5046	0.7888	0.9602	0.9929	0.9975 (89)
MIT 2	18.0259	18.2786	18.6754	19.1779	19.5882	19.8198	19.8827	19.8731	19.7017	19.1460	18.4881	17.9862 (90)
Living area fraction	fLA = Living area / (4) = 0.0949 (91)											
MIT	18.1161	18.3688	18.7658	19.2690	19.6823	19.9180	19.9843	19.9734	19.7958	19.2360	18.5778	18.0759 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.1161	18.3688	18.7658	19.2690	19.6823	19.9180	19.9843	19.9734	19.7958	19.2360	18.5778	18.0759 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9950	0.9871	0.9669	0.9125	0.7997	0.6230	0.4465	0.5137	0.7821	0.9512	0.9900	0.9963 (94)
Ext temp.	917.0434	1198.5354	1463.3467	1673.3694	1650.3697	1286.7146	878.6703	908.1236	1202.5272	1160.8137	944.1250	842.7855 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	3784.5184	3683.3900	3349.0311	2809.8648	2160.0312	1429.5812	909.7694	959.4154	1535.0409	2336.9450	3114.8411	3776.9165 (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	2133.4014	1669.8223	1402.9492	818.2767	379.1881	0.0000	0.0000	0.0000	0.0000	875.0417	1562.9156	2182.9935 (98)
Space heating per m2	11024.5886 (98)											
	(98) / (4) = 50.3268 (99)											

#### 8c. Space cooling requirement

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

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	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	2526.8838	1989.2489	2040.4983	0.0000	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7861	0.8538	0.8119	0.0000	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1986.4472	1698.4654	1656.7173	0.0000	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	2546.9597	2430.2417	2201.6287	0.0000	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh						1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	403.5690	544.4416	405.4141	0.0000	0.0000	0.0000	0.0000	0.0000 (104)
Intermittency factor (Table 10b)													1353.4247 (104)
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	1.0000 (105)
Space cooling Energy for space heating													0.0000 (106)
Space cooling Energy for space cooling													0.0000 (107)
Total													338.3562 (107)
Dwelling Fabric Energy Efficiency (DFEE)													1.5446 (108)
													50.3268 (99)
													1.5446 (108)
													51.8714 (109)
													51.9 (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 (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	99.9500 (1b)	2.6300 (2b)	262.8685 (1b) - (3b)
First floor	119.1100 (1c)	2.6900 (2c)	320.4059 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	219.0600		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 583.2744 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m <sup>3</sup> per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				4 * 10 =	40.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.0686 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate					0.3186 (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) =		0.2708 (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	0.3453	0.3385	0.3317	0.2979	0.2911	0.2573	0.2573	0.2505	0.2708	0.2911	0.3046	0.3182 (22b)
Effective ac	0.5596	0.5573	0.5550	0.5444	0.5424	0.5331	0.5331	0.5314	0.5367	0.5424	0.5464	0.5506 (25)

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

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			38.8300	1.3258	51.4792		(27)
TER Room Window (Uw = 1.70)			0.8600	1.5918	1.3689		(27a)
Heat Loss Floor 1			64.6300	0.1300	8.4019		(28a)
Heat Loss Floor 2			35.3200	0.1300	4.5916		(28b)
External Wall 1	215.1200	40.9500	174.1700	0.1800	31.3506		(29a)
Wall to Garage	18.6700		18.6700	0.1800	3.3606		(29a)
External Roof 2	119.1100		119.1100	0.1300	15.4843		(30)
External Roof 2	13.9800	0.8600	13.1200	0.1300	1.7056		(30)
Total net area of external elements Aum(A, m <sup>2</sup> )			466.8300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	119.8627		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							23.3176 (36)
Total fabric heat loss						(33) + (36) =	143.1803 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	107.7125	107.2670	106.8304	104.7794	104.3957	102.6093	102.6093	102.2785	103.2974	104.3957	105.1719	105.9835 (38)
Heat transfer coeff	250.8928	250.4473	250.0106	247.9597	247.5759	245.7896	245.7896	245.4588	246.4777	247.5759	248.3522	249.1638 (39)
Average = Sum(39)m / 12 =												247.9578 (39)
HLP	1.1453	1.1433	1.1413	1.1319	1.1302	1.1220	1.1220	1.1205	1.1252	1.1302	1.1337	1.1374 (40)
HLP (average)												1.1319 (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												3.0267 (42)
Average daily hot water use (litres/day)												106.0843 (43)
Daily hot water use	116.6927	112.4494	108.2060	103.9626	99.7192	95.4759	95.4759	99.7192	103.9626	108.2060	112.4494	116.6927 (44)
Energy conte	173.0519	151.3523	156.1821	136.1633	130.6519	112.7427	104.4727	119.8839	121.3157	141.3818	154.3292	167.5916 (45)
Energy content (annual)												Total = Sum(45)m = 1669.1191 (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)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	36.7735	32.1624	33.1887	28.9347	27.7635	23.9578	22.2004	25.4753	25.7796	30.0436	32.7950	35.6132	(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	151.3354	151.3354	151.3354	151.3354	151.3354	151.3354	151.3354	151.3354	151.3354	151.3354	151.3354	151.3354	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	35.3426	31.3910	25.5288	19.3270	14.4471	12.1969	13.1792	17.1308	22.9929	29.1948	34.0746	36.3249	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	388.8180	392.8527	382.6854	361.0403	333.7173	308.0375	290.8818	286.8471	297.0144	318.6595	345.9825	371.6623	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.1335	38.1335	38.1335	38.1335	38.1335	38.1335	38.1335	38.1335	38.1335	38.1335	38.1335	38.1335	(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)	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	(71)
Water heating gains (Table 5)	49.4268	47.8607	44.6084	40.1871	37.3166	33.2747	29.8393	34.2410	35.8050	40.3812	45.5486	47.8672	(72)
Total internal gains	541.9880	540.5050	521.2233	488.9550	453.8816	421.9097	402.3009	406.6195	424.2129	456.6361	494.0063	524.2550	(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	5.5700	11.2829	0.6300	0.7000	0.7700	19.2065 (75)							
Southeast	16.9100	36.7938	0.6300	0.7000	0.7700	190.1474 (77)							
Southwest	4.7900	36.7938	0.6300	0.7000	0.7700	53.8620 (79)							
Northwest	11.5600	11.2829	0.6300	0.7000	0.7700	39.8613 (81)							
Southwest	0.8600	34.0172	0.6300	0.7000	1.0000	11.6112 (82)							
Solar gains	314.6885	558.4708	822.4591	1114.7715	1334.4912	1362.2045	1297.7910	1128.4231	922.9698	633.0804	381.0416	266.6270	(83)
Total gains	856.6765	1098.9758	1343.6824	1603.7265	1788.3728	1784.1142	1700.0918	1535.0426	1347.1827	1089.7165	875.0479	790.8820	(84)

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

Temperature during heating periods in the living area from Table 9, T <sub>hl</sub> (C)													21.0000 (85)	
Utilisation factor for gains for living area, n <sub>ll,m</sub> (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	60.6335	60.7413	60.8474	61.3507	61.4458	61.8924	61.8924	61.9758	61.7196	61.4458	61.2537	61.0542		
alpha	5.0422	5.0494	5.0565	5.0900	5.0964	5.1262	5.1262	5.1317	5.1146	5.0964	5.0836	5.0703		
util living area	0.9997	0.9990	0.9958	0.9804	0.9216	0.7799	0.6118	0.6881	0.9169	0.9928	0.9993	0.9998	(86)	
MIT	19.5696	19.7404	20.0179	20.3857	20.7185	20.9218	20.9822	20.9686	20.7995	20.3576	19.8916	19.5411	(87)	
Th 2	19.9640	19.9656	19.9673	19.9748	19.9763	19.9829	19.9829	19.9841	19.9803	19.9763	19.9734	19.9704	(88)	
util rest of house	0.9996	0.9986	0.9942	0.9720	0.8872	0.6923	0.4826	0.5586	0.8654	0.9886	0.9990	0.9998	(89)	
MIT 2	18.6451	18.8171	19.0951	19.4642	19.7773	19.9450	19.9782	19.9745	19.8583	19.4410	18.9745	18.6217	(90)	
Living area fraction	18.7329	18.9047	19.1827	19.5516	19.8666	20.0377	20.0734	20.0688	fLA = Living area / (4) =	19.9476	19.5280	19.0616	0.0949	(91)
MIT	18.7329	18.9047	19.1827	19.5516	19.8666	20.0377	20.0734	20.0688	19.9476	19.5280	19.0616	18.7089	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.7329	18.9047	19.1827	19.5516	19.8666	20.0377	20.0734	20.0688	19.9476	19.5280	19.0616	18.7089	(93)	

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	856.2204	1096.8220	1333.5464	1551.5131	1578.5878	1244.5862	841.1072	875.4857	1163.0817	1074.4819	873.8112	790.6037	(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	3621.1061	3507.4465	3170.8071	2641.1724	2021.8638	1336.5308	853.7357	900.5509	1441.3004	2210.3566	2970.6797	3615.0964	(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	1.0000	(98)
Space heating kWh	2057.0750	1619.9397	1366.9220	784.5547	329.7973	0.0000	0.0000	0.0000	0.0000	845.0908	1509.7453	2101.4226	(98)	
Space heating												10614.5474	(98)	
Space heating per m2												48.4550	(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	2310.4223	1818.8431	1865.4869	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8198	0.8935	0.8511	0.0000	0.0000	0.0000	0.0000	(101)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1894.0303	1625.2192	1587.7015	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2220.8112	2119.5107	1931.4152	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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	235.2822	367.7529	255.7230	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												858.7581 (104)
Intermittency factor (Table 10b)									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor	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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	58.8206	91.9382	63.9308	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												214.6895 (107)
Energy for space heating												0.9800 (108)
Energy for space cooling												48.4550 (99)
Total												0.9800 (108)
Target Fabric Energy Efficiency (TFEE)												49.4350 (109)
												56.9 (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 (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	99.9500 (1b)	x 2.6300 (2b)	= 262.8685 (1b) - (3b)
First floor	119.1100 (1c)	x 2.6900 (2c)	= 320.4059 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	219.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 583.2744 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m <sup>3</sup> 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					0 * 10 = 0.0000 (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)					0.0000 / (5) = 0.0000 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.2500 (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) =		0.2125 (21)							
Wind speed	Jan 5.0000	Feb 5.0000	Mar 4.9000	Apr 4.3000	May 4.2000	Jun 3.9000	Jul 3.7000	Aug 3.5000	Sep 3.9000	Oct 4.2000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2500	1.2500	1.2250	1.0750	1.0500	0.9750	0.9250	0.8750	0.9750	1.0500	1.1250	1.1750 (22a)
Adj infilt rate	0.2656	0.2656	0.2603	0.2284	0.2231	0.2072	0.1966	0.1859	0.2072	0.2231	0.2391	0.2497 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5156	0.5156	0.5103	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

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

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K					
Opening Type 1			2.1200	1.8000	3.8160		(26)					
Opening Type 2 (Uw = 1.60)			38.8300	1.5038	58.3910		(27)					
Opening Type 3 (Uw = 1.60)			0.8600	1.5038	1.2932		(27a)					
Heat Loss Floor 1			64.6300	0.1300	8.4019	75.0000	4847.2500 (28a)					
Heat Loss Floor 2			35.3200	0.1886	6.6618	20.0000	706.4000 (28b)					
External Wall 1	215.1200	40.9500	174.1700	0.1800	31.3506	110.0000	19158.7000 (29a)					
Wall to Garage	18.6700		18.6700	0.1557	2.9070	110.0000	2053.7000 (29a)					
External Roof 2	119.1100		119.1100	0.1300	15.4843	9.0000	1071.9900 (30)					
External Roof 2	13.9800	0.8600	13.1200	0.1700	2.2304	0.0000	0.0000 (30)					
Total net area of external elements Aum(A, m <sup>2</sup> )			466.8300				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		130.5362		(33)					
Internal Wall 1			87.3200			75.0000	6549.0000 (32c)					
Internal Wall 2			136.0700			9.0000	1224.6300 (32c)					
Internal Floor 1			83.7900			18.0000	1508.2200 (32d)					
Internal Ceiling 1			83.7900			18.0000	1508.2200 (32e)					
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 38628.1100 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							176.3358 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							35.6719 (36)					
Total fabric heat loss							(33) + (36) = 166.2081 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 99.2478	Feb 99.2478	Mar 98.2252	Apr 96.2403	May 96.2403	Jun 96.2403	Jul 96.2403	Aug 96.2403	Sep 96.2403	Oct 96.2403	Nov 96.2403	Dec 96.2403 (38)
Heat transfer coeff	265.4559	265.4559	264.4333	262.4484	262.4484	262.4484	262.4484	262.4484	262.4484	262.4484	262.4484	262.4484 (39)
Average = Sum(39)m / 12 =												263.1150 (39)
HLP	Jan 1.2118	Feb 1.2118	Mar 1.2071	Apr 1.1981	May 1.1981	Jun 1.1981	Jul 1.1981	Aug 1.1981	Sep 1.1981	Oct 1.1981	Nov 1.1981	Dec 1.1981 (40)
HLP (average)												1.2011 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

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

Assumed occupancy	3.0267 (42)
Average daily hot water use (litres/day)	106.0843 (43)

# 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
Daily hot water use	116.6927	112.4494	108.2060	103.9626	99.7192	95.4759	95.4759	99.7192	103.9626	108.2060	112.4494	116.6927 (44)
Energy conte	173.0519	151.3523	156.1821	136.1633	130.6519	112.7427	104.4727	119.8839	121.3157	141.3818	154.3292	167.5916 (45)
Energy content (annual)	Total = Sum (45)m =											1669.1191 (45)
Distribution loss (46)m = 0.15 x (45)m	25.9578	22.7029	23.4273	20.4245	19.5978	16.9114	15.6709	17.9826	18.1974	21.2073	23.1494	25.1387 (46)
Water storage loss:												
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (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	230.0270	202.8137	213.1571	191.3004	187.6270	167.8798	161.4477	176.8590	176.4529	198.3568	209.4664	224.5666 (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	230.0270	202.8137	213.1571	191.3004	187.6270	167.8798	161.4477	176.8590	176.4529	198.3568	209.4664	224.5666 (64)
Total per year (kWh/year) = Sum (64)m =												2339.9544 (64)
RHI water heating demand												2340 (64)
Heat gains from water heating, kWh/month	103.1198	91.4937	97.5106	89.3840	89.0218	81.5967	80.3172	85.4414	84.4472	92.5895	95.4242	101.3042 (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	181.6024	181.6024	181.6024	181.6024	181.6024	181.6024	181.6024	181.6024	181.6024	181.6024	181.6024	181.6024 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	88.3564	78.4774	63.8221	48.3174	36.1179	30.4922	32.9479	42.8269	57.4822	72.9869	85.1865	90.8121 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	580.3254	586.3473	571.1722	538.8661	498.0855	459.7574	434.1519	428.1299	443.3051	475.6112	516.3918	554.7199 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.1870	56.1870	56.1870	56.1870	56.1870	56.1870	56.1870	56.1870	56.1870	56.1870	56.1870	56.1870 (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)	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683 (71)
Water heating gains (Table 5)	138.6019	136.1514	131.0626	124.1445	119.6530	113.3287	107.9532	114.8407	117.2878	124.4482	132.5336	136.1616 (72)
Total internal gains	927.0048	920.6972	885.7780	831.0491	773.5774	723.2994	694.7742	705.5186	737.7962	792.7674	853.8330	901.4147 (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	5.5700	10.4427	0.7600	0.7000	0.7700	21.4443 (75)						
Southeast	16.9100	34.4805	0.7600	0.7000	0.7700	214.9624 (77)						
Southwest	4.7900	34.4805	0.7600	0.7000	0.7700	60.8912 (79)						
Northwest	11.5600	10.4427	0.7600	0.7000	0.7700	44.5056 (81)						
Southwest	0.8600	31.5636	0.7600	0.7000	1.0000	12.9969 (82)						
Solar gains	354.8003	630.9829	969.9069	1325.5450	1573.2494	1589.6419	1511.8806	1297.9782	1073.3157	713.4357	408.9097	294.6962 (83)
Total gains	1281.8051	1551.6801	1855.6849	2156.5941	2346.8268	2312.9413	2206.6547	2003.4969	1811.1119	1506.2031	1262.7427	1196.1109 (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)	40.4211	40.4211	40.5775	40.8843	40.8843	40.8843	40.8843	40.8843	40.8843	40.8843	40.8843	40.8843 (85)
alpha	3.6947	3.6947	3.7052	3.7256	3.7256	3.7256	3.7256	3.7256	3.7256	3.7256	3.7256	3.7256
util living area	0.9936	0.9872	0.9702	0.9277	0.8402	0.7207	0.6250	0.6851	0.8505	0.9609	0.9895	0.9951 (86)
MIT	19.5449	19.6954	19.9766	20.3209	20.6244	20.8026	20.8682	20.8437	20.6740	20.2765	19.8464	19.5172 (87)
Th 2	19.9106	19.9106	19.9143	19.9215	19.9215	19.9215	19.9215	19.9215	19.9215	19.9215	19.9215	19.9215 (88)
util rest of house	0.9921	0.9842	0.9631	0.9100	0.8003	0.6503	0.5309	0.5936	0.8006	0.9482	0.9865	0.9939 (89)
MIT 2	17.9531	18.1720	18.5813	19.0755	19.4864	19.7053	19.7742	19.7533	19.5610	19.0220	18.4014	17.9208 (90)
Living area fraction	fLA = Living area / (4) =											0.0949 (91)
MIT	18.1042	18.3165	18.7137	19.1937	19.5944	19.8095	19.8780	19.8567	19.6666	19.1411	18.5385	18.0723 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9542	18.1665	18.5637	19.0437	19.4444	19.6595	19.7280	19.7067	19.5166	18.9911	18.3885	17.9223 (93)

#### 8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF HEAT DEMAND 09 Jan 2014

Utilisation	0.9881	0.9773	0.9511	0.8917	0.7795	0.6310	0.5124	0.5731	0.7776	0.9331	0.9803	0.9906 (94)
Useful gains	1266.5231	1516.5140	1764.9120	1923.0493	1829.3238	1459.5205	1130.6115	1148.2624	1408.3068	1405.4695	1237.8604	1184.8713 (95)
Ext temp.	3.6000	4.0000	5.5000	7.8000	10.7000	13.5000	15.2000	15.0000	12.8000	9.5000	6.3000	3.5000 (96)
Heat loss rate W												
Month fracti	3810.4092	3760.5940	3454.4717	2950.8843	2294.9501	1616.5439	1188.3783	1235.2763	1762.7612	2490.9179	3172.6184	3785.1099 (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)
RHI space heating demand	1892.6513	1508.0217	1257.0324	740.0412	346.4260	0.0000	0.0000	0.0000	0.0000	807.5736	1393.0257	1934.5775 (98)
												9879.3495 (98)
												9879 (98)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

#### 1. Overall dwelling dimensions

	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	99.9500 (1b)	x 2.6300 (2b)	= 262.8685 (1b) - (3b)
First floor	119.1100 (1c)	x 2.6900 (2c)	= 320.4059 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	219.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 583.2744 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m <sup>3</sup> 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					0 * 10 = 0.0000 (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)					0.0000 / (5) = 0.0000 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.2500 (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) =		0.2125 (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	0.2709	0.2656	0.2603	0.2338	0.2284	0.2019	0.2019	0.1966	0.2125	0.2284	0.2391	0.2497 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5209	0.5156	0.5103	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

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

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K					
Opening Type 1			2.1200	1.8000	3.8160		(26)					
Opening Type 2 (Uw = 1.60)			38.8300	1.5038	58.3910		(27)					
Opening Type 3 (Uw = 1.60)			0.8600	1.5038	1.2932		(27a)					
Heat Loss Floor 1			64.6300	0.1300	8.4019	75.0000	4847.2500 (28a)					
Heat Loss Floor 2			35.3200	0.1886	6.6618	20.0000	706.4000 (28b)					
External Wall 1	215.1200	40.9500	174.1700	0.1800	31.3506	110.0000	19158.7000 (29a)					
Wall to Garage	18.6700		18.6700	0.1557	2.9070	110.0000	2053.7000 (29a)					
External Roof 2	119.1100		119.1100	0.1300	15.4843	9.0000	1071.9900 (30)					
External Roof 2	13.9800	0.8600	13.1200	0.1700	2.2304	0.0000	0.0000 (30)					
Total net area of external elements Aum(A, m <sup>2</sup> )			466.8300				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		130.5362		(33)					
Internal Wall 1			87.3200			75.0000	6549.0000 (32c)					
Internal Wall 2			136.0700			9.0000	1224.6300 (32c)					
Internal Floor 1			83.7900			18.0000	1508.2200 (32d)					
Internal Ceiling 1			83.7900			18.0000	1508.2200 (32e)					
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 38628.1100 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							176.3358 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							35.6719 (36)					
Total fabric heat loss							(33) + (36) = 166.2081 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 100.2703	Feb 99.2478	Mar 98.2252	Apr 96.2403	May 96.2403	Jun 96.2403	Jul 96.2403	Aug 96.2403	Sep 96.2403	Oct 96.2403	Nov 96.2403	Dec 96.2403 (38)
Heat transfer coeff	266.4784	265.4559	264.4333	262.4484	262.4484	262.4484	262.4484	262.4484	262.4484	262.4484	262.4484	262.4484 (39)
Average = Sum(39)m / 12 =												263.2003 (39)
HLP	Jan 1.2165	Feb 1.2118	Mar 1.2071	Apr 1.1981	May 1.1981	Jun 1.1981	Jul 1.1981	Aug 1.1981	Sep 1.1981	Oct 1.1981	Nov 1.1981	Dec 1.1981 (40)
HLP (average)												1.2015 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

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

Assumed occupancy	3.0267 (42)
Average daily hot water use (litres/day)	106.0843 (43)

# 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
Daily hot water use	116.6927	112.4494	108.2060	103.9626	99.7192	95.4759	95.4759	99.7192	103.9626	108.2060	112.4494	116.6927 (44)
Energy cont	173.0519	151.3523	156.1821	136.1633	130.6519	112.7427	104.4727	119.8839	121.3157	141.3818	154.3292	167.5916 (45)
Energy content (annual)	Total = Sum(45)m = 1669.1191 (45)											
Distribution loss (46)m = 0.15 x (45)m	25.9578	22.7029	23.4273	20.4245	19.5978	16.9114	15.6709	17.9826	18.1974	21.2073	23.1494	25.1387 (46)
Water storage loss:												
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (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	230.0270	202.8137	213.1571	191.3004	187.6270	167.8798	161.4477	176.8590	176.4529	198.3568	209.4664	224.5666 (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	230.0270	202.8137	213.1571	191.3004	187.6270	167.8798	161.4477	176.8590	176.4529	198.3568	209.4664	224.5666 (64)
Total per year (kWh/year) = Sum(64)m =												2339.9544 (64)
Heat gains from water heating, kWh/month	103.1198	91.4937	97.5106	89.3840	89.0218	81.5967	80.3172	85.4414	84.4472	92.5895	95.4242	101.3042 (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	181.6024	181.6024	181.6024	181.6024	181.6024	181.6024	181.6024	181.6024	181.6024	181.6024	181.6024	181.6024 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	88.3564	78.4774	63.8221	48.3174	36.1179	30.4922	32.9479	42.8269	57.4822	72.9869	85.1865	90.8121 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	580.3254	586.3473	571.1722	538.8661	498.0855	459.7574	434.1519	428.1299	443.3051	475.6112	516.3918	554.7199 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.1870	56.1870	56.1870	56.1870	56.1870	56.1870	56.1870	56.1870	56.1870	56.1870	56.1870	56.1870 (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)	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683 (71)
Water heating gains (Table 5)	138.6019	136.1514	131.0626	124.1445	119.6530	113.3287	107.9532	114.8407	117.2878	124.4482	132.5336	136.1616 (72)
Total internal gains	927.0048	920.6972	885.7780	831.0491	773.5774	723.2994	694.7742	705.5186	737.7962	792.7674	853.8330	901.4147 (73)

#### 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
Northeast	5.5700	11.2829	0.7600	0.7000	0.7700	23.1698 (75)	
Southeast	16.9100	36.7938	0.7600	0.7000	0.7700	229.3842 (77)	
Southwest	4.7900	36.7938	0.7600	0.7000	0.7700	64.9764 (79)	
Northwest	11.5600	11.2829	0.7600	0.7000	0.7700	48.0867 (81)	
Southwest	0.8600	34.0172	0.7600	0.7000	1.0000	14.0072 (82)	

Solar gains	379.6243	673.7108	992.1729	1344.8037	1609.8624	1643.2943	1565.5891	1361.2723	1113.4239	763.7161	459.6692	321.6452 (83)
Total gains	1306.6291	1594.4080	1877.9509	2175.8529	2383.4398	2366.5937	2260.3633	2066.7910	1851.2201	1556.4835	1313.5023	1223.0600 (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	40.2660	40.4211	40.5775	40.8843	40.8843	40.8843	40.8843	40.8843	40.8843	40.8843	40.8843	40.8843
alpha	3.6844	3.6947	3.7052	3.7256	3.7256	3.7256	3.7256	3.7256	3.7256	3.7256	3.7256	3.7256
util living area	0.9922	0.9834	0.9625	0.9075	0.7977	0.6381	0.4895	0.5485	0.7796	0.9430	0.9857	0.9939 (86)
MIT	19.6252	19.8090	20.0888	20.4297	20.7038	20.8573	20.9075	20.8970	20.7751	20.4045	19.9521	19.6039 (87)
Th 2	19.9069	19.9106	19.9143	19.9215	19.9215	19.9215	19.9215	19.9215	19.9215	19.9215	19.9215	19.9215 (88)
util rest of house	0.9903	0.9794	0.9531	0.8840	0.7475	0.5532	0.3788	0.4346	0.7071	0.9235	0.9815	0.9924 (89)
MIT 2	18.0679	18.3373	18.7430	19.2271	19.5871	19.7622	19.8059	19.7995	19.6825	19.2028	18.5552	18.0475 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.2157	18.4770	18.8707	19.3412	19.6931	19.8662	19.9104	19.9037	19.7862	19.3169	18.6878	18.1952 (92)
Temperature adjustment												
adjusted MIT	18.0657	18.3270	18.7207	19.1912	19.5431	19.7162	19.7604	19.7537	19.6362	19.1669	18.5378	18.0452 (93)

#### 8. Space heating requirement

Utilisation	0.9855	0.9710	0.9392	0.8642	0.7272	0.5355	0.3614	0.4155	0.6844	0.9051	0.9736	0.9885 (94)
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# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF ENERGY RATINGS 09 Jan 2014

Useful gains	1287.7221	1548.2458	1763.7898	1880.4521	1733.1659	1267.2185	816.8059	858.7806	1266.9996	1408.8265	1278.8289	1208.9366 (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	3668.2551	3564.2732	3231.5631	2700.9119	2058.3970	1342.7281	829.4520	880.1668	1452.9600	2248.3632	3001.8337	3633.6428 (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	1771.1166	1354.7704	1092.0234	590.7310	241.9719	0.0000	0.0000	0.0000	0.0000	624.6153	1240.5635	1803.9814 (98)
Space heating per m2												8719.7735 (98)
												(98) / (4) = 39.8054 (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)												0.1000 (201)
Fraction of space heat from main system(s)												0.9000 (202)
Efficiency of main space heating system 1 (in %)												89.0000 (206)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
Space heating requirement												8817.7485 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1771.1166	1354.7704	1092.0234	590.7310	241.9719	0.0000	0.0000	0.0000	0.0000	624.6153	1240.5635	1803.9814 (98)
Space heating efficiency (main heating system 1)	89.0000	89.0000	89.0000	89.0000	89.0000	0.0000	0.0000	0.0000	0.0000	89.0000	89.0000	89.0000 (210)
Space heating fuel (main heating system)	1791.0168	1369.9925	1104.2933	597.3685	244.6907	0.0000	0.0000	0.0000	0.0000	631.6334	1254.5024	1824.2509 (211)
Water heating requirement	272.4795	208.4262	168.0036	90.8817	37.2265	0.0000	0.0000	0.0000	0.0000	96.0947	190.8559	277.5356 (215)
Water heating requirement	230.0270	202.8137	213.1571	191.3004	187.6270	167.8798	161.4477	176.8590	176.4529	198.3568	209.4664	224.5666 (64)
Efficiency of water heater	89.0000	89.0000	89.0000	89.0000	89.0000	89.0000	89.0000	89.0000	89.0000	89.0000	89.0000	89.0000 (216)
Fuel for water heating, kWh/month	258.4573	227.8805	239.5024	214.9443	210.8168	188.6290	181.4019	198.7179	198.2616	222.8728	235.3555	252.3220 (219)
Water heating fuel used												2629.1623 (219)
Annual totals kWh/year												
Space heating fuel - main system												8817.7485 (211)
Space heating fuel - secondary												1341.5036 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 10.6720, total flow = 58.0000, SFP = 0.1840)												
mechanical ventilation fans (SFP = 0.1840)												130.9334 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												205.9334 (231)
Electricity for lighting (calculated in Appendix L)												624.1609 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 2.00 * 1029 * 1.00) =										-1646.6987		-1646.6987 (233)
Total delivered energy for all uses												11971.8100 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	8817.7485	3.4800	306.8576 (240)
Space heating - secondary	1341.5036	4.2300	56.7456 (242)
Water heating (other fuel)	2629.1623	3.4800	91.4948 (247)
Mechanical ventilation fans	130.9334	13.1900	17.2701 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	624.1609	13.1900	82.3268 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1646.6987	13.1900	-217.1996 (252)
Total energy cost			467.3880 (255)

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

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7434 (257)
SAP value		89.6295
SAP rating (Section 12)		90 (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	8817.7485	0.2160	1904.6337 (261)
Space heating - secondary	1341.5036	0.0190	25.4886 (263)
Water heating (other fuel)	2629.1623	0.2160	567.8991 (264)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space and water heating			2498.0213 (265)
Pumps and fans	205.9334	0.5190	106.8795 (267)
Energy for lighting	624.1609	0.5190	323.9395 (268)
Energy saving/generation technologies			
PV Unit	-1646.6987	0.5190	-854.6366 (269)
Total kg/year			2074.2036 (272)
CO2 emissions per m2			9.4700 (273)
EI value			89.4742
EI rating			89 (274)
EI band			B

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 Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.25) / 0.8900 = 4.194$ , stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.25) / 0.8900 = 0.2603$ , stars = 4
Water heating energy efficiency	$3.48 / 0.8900 = 3.910$ , stars = 4
Water heating environmental impact	$0.216 / 0.8900 = 0.2427$ , stars = 4

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# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



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

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

#### 1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	99.9500 (1b)	x 2.6300 (2b)	= 262.8685 (1b) - (3b)
First floor	119.1100 (1c)	x 2.6900 (2c)	= 320.4059 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	219.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 583.2744 (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					0 * 10 = 0.0000 (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)					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.2500 (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)	=	0.2125 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.0000	5.0000	4.9000	4.3000	4.2000	3.9000	3.7000	3.5000	3.9000	4.2000	4.5000	4.7000 (22)
Wind factor	1.2500	1.2500	1.2250	1.0750	1.0500	0.9750	0.9250	0.8750	0.9750	1.0500	1.1250	1.1750 (22a)
Adj infilt rate	0.2656	0.2656	0.2603	0.2284	0.2231	0.2072	0.1966	0.1859	0.2072	0.2231	0.2391	0.2497 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5156	0.5156	0.5103	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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
Opening Type 1			2.1200	1.8000	3.8160		(26)
Opening Type 2 (Uw = 1.60)			38.8300	1.5038	58.3910		(27)
Opening Type 3 (Uw = 1.60)			0.8600	1.5038	1.2932		(27a)
Heat Loss Floor 1			64.6300	0.1300	8.4019	75.0000	4847.2500 (28a)
Heat Loss Floor 2			35.3200	0.1886	6.6618	20.0000	706.4000 (28b)
External Wall 1	215.1200	40.9500	174.1700	0.1800	31.3506	110.0000	19158.7000 (29a)
Wall to Garage	18.6700		18.6700	0.1557	2.9070	110.0000	2053.7000 (29a)
External Roof 2	119.1100		119.1100	0.1300	15.4843	9.0000	1071.9900 (30)
External Roof 2	13.9800	0.8600	13.1200	0.1700	2.2304	0.0000	0.0000 (30)
Total net area of external elements Aum(A, m2)			466.8300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		130.5362		(33)
Internal Wall 1			87.3200			75.0000	6549.0000 (32c)
Internal Wall 2			136.0700			9.0000	1224.6300 (32c)
Internal Floor 1			83.7900			18.0000	1508.2200 (32d)
Internal Ceiling 1			83.7900			18.0000	1508.2200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	38628.1100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							176.3358 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							35.6719 (36)
Total fabric heat loss						(33) + (36) =	166.2081 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	99.2478	99.2478	98.2252	96.2403	96.2403	96.2403	96.2403	96.2403	96.2403	96.2403	96.2403	96.2403 (38)
Heat transfer coeff	265.4559	265.4559	264.4333	262.4484	262.4484	262.4484	262.4484	262.4484	262.4484	262.4484	262.4484	262.4484 (39)
Average = Sum(39)m / 12 =												263.1150 (39)
HLP	1.2118	1.2118	1.2071	1.1981	1.1981	1.1981	1.1981	1.1981	1.1981	1.1981	1.1981	1.1981 (40)
HLP (average)												1.2011 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

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

Assumed occupancy	3.0267 (42)
Average daily hot water use (litres/day)	106.0843 (43)

# 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		
Daily hot water use	116.6927	112.4494	108.2060	103.9626	99.7192	95.4759	95.4759	99.7192	103.9626	108.2060	112.4494	116.6927	(44)	
Energy conte	173.0519	151.3523	156.1821	136.1633	130.6519	112.7427	104.4727	119.8839	121.3157	141.3818	154.3292	167.5916	(45)	
Energy content (annual)													Total = Sum (45)m =	1669.1191 (45)
Distribution loss (46)m = 0.15 x (45)m	25.9578	22.7029	23.4273	20.4245	19.5978	16.9114	15.6709	17.9826	18.1974	21.2073	23.1494	25.1387	(46)	
Water storage loss:														
Store volume														250.0000 (47)
b) If manufacturer declared loss factor is not known :														
Hot water storage loss factor from Table 2 (kWh/litre/day)														0.0103 (51)
Volume factor from Table 2a														0.7830 (52)
Temperature factor from Table 2b														0.5400 (53)
Enter (49) or (54) in (55)														1.0875 (55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(56)	
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(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	230.0270	202.8137	213.1571	191.3004	187.6270	167.8798	161.4477	176.8590	176.4529	198.3568	209.4664	224.5666	(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	230.0270	202.8137	213.1571	191.3004	187.6270	167.8798	161.4477	176.8590	176.4529	198.3568	209.4664	224.5666	(64)	
Total per year (kWh/year) =													Sum(64)m =	2339.9544 (64)
Heat gains from water heating, kWh/month	103.1198	91.4937	97.5106	89.3840	89.0218	81.5967	80.3172	85.4414	84.4472	92.5895	95.4242	101.3042	(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	181.6024	181.6024	181.6024	181.6024	181.6024	181.6024	181.6024	181.6024	181.6024	181.6024	181.6024	181.6024	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	88.3564	78.4774	63.8221	48.3174	36.1179	30.4922	32.9479	42.8269	57.4822	72.9869	85.1865	90.8121	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	580.3254	586.3473	571.1722	538.8661	498.0855	459.7574	434.1519	428.1299	443.3051	475.6112	516.3918	554.7199	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.1870	56.1870	56.1870	56.1870	56.1870	56.1870	56.1870	56.1870	56.1870	56.1870	56.1870	56.1870	(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)	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	-121.0683	(71)
Water heating gains (Table 5)	138.6019	136.1514	131.0626	124.1445	119.6530	113.3287	107.9532	114.8407	117.2878	124.4482	132.5336	136.1616	(72)
Total internal gains	927.0048	920.6972	885.7780	831.0491	773.5774	723.2994	694.7742	705.5186	737.7962	792.7674	853.8330	901.4147	(73)

#### 6. Solar gains

[Jan]	Area m <sup>2</sup>	Solar flux Table 6a W/m <sup>2</sup>	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W							
Northeast	5.5700	10.4427	0.7600	0.7000	0.7700	21.4443 (75)							
Southeast	16.9100	34.4805	0.7600	0.7000	0.7700	214.9624 (77)							
Southwest	4.7900	34.4805	0.7600	0.7000	0.7700	60.8912 (79)							
Northwest	11.5600	10.4427	0.7600	0.7000	0.7700	44.5056 (81)							
Southwest	0.8600	31.5636	0.7600	0.7000	1.0000	12.9969 (82)							
Solar gains	354.8003	630.9829	969.9069	1325.5450	1573.2494	1589.6419	1511.8806	1297.9782	1073.3157	713.4357	408.9097	294.6962	(83)
Total gains	1281.8051	1551.6801	1855.6849	2156.5941	2346.8268	2312.9413	2206.6547	2003.4969	1811.1119	1506.2031	1262.7427	1196.1109	(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	40.4211	40.4211	40.5775	40.8843	40.8843	40.8843	40.8843	40.8843	40.8843	40.8843	40.8843	40.8843		
alpha	3.6947	3.6947	3.7052	3.7256	3.7256	3.7256	3.7256	3.7256	3.7256	3.7256	3.7256	3.7256		
util living area	0.9936	0.9872	0.9702	0.9277	0.8402	0.7207	0.6250	0.6851	0.8505	0.9609	0.9895	0.9951	(86)	
MIT	19.5449	19.6954	19.9766	20.3209	20.6244	20.8026	20.8682	20.8437	20.6740	20.2765	19.8464	19.5172	(87)	
Th 2	19.9106	19.9106	19.9143	19.9215	19.9215	19.9215	19.9215	19.9215	19.9215	19.9215	19.9215	19.9215	(88)	
util rest of house	0.9921	0.9842	0.9631	0.9100	0.8003	0.6503	0.5309	0.5936	0.8006	0.9482	0.9865	0.9939	(89)	
MIT 2	17.9531	18.1720	18.5813	19.0755	19.4864	19.7053	19.7742	19.7533	19.5610	19.0220	18.4014	17.9208	(90)	
Living area fraction													fLA = Living area / (4) =	0.0949 (91)
MIT	18.1042	18.3165	18.7137	19.1937	19.5944	19.8095	19.8780	19.8567	19.6666	19.1411	18.5385	18.0723	(92)	
Temperature adjustment														-0.1500
adjusted MIT	17.9542	18.1665	18.5637	19.0437	19.4444	19.6595	19.7280	19.7067	19.5166	18.9911	18.3885	17.9223	(93)	

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9881	0.9773	0.9511	0.8917	0.7795	0.6310	0.5124	0.5731	0.7776	0.9331	0.9803	0.9906	(94)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



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

Useful gains	1266.5231	1516.5140	1764.9120	1923.0493	1829.3238	1459.5205	1130.6115	1148.2624	1408.3068	1405.4695	1237.8604	1184.8713	(95)
Ext temp.	3.6000	4.0000	5.5000	7.8000	10.7000	13.5000	15.2000	15.0000	12.8000	9.5000	6.3000	3.5000	(96)
Heat loss rate W													
Month fracti	3810.4092	3760.5940	3454.4717	2950.8843	2294.9501	1616.5439	1188.3783	1235.2763	1762.7612	2490.9179	3172.6184	3785.1099	(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	1892.6513	1508.0217	1257.0324	740.0412	346.4260	0.0000	0.0000	0.0000	0.0000	807.5736	1393.0257	1934.5775	(98)
Space heating per m2													(98) / (4) = 45.0988 (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)		0.1000	(201)
Fraction of space heat from main system(s)		0.9000	(202)
Efficiency of main space heating system 1 (in %)		89.0000	(206)
Efficiency of secondary/supplementary heating system, %		65.0000	(208)
Space heating requirement		9990.3534	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1892.6513	1508.0217	1257.0324	740.0412	346.4260	0.0000	0.0000	0.0000	0.0000	807.5736	1393.0257	1934.5775	(98)
Space heating efficiency (main heating system 1)	89.0000	89.0000	89.0000	89.0000	89.0000	0.0000	0.0000	0.0000	0.0000	89.0000	89.0000	89.0000	(210)
Space heating fuel (main heating system)	1913.9171	1524.9658	1271.1563	748.3563	350.3184	0.0000	0.0000	0.0000	0.0000	816.6475	1408.6777	1956.3143	(211)
Water heating requirement	291.1771	232.0033	193.3896	113.8525	53.2963	0.0000	0.0000	0.0000	0.0000	124.2421	214.3117	297.6273	(215)
Water heating requirement	230.0270	202.8137	213.1571	191.3004	187.6270	167.8798	161.4477	176.8590	176.4529	198.3568	209.4664	224.5666	(64)
Efficiency of water heater	89.0000	89.0000	89.0000	89.0000	89.0000	89.0000	89.0000	89.0000	89.0000	89.0000	89.0000	89.0000	(216)
Fuel for water heating, kWh/month	258.4573	227.8805	239.5024	214.9443	210.8168	188.6290	181.4019	198.7179	198.2616	222.8728	235.3555	252.3220	(219)
Water heating fuel used													2629.1623 (219)
Annual totals kWh/year													
Space heating fuel - main system													9990.3534 (211)
Space heating fuel - secondary													1519.8999 (215)

#### Electricity for pumps and fans:

(MEV)Decentralised, Database: total watage = 10.6720, total flow = 58.0000, SFP = 0.1840)			
mechanical ventilation fans (SFP = 0.1840)			130.9334 (230a)
central heating pump			30.0000 (230c)
main heating flue fan			45.0000 (230e)
Total electricity for the above, kWh/year			205.9334 (231)
Electricity for lighting (calculated in Appendix L)			624.1609 (232)

#### Energy saving/generation technologies (Appendices M ,N and Q)

PV Unit 0 (0.80 * 2.00 * 988 * 1.00) =		-1580.6274	-1580.6274 (233)
Total delivered energy for all uses			13388.8826 (238)

#### 10a. Fuel costs - using BEDF prices (500)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	9990.3534	3.6300	362.6498	(240)
Space heating - secondary	1519.8999	5.1600	78.4268	(242)
Water heating (other fuel)	2629.1623	3.6300	95.4386	(247)
Mechanical ventilation fans	130.9334	19.4400	25.4535	(249)
Pumps and fans for heating	75.0000	19.4400	14.5800	(249)
Energy for lighting	624.1609	19.4400	121.3369	(250)
Additional standing charges			95.0000	(251)
Energy saving/generation technologies				
PV Unit		-1580.6274	19.4400	-307.2740 (252)
Total energy cost			485.6116	(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	9990.3534	0.2160	2157.9163	(261)
Space heating - secondary	1519.8999	0.0190	28.8781	(263)
Water heating (other fuel)	2629.1623	0.2160	567.8991	(264)
Space and water heating			2754.6935	(265)
Pumps and fans	205.9334	0.5190	106.8795	(267)
Energy for lighting	624.1609	0.5190	323.9395	(268)
Energy saving/generation technologies				
PV Unit		-1580.6274	0.5190	-820.3456 (269)
Total kg/year			2365.1669	(272)



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



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

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	9990.3534	1.2200	12188.2312 (261)
Space heating - secondary	1519.8999	1.0400	1580.6959 (263)
Water heating (other fuel)	2629.1623	1.2200	3207.5780 (264)
Space and water heating			16976.5051 (265)
Pumps and fans	205.9334	3.0700	632.2157 (267)
Energy for lighting	624.1609	3.0700	1916.1740 (268)
Energy saving/generation technologies			
PV Unit	-1580.6274	3.0700	-4852.5260 (269)
Primary energy kWh/year			14672.3687 (272)
Primary energy kWh/m2/year			66.9788 (273)

#### SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 90  
 Current environmental impact rating: B 89

(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	Already installed
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures: (none) SAP change Cost change CO2 change

Measures omitted - SAP change or cost saving too small:  
 N Solar water heating + 0.8 -£ 34 -237 kg (10.0%)

Recommended measures (none) Typical annual savings Energy Environmental efficiency impact  
 Total Savings £0 0.00 kg/m²

Potential energy efficiency rating: B 90  
 Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 500 TEST (30 Jun 2022)  
 Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, North East England):

	Current	Potential	Saving
Electricity	£161	£161	£0
Mains gas	£553	£553	£0
Wood	£78	£78	£0
Space heating	£576	£576	£0
Water heating	£95	£95	£0
Lighting	£121	£121	£0
Generated (PV)	-£307	-£307	£0
Total cost of fuels	£485	£485	£0
Total cost of uses	£485	£485	£0
Delivered energy	61 kWh/m²	61 kWh/m²	0 kWh/m²
Carbon dioxide emissions	2.4 tonnes	2.4 tonnes	0.0 tonnes
CO2 emissions per m²	11 kg/m²	11 kg/m²	0 kg/m²

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



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

Primary energy                      67 kWh/m<sup>2</sup>                      67 kWh/m<sup>2</sup>                      0 kWh/m<sup>2</sup>

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# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



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

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SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)  
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014  
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No improvements selected / applicable  
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# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



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

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

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

#### Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	No
SAP Region	North East England
Front of dwelling faces	North West
Overshading	Average or unknown
Thermal mass parameter	176.3 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	2.50 (Windows half open)

#### Overheating Calculation

Summer ventilation heat loss coefficient	481.20 (P1)
Transmission heat loss coefficient	166.21 (37)
Summer heat loss coefficient	647.41 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
North East	0.000	1.000	None
South East	0.000	1.000	None
South West	0.000	1.000	None
North West	0.000	1.000	None

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North East	0.800	0.90	1.000	0.720 (P8)
South East	0.800	0.90	1.000	0.720 (P8)
South West	0.800	0.90	1.000	0.720 (P8)
South West	0.800	1.00	1.000	0.800 (P8)
North West	0.800	0.90	1.000	0.720 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	5.5700	91.1383	0.7600	0.7000	0.7200	175.0018
South East	16.9100	115.6809	0.7600	0.7000	0.7200	674.3602
South West	4.7900	115.6809	0.7600	0.7000	0.7200	191.0222
North West	11.5600	91.1383	0.7600	0.7000	0.7200	363.1994
South West	0.8600	193.3062	0.7600	0.7000	0.8000	63.6779
total:						1467.2615

	Jun	Jul	Aug	
Solar gains	1516	1467	1265	(P3)
Internal gains	720	692	703	
Total summer gains	2236	2159	1967	(P5)
Summer gain/loss ratio	3.45	3.33	3.04	(P6)
Summer external temperature	13.80	15.80	15.60	
Thermal mass temperature increment (TMP = 176.3)	0.77	0.77	0.77	
Threshold temperature	18.02	19.90	19.40	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			