

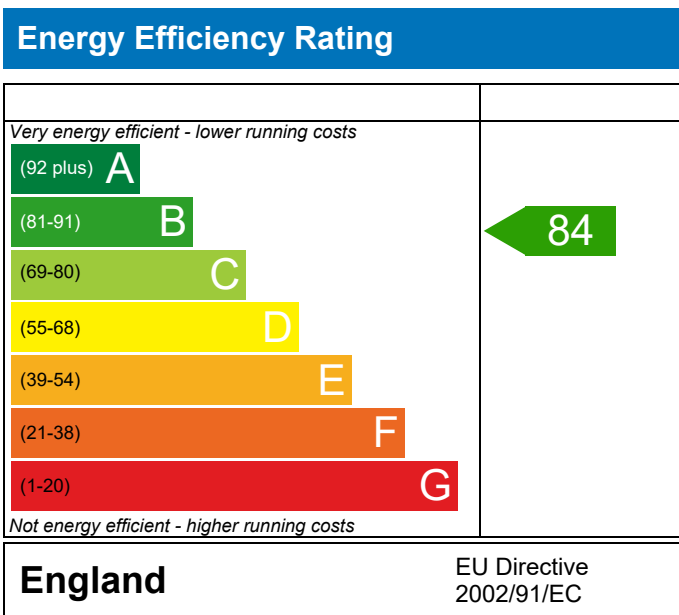
# PREDICTED ENERGY ASSESSMENT

243 - PRJ012318

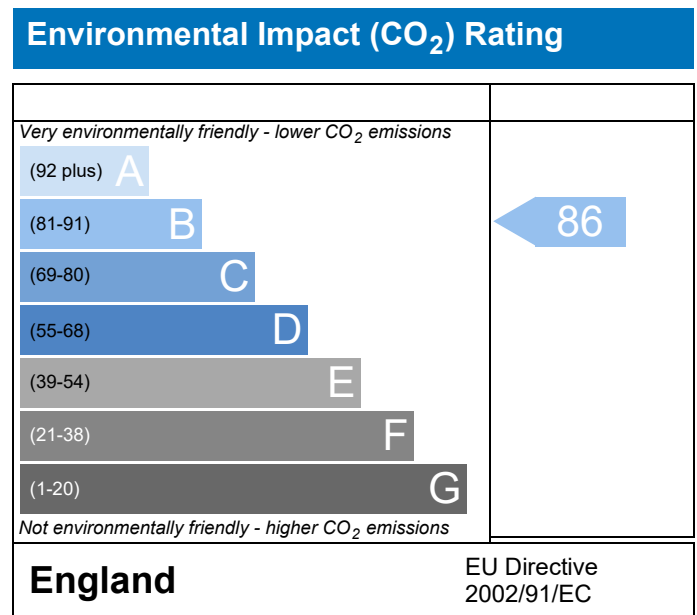
Dwelling type: House, Semi-Detached  
 Date of assessment: 13/07/2022  
 Produced by: Scott Binstead  
 Total floor area: 101.78 m<sup>2</sup>

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO<sub>2</sub>) emissions.



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO<sub>2</sub>) emissions. The higher the rating the less impact it has on the environment.

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

Property Reference	243 - PRJ012318			Issued on Date	13/07/2022
Assessment Reference	243 S	Prop Type Ref	Penrith		
Property	243 - PRJ012318				
SAP Rating	84 B	DER	17.04	TER	18.17
Environmental	86 B	% DER<TER	6.20		
CO <sub>2</sub> Emissions (t/year)	1.44	DFEE	48.76	TFEE	56.97
General Requirements Compliance	Pass	% DFEE<TFEE	14.41		
Assessor Details	Chris Nicholls, , Tel: ,			Assessor ID	U903-0001
Client					

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Semi-Detached House, total floor area 102 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) 18.17 kgCO<sub>2</sub>/m<sup>2</sup>  
Dwelling Carbon Dioxide Emission Rate (DER) 17.04 kgCO<sub>2</sub>/m<sup>2</sup>OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)57.0 kWh/m<sup>2</sup>/yr  
Dwelling Fabric Energy Efficiency (DFEE)48.8 kWh/m<sup>2</sup>/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.43 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.12 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.37 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 5.01 (design value)  
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas

Data from database

Ideal LOGIC COMBI ESPl 35

Combi boiler

Efficiency: 89.6% SEDBUK2009

Minimum: 88.0%

OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls:

No cylinder

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: 0.1900 0.1800

Maximum 0.7 OK

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

Overshading:

Average

Windows facing North: 1.34 m<sup>2</sup>, No overhang

Windows facing East: 6.29 m<sup>2</sup>, No overhang

Windows facing West: 5.29 m<sup>2</sup>, No overhang

Air change rate: 4.21 ach

Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

External wall U-value 0.14 W/m<sup>2</sup>K

Party wall U-value 0.00 W/m<sup>2</sup>K

Roof U-value 0.10 W/m<sup>2</sup>K

Roof U-value 0.10 W/m<sup>2</sup>K

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### 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	37.2900 (1b)	x 2.6100 (2b)	= 97.3269 (1b) - (3b)
First floor	37.2900 (1c)	x 2.8500 (2c)	= 106.2765 (1c) - (3c)
Second floor	27.2000 (1d)	x 2.5800 (2d)	= 70.1760 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 273.7794 (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)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.2505 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2317 (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	0.2954	0.2896	0.2838	0.2549	0.2491	0.2201	0.2201	0.2143	0.2317	0.2491	0.2607	0.2723 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5454	0.5396	0.5338	0.5049	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5107	0.5223 (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
Windows (Uw = 1.40)			12.9200	1.3258	17.1420		(27)
Solid Door			2.1500	1.2000	2.5800		(26)
Roof Window (Uw = 1.40)			1.5300	1.3258	2.0284		(27a)
Flr - Ground			37.2910	0.1500	5.5937	75.6000	2819.1996 (28a)
Wl - Brick	45.0900	7.8480	37.2420	0.2200	8.1932	58.3400	2172.6983 (29a)
Wl - Clad	64.6300	5.7480	58.8820	0.2200	12.9540	58.3400	3435.1759 (29a)
Wl - Dormer	4.2900	1.4760	2.8140	0.4300	1.2100	7.6200	21.4427 (29a)
Wl - Stud Ashlar	21.6080		21.6080	0.1440	3.1116	5.8200	125.7586 (29a)
Rf - Ins Joist	18.9410		18.9410	0.1000	1.8941	5.8200	110.2366 (30)
Rf - Ins Rafter	8.9840	1.5280	7.4560	0.1600	1.1930	1.8000	13.4208 (30)
Rf - Joist over Dormer	1.9000		1.9000	0.1000	0.1900	5.8200	11.0580 (30)
Rf - Ashlar behind Stud	10.0950		10.0950	0.1440	1.4537	5.8200	58.7529 (30)
Total net area of external elements Aum(A, m2)			212.8390				(31)
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		57.5437		(33)
Party Wall			63.3960	0.0000	0.0000	54.0300	3425.2859 (32)
Ground Floor Stud			73.3097			5.8200	426.6623 (32c)
1st Floor Stud			103.7514			5.8200	603.8331 (32c)
2nd Floor Stud			31.2878			5.8200	182.0951 (32c)
Internal Floor			64.4900			18.0000	1160.8200 (32d)
Internal Ceiling			64.4900			5.8200	375.3318 (32e)
Heat capacity Cm = Sum(A x k)						(28) ... (30) + (32) + (32a) ... (32e) =	14941.7716 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							146.8046 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.3383 (36)
Total fabric heat loss						(33) + (36) =	70.8820 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	49.2784	48.7550	48.2317	45.6148	45.1736	45.1736	45.1736	45.1736	45.1736	45.1736	46.1382	47.1849 (38)
Average = Sum(39)m / 12 =	120.1604	119.6371	119.1137	116.4969	116.0556	116.0556	116.0556	116.0556	116.0556	116.0556	117.0202	118.0670 (39)
												117.2358 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1806	1.1754	1.1703	1.1446	1.1403	1.1403	1.1403	1.1403	1.1403	1.1403	1.1497	1.1600 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Assumed occupancy												2.7554 (42)	
Average daily hot water use (litres/day)												99.6408 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.6049	105.6193	101.6337	97.6480	93.6624	89.6768	89.6768	93.6624	97.6480	101.6337	105.6193	109.6049	(44)
Energy content (annual)	162.5409	142.1593	146.6957	127.8929	122.7163	105.8948	98.1271	112.6023	113.9471	132.7944	144.9554	157.4122	(45)
Distribution loss (46)m = 0.15 x (45)m	24.3811	21.3239	22.0044	19.1839	18.4074	15.8842	14.7191	16.8903	17.0921	19.9192	21.7433	23.6118	(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)
Combi loss	14.1467	12.7665	14.1086	13.6125	14.0324	13.5407	13.9678	14.0097	13.5798	14.0753	13.6607	14.1343	(61)
Total heat required for water heating calculated for each month	176.6876	154.9258	160.8043	141.5054	136.7487	119.4355	112.0949	126.6120	127.5269	146.8696	158.6161	171.5466	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	176.6876	154.9258	160.8043	141.5054	136.7487	119.4355	112.0949	126.6120	127.5269	146.8696	158.6161	171.5466	(64)
Heat gains from water heating, kWh/month	57.5815	50.4596	52.3035	45.9275	44.3113	38.5952	36.1192	40.9427	41.2824	47.6729	51.6129	55.8732	(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	137.7702	137.7702	137.7702	137.7702	137.7702	137.7702	137.7702	137.7702	137.7702	137.7702	137.7702	137.7702	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.4518	21.7179	17.6621	13.3714	9.9953	8.4384	9.1180	11.8519	15.9076	20.1984	23.5745	25.1314	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	259.1737	261.8631	255.0859	240.6579	222.4453	205.3279	193.8925	191.2031	197.9803	212.4083	230.6209	247.7382	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7770	36.7770	36.7770	36.7770	36.7770	36.7770	36.7770	36.7770	36.7770	36.7770	36.7770	36.7770	(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)	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	(71)
Water heating gains (Table 5)	77.3945	75.0887	70.3004	63.7882	59.5581	53.6044	48.5473	55.0305	57.3366	64.0765	71.6845	75.0983	(72)
Total internal gains	428.3510	426.0007	410.3794	385.1486	359.3297	334.7019	318.8889	325.4166	338.5557	364.0143	393.2110	415.2990	(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							
North	1.3440	10.6334	0.7600	0.7200	0.7700	5.4194 (74)							
East	6.2880	19.6403	0.7600	0.7200	0.7700	46.8316 (76)							
West	5.2920	19.6403	0.7600	0.7200	0.7700	39.4136 (80)							
East	1.5280	25.9287	0.7600	0.7200	1.0000	19.5116 (82)							
Solar gains	111.1763	218.1081	361.9546	534.0665	661.1929	680.0814	646.1184	550.3294	422.8146	259.4209	138.7063	91.3893	(83)
Total gains	539.5273	644.1088	772.3341	919.2150	1020.5227	1014.7832	965.0073	875.7460	761.3703	623.4352	531.9174	506.6883	(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	34.5413	34.6924	34.8448	35.6275	35.7630	35.7630	35.7630	35.7630	35.7630	35.7630	35.4682	35.1537	(86)
alpha	3.3028	3.3128	3.3230	3.3752	3.3842	3.3842	3.3842	3.3842	3.3842	3.3842	3.3645	3.3436	(87)
util living area	0.9904	0.9822	0.9607	0.9029	0.7930	0.6404	0.4984	0.5593	0.7910	0.9453	0.9842	0.9922	(88)
MIT	18.9999	19.2404	19.6580	20.2048	20.6292	20.8724	20.9592	20.9395	20.7273	20.1518	19.4890	18.9773	(89)
Th 2	19.9356	19.9397	19.9438	19.9646	19.9681	19.9681	19.9681	19.9681	19.9681	19.9681	19.9604	19.9521	(90)
util rest of house	0.9884	0.9784	0.9521	0.8813	0.7476	0.5624	0.3935	0.4523	0.7271	0.9288	0.9802	0.9906	(91)
MIT 2	18.1077	18.3493	18.7641	19.3077	19.6980	19.8963	19.9528	19.9434	19.7931	19.2702	18.6132	18.0972	(92)
Living area fraction	18.2136	18.4551	18.8702	19.4142	19.8086	20.0121	20.0722	20.0616	19.9040	19.3749	18.7172	18.2017	(93)
Temperature adjustment												-0.1500	(94)
adjusted MIT	18.0636	18.3051	18.7202	19.2642	19.6586	19.8621	19.9222	19.9116	19.7540	19.2249	18.5672	18.0517	(95)

#### 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9832	0.9703	0.9389	0.8635	0.7320	0.5536	0.3886	0.4460	0.7115	0.9131	0.9727	0.9862	(96)
Useful gains	530.4633	624.9641	725.1551	793.7734	747.0197	561.8169	374.9958	390.5826	541.7309	569.2777	517.3895	499.6919	(97)

# FULL SAP CALCULATION PRINTOUT

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### CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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	1653.8421	1603.7418	1455.5917	1207.3963	923.6358	610.6987	385.5652	407.5430	656.1770	1000.9638	1341.8894	1635.4259 (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	835.7938	657.7386	543.4448	297.8085	131.4024	0.0000	0.0000	0.0000	0.0000	321.1745	593.6399	844.9861 (98)
Space heating												4225.9886 (98)
Space heating per m2												(98) / (4) = 41.5208 (99)

#### 8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)		0.0000 (201)
Fraction of space heat from main system(s)		1.0000 (202)
Efficiency of main space heating system 1 (in %)		90.5000 (206)
Efficiency of secondary/supplementary heating system, %		0.0000 (208)
Space heating requirement		4669.6007 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	835.7938	657.7386	543.4448	297.8085	131.4024	0.0000	0.0000	0.0000	0.0000	321.1745	593.6399	844.9861	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	923.5291	726.7830	600.4915	329.0701	145.1960	0.0000	0.0000	0.0000	0.0000	354.8889	655.9557	933.6863	(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	176.6876	154.9258	160.8043	141.5054	136.7487	119.4355	112.0949	126.6120	127.5269	146.8696	158.6161	171.5466	(64)
Efficiency of water heater (217)m	89.9248	89.8720	89.7488	89.4439	88.8393	87.3000	87.3000	87.3000	87.3000	89.4709	89.8059	89.9436	(216)
Fuel for water heating, kWh/month	196.4838	172.3850	179.1715	158.2057	153.9281	136.8104	128.4019	145.0309	146.0790	164.1535	176.6211	190.7268	(219)
Water heating fuel used													(219)
Annual totals kWh/year													
Space heating fuel - main system													4669.6007 (211)
Space heating fuel - secondary													0.0000 (215)

#### Electricity for pumps and fans:

(MEV)Decentralised, Database: total watage = 6.9550, total flow = 29.0000, SFP = 0.2398)		
mechanical ventilation fans (SFP = 0.2398)		80.1050 (230a)
central heating pump		30.0000 (230c)
main heating flue fan		45.0000 (230e)
Total electricity for the above, kWh/year		155.1050 (231)
Electricity for lighting (calculated in Appendix L)		431.8261 (232)
Total delivered energy for all uses		7204.5294 (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	4669.6007	0.2160	1008.6338 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1947.9976	0.2160	422.7675 (264)
Space and water heating			1429.4012 (265)
Pumps and fans	155.1050	0.5190	80.4995 (267)
Energy for lighting	431.8261	0.5190	224.1177 (268)
Total CO2, kg/year			1734.0185 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.0400 (273)

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

DER		17.0400	ZC1
Total Floor Area		101.7800	TFA
Assumed number of occupants		2.7554	N
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	EF
CO2 emissions from appliances, equation (L14)		15.0895	ZC2
CO2 emissions from cooking, equation (L16)		1.8189	ZC3
Total CO2 emissions		33.9484	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		33.9484	ZC8

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### 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 (m2)	Storey height (m)	Volume (m3)
Ground floor	37.2900 (1b)	x 2.6100 (2b)	= 97.3269 (1b) - (3b)
First floor	37.2900 (1c)	x 2.8500 (2c)	= 106.2765 (1c) - (3c)
Second floor	27.2000 (1d)	x 2.5800 (2c)	= 70.1760 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 273.7794 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	+	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	+	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 40.0000 / (5) = 0.1461 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3961 (18)
Number of sides sheltered					1 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3664 (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	0.4672	0.4580	0.4488	0.4030	0.3939	0.3481	0.3481	0.3389	0.3664	0.3939	0.4122	0.4305 (22b)
Effective ac	0.6091	0.6049	0.6007	0.5812	0.5776	0.5606	0.5606	0.5574	0.5671	0.5776	0.5850	0.5927 (25)

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

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Opening Type (Uw = 1.40)			12.9200	1.3258	17.1420		(27)
TER Room Window (Uw = 1.70)			1.5300	1.5918	2.4354		(27a)
Flr - Ground			37.2910	0.1300	4.8478		(28a)
Wl - Brick	45.0900	7.8480	37.2420	0.1800	6.7036		(29a)
Wl - Clad	64.6300	5.7480	58.8820	0.1800	10.5988		(29a)
Wl - Dormer	4.2900	1.4760	2.8140	0.1800	0.5065		(29a)
Wl - Stud Ashlar	21.6080		21.6080	0.1800	3.8894		(29a)
Rf - Ins Joist	18.9410		18.9410	0.1300	2.4623		(30)
Rf - Ins Rafter	8.9840	1.5280	7.4560	0.1300	0.9693		(30)
Rf - Joist over Dormer	1.9000		1.9000	0.1300	0.2470		(30)
Rf - Ashlar behind Stud	10.0950		10.0950	0.1300	1.3124		(30)
Total net area of external elements Aum(A, m2)			212.8390				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 53.2645		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.4650 (36)
Total fabric heat loss						(33) + (36) =	66.7295 (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	55.0320	54.6492	54.2739	52.5115	52.1817	50.6467	50.6467	50.3624	51.2380	52.1817	52.8488	53.5462 (38)
Heat transfer coeff	121.7615	121.3787	121.0034	119.2410	118.9112	117.3762	117.3762	117.0919	117.9675	118.9112	119.5783	120.2757 (39)
Average = Sum(39)m / 12 =												119.2394 (39)
HLP	1.1963	1.1926	1.1889	1.1716	1.1683	1.1532	1.1532	1.1504	1.1590	1.1683	1.1749	1.1817 (40)
HLP (average)												1.1715 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.7554 (42)
Average daily hot water use (litres/day)												99.6408 (43)
Daily hot water use	109.6049	105.6193	101.6337	97.6480	93.6624	89.6768	89.6768	93.6624	97.6480	101.6337	105.6193	109.6049 (44)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Energy content (annual)	162.5409	142.1593	146.6957	127.8929	122.7163	105.8948	98.1271	112.6023	113.9471	132.7944	144.9554	157.4122 (45)	
Distribution loss (46)m = 0.15 x (45)m	24.3811	21.3239	22.0044	19.1839	18.4074	15.8842	14.7191	16.8903	17.0921	19.9192	21.7433	23.6118 (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)	
Combi loss	50.9589	46.0274	50.9589	48.1552	47.7293	44.2242	45.6983	47.7293	48.1552	50.9589	49.3151	50.9589 (61)	
Total heat required for water heating calculated for each month	213.4998	188.1867	197.6546	176.0481	170.4456	150.1190	143.8254	160.3316	162.1023	183.7533	194.2705	208.3711 (62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)	
Output from w/h	213.4998	188.1867	197.6546	176.0481	170.4456	150.1190	143.8254	160.3316	162.1023	183.7533	194.2705	208.3711 (64)	
Heat gains from water heating, kWh/month	66.7846	58.7748	61.5160	54.5632	52.7355	46.2661	44.0518	49.3726	49.9262	56.8939	60.5265	65.0793 (65)	
										Total per year (kWh/year) = Sum(64)m =			2148.6080 (64)

#### 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	137.7702	137.7702	137.7702	137.7702	137.7702	137.7702	137.7702	137.7702	137.7702	137.7702	137.7702	137.7702 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.5984	21.8481	17.7681	13.4516	10.0552	8.4890	9.1727	11.9230	16.0030	20.3195	23.7159	25.2821 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	259.1737	261.8631	255.0859	240.6579	222.4453	205.3279	193.8925	191.2031	197.9803	212.4083	230.6209	247.7382 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7770	36.7770	36.7770	36.7770	36.7770	36.7770	36.7770	36.7770	36.7770	36.7770	36.7770	36.7770 (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)	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162 (71)
Water heating gains (Table 5)	89.7642	87.4625	82.6829	75.7822	70.8810	64.2584	59.2095	66.3610	69.3420	76.4702	84.0645	87.4722 (72)
Total internal gains	440.8674	438.5048	422.8678	397.2228	370.7126	345.4064	329.6057	336.8182	350.6564	376.5291	405.7324	427.8236 (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					
North	1.3440	10.6334	0.6300	0.7000	0.7700	4.3676 (74)						
East	6.2880	19.6403	0.6300	0.7000	0.7700	37.7426 (76)						
West	5.2920	19.6403	0.6300	0.7000	0.7700	31.7643 (80)						
East	1.5280	25.9287	0.6300	0.7000	1.0000	15.7248 (82)						
Solar gains	89.5993	175.7779	291.7068	430.4154	532.8693	548.0919	520.7204	443.5221	340.7552	209.0728	111.7864	73.6525 (83)
Total gains	530.4667	614.2827	714.5747	827.6382	903.5819	893.4983	850.3261	780.3403	691.4116	585.6019	517.5188	501.4761 (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	58.0484	58.2315	58.4120	59.2754	59.4398	60.2171	60.2171	60.3633	59.9153	59.4398	59.1082	58.7654
alpha	4.8699	4.8821	4.8941	4.9517	4.9627	5.0145	5.0145	5.0242	4.9944	4.9627	4.9405	4.9177
util living area	0.9989	0.9976	0.9927	0.9718	0.9041	0.7541	0.5868	0.6531	0.8932	0.9870	0.9978	0.9992 (86)
MIT	19.6243	19.7718	20.0423	20.4131	20.7343	20.9286	20.9839	20.9732	20.8191	20.3942	19.9476	19.6059 (87)
Th 2	19.9229	19.9260	19.9289	19.9428	19.9454	19.9576	19.9576	19.9599	19.9529	19.9454	19.9402	19.9346 (88)
util rest of house	0.9986	0.9967	0.9899	0.9602	0.8644	0.6631	0.4582	0.5233	0.8326	0.9799	0.9969	0.9989 (89)
MIT 2	18.0835	18.3012	18.6975	19.2401	19.6768	19.9084	19.9515	19.9483	19.7980	19.2215	18.5686	18.0648 (90)
Living area fraction												fLA = Living area / (4) =
MIT	18.2663	18.4757	18.8571	19.3793	19.8023	20.0295	20.0740	20.0700	19.9192	19.3607	18.7322	18.2477 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2663	18.4757	18.8571	19.3793	19.8023	20.0295	20.0740	20.0700	19.9192	19.3607	18.7322	18.2477 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	529.2109	611.1571	704.3877	787.8742	775.1061	598.6641	402.3778	419.8153	573.9953	570.4059	515.0547	500.5778 (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	1700.5618	1647.7999	1495.2531	1249.5598	963.4524	637.2949	407.7675	429.7261	686.4780	1041.7413	1390.9624	1689.5972 (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	871.4851	696.6240	588.4038	332.4137	140.1297	0.0000	0.0000	0.0000	0.0000	350.6735	630.6536	884.6304 (98)	
Space heating												4495.0137 (98)	
Space heating per m2												(98) / (4) =	44.1640 (99)



# 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 %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4812.6485 (211)
Space heating requirement	871.4851	696.6240	588.4038	332.4137	140.1297	0.0000	0.0000	0.0000	0.0000	350.6735	630.6536	884.6304	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	933.0675	745.8501	629.9827	355.9033	150.0317	0.0000	0.0000	0.0000	0.0000	375.4535	675.2179	947.1418	(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	213.4998	188.1867	197.6546	176.0481	170.4456	150.1190	143.8254	160.3316	162.1023	183.7533	194.2705	208.3711	(64)
Efficiency of water heater (217)m	88.2166	88.0447	87.6286	86.6275	84.5628	80.3000	80.3000	80.3000	80.3000	86.6526	87.7993	88.2831	(217)
Fuel for water heating, kWh/month	242.0177	213.7400	225.5596	203.2243	201.5609	186.9476	179.1101	199.6658	201.8709	212.0575	221.2666	236.0261	(219)
Water heating fuel used													2523.0470 (219)
Annual totals kWh/year													
Space heating fuel - main system													4812.6485 (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)													434.4158 (232)
Total delivered energy for all uses													7845.1114 (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	4812.6485	0.2160	1039.5321 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2523.0470	0.2160	544.9782 (264)
Space and water heating			1584.5102 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	434.4158	0.5190	225.4618 (268)
Total CO2, kg/m2/year			1848.8971 (272)
Emissions per m2 for space and water heating			15.5680 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2152 (272b)
Emissions per m2 for pumps and fans			0.3824 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.5680 * 1.00) + 2.2152 + 0.3824, rounded to 2 d.p.			18.1700 (273)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

#### 1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	37.2900 (1b)	x 2.6100 (2b)	= 97.3269 (1b) - (3b)
First floor	37.2900 (1c)	x 2.8500 (2c)	= 106.2765 (1c) - (3c)
Second floor	27.2000 (1d)	x 2.5800 (2c)	= 70.1760 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 273.7794 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 40.0000 / (5) = 0.1461 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3966 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3669 (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	0.4677	0.4586	0.4494	0.4035	0.3944	0.3485	0.3485	0.3393	0.3669	0.3944	0.4127	0.4311 (22b)
Effective ac	0.6094	0.6051	0.6010	0.5814	0.5778	0.5607	0.5607	0.5576	0.5673	0.5778	0.5852	0.5929 (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
Windows (Uw = 1.40)			12.9200	1.3258	17.1420		(27)
Solid Door			2.1500	1.2000	2.5800		(26)
Roof Window (Uw = 1.40)			1.5300	1.3258	2.0284		(27a)
Flr - Ground			37.2910	0.1500	5.5937	75.6000	2819.1996 (28a)
Wl - Brick	45.0900	7.8480	37.2420	0.2200	8.1932	58.3400	2172.6983 (29a)
Wl - Clad	64.6300	5.7480	58.8820	0.2200	12.9540	58.3400	3435.1759 (29a)
Wl - Dormer	4.2900	1.4760	2.8140	0.4300	1.2100	7.6200	21.4427 (29a)
Wl - Stud Ashlar	21.6080		21.6080	0.1440	3.1116	5.8200	125.7586 (29a)
Rf - Ins Joist	18.9410		18.9410	0.1000	1.8941	5.8200	110.2366 (30)
Rf - Ins Rafter	8.9840	1.5280	7.4560	0.1600	1.1930	1.8000	13.4208 (30)
Rf - Joist over Dormer	1.9000		1.9000	0.1000	0.1900	5.8200	11.0580 (30)
Rf - Ashlar behind Stud	10.0950		10.0950	0.1440	1.4537	5.8200	58.7529 (30)
Total net area of external elements Aum(A, m2)			212.8390				(31)
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	57.5437		(33)
Party Wall			63.3960	0.0000	0.0000	54.0300	3425.2859 (32)
Ground Floor Stud			73.3097			5.8200	426.6623 (32c)
1st Floor Stud			103.7514			5.8200	603.8331 (32c)
2nd Floor Stud			31.2878			5.8200	182.0951 (32c)
Internal Floor			64.4900			18.0000	1160.8200 (32d)
Internal Ceiling			64.4900			5.8200	375.3318 (32e)
Heat capacity Cm = Sum(A x k)						(28) ... (30) + (32) + (32a) ... (32e) =	14941.7716 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							146.8046 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.3383 (36)
Total fabric heat loss						(33) + (36) =	70.8820 (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	55.0569	54.6731	54.2969	52.5300	52.1994	50.6605	50.6605	50.3755	51.2533	52.1994	52.8682	53.5673 (38)
Heat transfer coeff	125.9389	125.5551	125.1789	123.4120	123.0815	121.5425	121.5425	121.2576	122.1353	123.0815	123.7502	124.4494 (39)
Average = Sum(39)m / 12 =												123.4105 (39)
HLP	1.2374	1.2336	1.2299	1.2125	1.2093	1.1942	1.1942	1.1914	1.2000	1.2093	1.2159	1.2227 (40)
HLP (average)												1.2125 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

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

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Assumed occupancy												2.7554 (42)	
Average daily hot water use (litres/day)												99.6408 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.6049	105.6193	101.6337	97.6480	93.6624	89.6768	89.6768	93.6624	97.6480	101.6337	105.6193	109.6049	(44)
Energy conte	162.5409	142.1593	146.6957	127.8929	122.7163	105.8948	98.1271	112.6023	113.9471	132.7944	144.9554	157.4122	(45)
Energy content (annual)	Total = Sum(45)m =											1567.7384 (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	34.5399	30.2089	31.1728	27.1772	26.0772	22.5026	20.8520	23.9280	24.2138	28.2188	30.8030	33.4501	(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	137.7702	137.7702	137.7702	137.7702	137.7702	137.7702	137.7702	137.7702	137.7702	137.7702	137.7702	137.7702	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.4518	21.7179	17.6621	13.3714	9.9953	8.4384	9.1180	11.8519	15.9076	20.1984	23.5745	25.1314	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	259.1737	261.8631	255.0859	240.6579	222.4453	205.3279	193.8925	191.2031	197.9803	212.4083	230.6209	247.7382	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7770	36.7770	36.7770	36.7770	36.7770	36.7770	36.7770	36.7770	36.7770	36.7770	36.7770	36.7770	(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)	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	(71)
Water heating gains (Table 5)	46.4247	44.9537	41.8990	37.7462	35.0500	31.2537	28.0269	32.1613	33.6302	37.9285	42.7820	44.9598	(72)
Total internal gains	394.3812	392.8657	378.9780	356.1065	331.8216	309.3511	295.3685	299.5474	311.8493	334.8662	361.3085	382.1605	(73)

#### 6. Solar gains

[Jan]	Area m <sup>2</sup>	Solar flux Table 6a W/m <sup>2</sup>	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W							
North	1.3440	10.6334	0.7600	0.7200	0.7700	5.4194 (74)							
East	6.2880	19.6403	0.7600	0.7200	0.7700	46.8316 (76)							
West	5.2920	19.6403	0.7600	0.7200	0.7700	39.4136 (80)							
East	1.5280	25.9287	0.7600	0.7200	1.0000	19.5116 (82)							
Solar gains	111.1763	218.1081	361.9546	534.0665	661.1929	680.0814	646.1184	550.3294	422.8146	259.4209	138.7063	91.3893	(83)
Total gains	505.5574	610.9738	740.9327	890.1730	993.0145	989.4325	941.4869	849.8768	734.6639	594.2871	500.0148	473.5497	(84)

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

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	32.9564	33.0571	33.1565	33.6312	33.7215	34.1485	34.1485	34.2287	33.9827	33.7215	33.5393	33.3508	
alpha	3.1971	3.2038	3.2104	3.2421	3.2481	3.2766	3.2766	3.2819	3.2655	3.2481	3.2360	3.2234	
util living area	0.9920	0.9848	0.9659	0.9151	0.8158	0.6672	0.5258	0.5885	0.8151	0.9539	0.9869	0.9935	(86)
MIT	18.8568	19.0984	19.5259	20.0858	20.5490	20.8407	20.9462	20.9219	20.6704	20.0386	19.3492	18.8235	(87)
Th 2	19.8902	19.8932	19.8962	19.9100	19.9126	19.9247	19.9247	19.9269	19.9200	19.9126	19.9073	19.9019	(88)
util rest of house	0.9903	0.9815	0.9581	0.8950	0.7713	0.5868	0.4134	0.4755	0.7528	0.9392	0.9835	0.9921	(89)
MIT 2	17.9329	18.1750	18.5996	19.1529	19.5825	19.8346	19.9046	19.8950	19.7068	19.1199	18.4363	17.9081	(90)
Living area fraction	fLA = Living area / (4) =											0.1187 (91)	
MIT	18.0426	18.2846	18.7096	19.2637	19.6972	19.9540	20.0282	20.0169	19.8211	19.2289	18.5446	18.0167	(92)
Temperature adjustment													
adjusted MIT	18.0426	18.2846	18.7096	19.2637	19.6972	19.9540	20.0282	20.0169	19.8211	19.2289	18.5446	18.0167	(93)

#### 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9861	0.9748	0.9471	0.8804	0.7612	0.5892	0.4250	0.4858	0.7460	0.9270	0.9775	0.9886	(94)
Useful gains	498.5183	595.5501	701.7278	783.7182	755.9048	583.0197	400.0964	412.8565	548.0806	550.8971	488.7433	468.1529	(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	1730.7227	1680.5022	1528.3827	1279.0005	984.3065	650.7414	416.6744	438.5758	698.7533	1062.0595	1416.2738	1719.4832	(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	916.7600	729.0878	615.0312	356.6033	169.9308	0.0000	0.0000	0.0000	0.0000	380.3048	667.8219	930.9897	(98)
Space heating												4766.5296 (98)	
Space heating per m <sup>2</sup>												(98) / (4) = 46.8317 (99)	

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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 8c. Space cooling requirement  
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Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1142.4999	899.4148	921.5574	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7968	0.8587	0.8239	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	910.3414	772.3564	759.2580	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1240.9989	1183.8672	1082.1829	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	238.0734	306.1640	240.2561	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												784.4935 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	59.5184	76.5410	60.0640	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling kWh												196.1234 (107)
Space cooling per m2												1.9269 (108)
Energy for space heating												46.8317 (99)
Energy for space cooling												1.9269 (108)
Total												48.7586 (109)
Dwelling Fabric Energy Efficiency (DFEE)												48.8 (109)

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# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

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

#### 1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	37.2900 (1b)	x 2.6100 (2b)	= 97.3269 (1b) - (3b)
First floor	37.2900 (1c)	x 2.8500 (2c)	= 106.2765 (1c) - (3c)
Second floor	27.2000 (1d)	x 2.5800 (2d)	= 70.1760 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.7800		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 273.7794 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	+	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	+	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 40.0000 / (5) = 0.1461 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3961 (18)
Number of sides sheltered					1 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3664 (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	0.4672	0.4580	0.4488	0.4030	0.3939	0.3481	0.3481	0.3389	0.3664	0.3939	0.4122	0.4305 (22b)
Effective ac	0.6091	0.6049	0.6007	0.5812	0.5776	0.5606	0.5606	0.5574	0.5671	0.5776	0.5850	0.5927 (25)

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

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Opening Type (Uw = 1.40)			12.9200	1.3258	17.1420		(27)
TER Room Window (Uw = 1.70)			1.5300	1.5918	2.4354		(27a)
Flr - Ground			37.2910	0.1300	4.8478		(28a)
Wl - Brick	45.0900	7.8480	37.2420	0.1800	6.7036		(29a)
Wl - Clad	64.6300	5.7480	58.8820	0.1800	10.5988		(29a)
Wl - Dormer	4.2900	1.4760	2.8140	0.1800	0.5065		(29a)
Wl - Stud Ashlar	21.6080		21.6080	0.1800	3.8894		(29a)
Rf - Ins Joist	18.9410		18.9410	0.1300	2.4623		(30)
Rf - Ins Rafter	8.9840	1.5280	7.4560	0.1300	0.9693		(30)
Rf - Joist over Dormer	1.9000		1.9000	0.1300	0.2470		(30)
Rf - Ashlar behind Stud	10.0950		10.0950	0.1300	1.3124		(30)
Total net area of external elements Aum(A, m2)			212.8390				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 53.2645		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.4650 (36)
Total fabric heat loss							(33) + (36) = 66.7295 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	55.0320	54.6492	54.2739	52.5115	52.1817	50.6467	50.6467	50.3624	51.2380	52.1817	52.8488	53.5462 (38)
Heat transfer coeff	121.7615	121.3787	121.0034	119.2410	118.9112	117.3762	117.3762	117.0919	117.9675	118.9112	119.5783	120.2757 (39)
Average = Sum(39)m / 12 =												119.2394 (39)
HLP	1.1963	1.1926	1.1889	1.1716	1.1683	1.1532	1.1532	1.1504	1.1590	1.1683	1.1749	1.1817 (40)
HLP (average)												1.1715 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.7554 (42)
Average daily hot water use (litres/day)												99.6408 (43)
Daily hot water use	109.6049	105.6193	101.6337	97.6480	93.6624	89.6768	89.6768	93.6624	97.6480	101.6337	105.6193	109.6049 (44)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Energy conte	162.5409	142.1593	146.6957	127.8929	122.7163	105.8948	98.1271	112.6023	113.9471	132.7944	144.9554	157.4122 (45)
Energy content (annual)	Total = Sum(45)m = 1567.7384 (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												
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 (57)
Heat gains from water heating, kWh/month	34.5399	30.2089	31.1728	27.1772	26.0772	22.5026	20.8520	23.9280	24.2138	28.2188	30.8030	33.4501 (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	137.7702	137.7702	137.7702	137.7702	137.7702	137.7702	137.7702	137.7702	137.7702	137.7702	137.7702	137.7702 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.5984	21.8481	17.7681	13.4516	10.0552	8.4890	9.1727	11.9230	16.0030	20.3195	23.7159	25.2821 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	259.1737	261.8631	255.0859	240.6579	222.4453	205.3279	193.8925	191.2031	197.9803	212.4083	230.6209	247.7382 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7770	36.7770	36.7770	36.7770	36.7770	36.7770	36.7770	36.7770	36.7770	36.7770	36.7770	36.7770 (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)	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162 (71)
Water heating gains (Table 5)	46.4247	44.9537	41.8990	37.7462	35.0500	31.2537	28.0269	32.1613	33.6302	37.9285	42.7820	44.9598 (72)
Total internal gains	394.5278	392.9959	379.0840	356.1867	331.8815	309.4017	295.4232	299.6184	311.9447	334.9874	361.4499	382.3112 (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					
North	1.3440	10.6334	0.6300	0.7000	0.7700	4.3676 (74)						
East	6.2880	19.6403	0.6300	0.7000	0.7700	37.7426 (76)						
West	5.2920	19.6403	0.6300	0.7000	0.7700	31.7643 (80)						
East	1.5280	25.9287	0.6300	0.7000	1.0000	15.7248 (82)						
Solar gains	89.5993	175.7779	291.7068	430.4154	532.8693	548.0919	520.7204	443.5221	340.7552	209.0728	111.7864	73.6525 (83)
Total gains	484.1271	568.7739	670.7908	786.6021	864.7509	857.4936	816.1436	743.1405	652.6999	544.0601	473.2362	455.9637 (84)

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

Temperature during heating periods in the living area from Table 9, Th1 (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)	58.0484	58.2315	58.4120	59.2754	59.4398	60.2171	60.2171	60.3633	59.9153	59.4398	59.1082	58.7654
alpha	4.8699	4.8821	4.8941	4.9517	4.9627	5.0145	5.0145	5.0242	4.9944	4.9627	4.9405	4.9177
util living area	0.9993	0.9983	0.9944	0.9768	0.9164	0.7742	0.6078	0.6786	0.9104	0.9904	0.9986	0.9995 (86)
MIT	19.5821	19.7306	20.0036	20.3801	20.7117	20.9194	20.9812	20.9683	20.7975	20.3582	19.9073	19.5643 (87)
Th 2	19.9229	19.9260	19.9289	19.9428	19.9454	19.9576	19.9576	19.9599	19.9529	19.9454	19.9402	19.9346 (88)
util rest of house	0.9990	0.9977	0.9922	0.9671	0.8799	0.6845	0.4763	0.5470	0.8557	0.9850	0.9979	0.9993 (89)
MIT 2	18.6249	18.7756	19.0499	19.4317	19.7435	19.9190	19.9527	19.9503	19.8314	19.4163	18.9636	18.6164 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.7385	18.8889	19.1631	19.5443	19.8584	20.0377	20.0747	20.0711	19.9460	19.5281	19.0756	18.7289 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.7385	18.8889	19.1631	19.5443	19.8584	20.0377	20.0747	20.0711	19.9460	19.5281	19.0756	18.7289 (93)

#### 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9986	0.9968	0.9901	0.9622	0.8763	0.6922	0.4919	0.5623	0.8552	0.9820	0.9972	0.9990 (94)
Useful gains	483.4697	566.9561	664.1216	756.8940	757.7708	593.5660	401.4558	417.8357	558.2178	534.2661	471.9006	455.5083 (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	1758.0532	1697.9554	1532.2764	1269.2355	970.1297	638.2565	407.8497	429.8603	689.6417	1061.6504	1432.0200	1747.4780 (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	948.2901	760.0316	645.9072	368.8858	157.9950	0.0000	0.0000	0.0000	0.0000	392.3739	691.2860	961.2254 (98)
Space heating	4925.9950 (98)											
Space heating per m2	(98) / (4) = 48.3985 (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

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1103.3362	868.5838	889.8986	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8291	0.8995	0.8643	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	914.7402	781.2555	769.1493	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1091.1424	1041.5000	960.9413	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	127.0096	193.6219	142.6932	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling Cooled fraction												463.3247	(104)
Intermittency factor (Table 10b)												1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	31.7524	48.4055	35.6733	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling Space cooling per m2												115.8312	(107)
Energy for space heating												1.1381	(108)
Energy for space cooling												48.3985	(99)
Total												1.1381	(108)
Target Fabric Energy Efficiency (TFEE)												49.5365	(109)
												57.0	(109)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF HEAT DEMAND 09 Jan 2014

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

#### 1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	37.2900 (1b)	2.6100 (2b)	97.3269 (1b) - (3b)
First floor	37.2900 (1c)	2.8500 (2c)	106.2765 (1c) - (3c)
Second floor	27.2000 (1d)	2.5800 (2d)	70.1760 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.7800		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 273.7794 (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				5.0100	
Infiltration rate				0.2505	(18)
Number of sides sheltered				1	(19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2317 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.2433	0.2317	0.2317	0.2143	0.2143	0.1912	0.1970	0.1854	0.1912	0.2027	0.2027	0.2201 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	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
Windows (Uw = 1.40)			12.9200	1.3258	17.1420		(27)
Solid Door			2.1500	1.2000	2.5800		(26)
Roof Window (Uw = 1.40)			1.5300	1.3258	2.0284		(27a)
Flr - Ground			37.2910	0.1500	5.5937	75.6000	2819.1996 (28a)
Wl - Brick	45.0900	7.8480	37.2420	0.2200	8.1932	58.3400	2172.6983 (29a)
Wl - Clad	64.6300	5.7480	58.8820	0.2200	12.9540	58.3400	3435.1759 (29a)
Wl - Dormer	4.2900	1.4760	2.8140	0.4300	1.2100	7.6200	21.4427 (29a)
Wl - Stud Ashlar	21.6080		21.6080	0.1440	3.1116	5.8200	125.7586 (29a)
Rf - Ins Joist	18.9410		18.9410	0.1000	1.8941	5.8200	110.2366 (30)
Rf - Ins Rafter	8.9840	1.5280	7.4560	0.1600	1.1930	1.8000	13.4208 (30)
Rf - Joist over Dormer	1.9000		1.9000	0.1000	0.1900	5.8200	11.0580 (30)
Rf - Ashlar behind Stud	10.0950		10.0950	0.1440	1.4537	5.8200	58.7529 (30)
Total net area of external elements Aum(A, m2)			212.8390				(31)
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	57.5437		(33)
Party Wall			63.3960	0.0000	0.0000	54.0300	3425.2859 (32)
Ground Floor Stud			73.3097			5.8200	426.6623 (32c)
1st Floor Stud			103.7514			5.8200	603.8331 (32c)
2nd Floor Stud			31.2878			5.8200	182.0951 (32c)
Internal Floor			64.4900			18.0000	1160.8200 (32d)
Internal Ceiling			64.4900			5.8200	375.3318 (32e)
Heat capacity Cm = Sum(A x k)							(28) ... (30) + (32) + (32a) ... (32e) = 14941.7716 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							146.8046 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.3383 (36)
Total fabric heat loss							(33) + (36) = 70.8820 (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	45.1736	45.1736	45.1736	45.1736	45.1736	45.1736	45.1736	45.1736	45.1736	45.1736	45.1736	45.1736 (38)
Heat transfer coeff	116.0556	116.0556	116.0556	116.0556	116.0556	116.0556	116.0556	116.0556	116.0556	116.0556	116.0556	116.0556 (39)
Average = Sum(39)m / 12 =												116.0556 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1403	1.1403	1.1403	1.1403	1.1403	1.1403	1.1403	1.1403	1.1403	1.1403	1.1403	1.1403 (40)
HLP (average)												1.1403 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF HEAT DEMAND 09 Jan 2014

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

Assumed occupancy												2.7554 (42)
Average daily hot water use (litres/day)												99.6408 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.6049	105.6193	101.6337	97.6480	93.6624	89.6768	89.6768	93.6624	97.6480	101.6337	105.6193	109.6049 (44)
Energy content	162.5409	142.1593	146.6957	127.8929	122.7163	105.8948	98.1271	112.6023	113.9471	132.7944	144.9554	157.4122 (45)
Energy content (annual)												Total = Sum(45)m = 1567.7384 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.3811	21.3239	22.0044	19.1839	18.4074	15.8842	14.7191	16.8903	17.0921	19.9192	21.7433	23.6118 (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)
Combi loss	14.1467	12.7665	14.1086	13.6125	14.0324	13.5407	13.9678	14.0097	13.5798	14.0753	13.6607	14.1343 (61)
Total heat required for water heating calculated for each month	176.6876	154.9258	160.8043	141.5054	136.7487	119.4355	112.0949	126.6120	127.5269	146.8696	158.6161	171.5466 (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	176.6876	154.9258	160.8043	141.5054	136.7487	119.4355	112.0949	126.6120	127.5269	146.8696	158.6161	171.5466 (64)
												Total per year (kWh/year) = Sum(64)m = 1733.3734 (64)
RHI water heating demand												1733 (64)
Heat gains from water heating, kWh/month	57.5815	50.4596	52.3035	45.9275	44.3113	38.5952	36.1192	40.9427	41.2824	47.6729	51.6129	55.8732 (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	165.3242	165.3242	165.3242	165.3242	165.3242	165.3242	165.3242	165.3242	165.3242	165.3242	165.3242	165.3242 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.1295	54.2946	44.1554	33.4285	24.9882	21.0961	22.7950	29.6298	39.7691	50.4960	58.9363	62.8284 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	386.8264	390.8404	380.7252	359.1909	332.0079	306.4596	289.3918	285.3778	295.4930	317.0272	344.2103	369.7586 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.2878	54.2878	54.2878	54.2878	54.2878	54.2878	54.2878	54.2878	54.2878	54.2878	54.2878	54.2878 (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)	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162 (71)
Water heating gains (Table 5)	77.3945	75.0887	70.3004	63.7882	59.5581	53.6044	48.5473	55.0305	57.3366	64.0765	71.6845	75.0983 (72)
Total internal gains	637.7463	632.6197	607.5768	568.8035	528.9501	493.5560	473.1301	482.4340	504.9947	543.9957	587.2271	620.0812 (73)

#### 6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m <sup>2</sup>	Table 6a	Specific data	Specific data	factor	W						
		W/m <sup>2</sup>	or Table 6b	or Table 6c	Table 6d							
North	1.3440	11.9814	0.7600	0.7200	0.7700	6.1064 (74)						
East	6.2880	22.3313	0.7600	0.7200	0.7700	53.2484 (76)						
West	5.2920	22.3313	0.7600	0.7200	0.7700	44.8140 (80)						
East	1.5280	29.6355	0.7600	0.7200	1.0000	22.3010 (82)						
Solar gains	126.4698	223.3033	365.6386	554.6278	667.6114	734.2428	690.2826	602.2115	462.5567	283.5127	161.6720	102.9356 (83)
Total gains	764.2160	855.9230	973.2154	1123.4313	1196.5615	1227.7988	1163.4126	1084.6455	967.5514	827.5084	748.8991	723.0168 (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	35.7630	35.7630	35.7630	35.7630	35.7630	35.7630	35.7630	35.7630	35.7630	35.7630	35.7630	35.7630
alpha	3.3842	3.3842	3.3842	3.3842	3.3842	3.3842	3.3842	3.3842	3.3842	3.3842	3.3842	3.3842
util living area	0.9697	0.9551	0.9152	0.8216	0.6662	0.4521	0.3052	0.3364	0.6178	0.8651	0.9506	0.9740 (86)
MIT	19.4836	19.6682	20.0556	20.4985	20.8196	20.9654	20.9935	20.9910	20.8965	20.4849	19.9058	19.4330 (87)
Th 2	19.9681	19.9681	19.9681	19.9681	19.9681	19.9681	19.9681	19.9681	19.9681	19.9681	19.9681	19.9681 (88)
util rest of house	0.9636	0.9462	0.8981	0.7868	0.6049	0.3665	0.2055	0.2307	0.5315	0.8294	0.9390	0.9687 (89)
MIT 2	18.6097	18.7903	19.1653	19.5774	19.8516	19.9536	19.9668	19.9662	19.9144	19.5769	19.0263	18.5603 (90)
Living area fraction												fLA = Living area / (4) = 0.1187 (91)
MIT	18.7134	18.8945	19.2710	19.6867	19.9665	20.0737	20.0887	20.0878	20.0309	19.6847	19.1307	18.6638 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.5634	18.7445	19.1210	19.5367	19.8165	19.9237	19.9387	19.9378	19.8809	19.5347	18.9807	18.5138 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9525	0.9326	0.8809	0.7702	0.5952	0.3626	0.2026	0.2275	0.5235	0.8113	0.9244	0.9586 (94)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF HEAT DEMAND 09 Jan 2014

Useful gains	727.9325	798.1946	857.3486	865.2333	712.1418	445.2506	235.7411	246.8055	506.5452	671.3479	692.3034	693.0876 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W												
Month fracti	1562.5045	1525.4890	1360.2850	1118.3929	791.0897	455.3651	236.6017	248.1069	543.2474	920.8623	1274.3703	1556.7529 (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	620.9216	488.7418	374.1847	182.2750	58.7373	0.0000	0.0000	0.0000	0.0000	185.6387	419.0881	642.5669 (98)
RHI space heating demand												2972.1542 (98)
												2972 (98)

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# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

#### 1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	37.2900 (1b)	x 2.6100 (2b)	= 97.3269 (1b) - (3b)
First floor	37.2900 (1c)	x 2.8500 (2c)	= 106.2765 (1c) - (3c)
Second floor	27.2000 (1d)	x 2.5800 (2d)	= 70.1760 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.7800		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 273.7794 (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) =					Air changes per hour 0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.2505 (18)
Number of sides sheltered					1 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.2317 (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	0.2954	0.2896	0.2838	0.2549	0.2491	0.2201	0.2201	0.2143	0.2317	0.2491	0.2607	0.2723 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5454	0.5396	0.5338	0.5049	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5107	0.5223 (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
Windows (Uw = 1.40)			12.9200	1.3258	17.1420		(27)
Solid Door			2.1500	1.2000	2.5800		(26)
Roof Window (Uw = 1.40)			1.5300	1.3258	2.0284		(27a)
Flr - Ground			37.2910	0.1500	5.5937	75.6000	2819.1996 (28a)
Wl - Brick	45.0900	7.8480	37.2420	0.2200	8.1932	58.3400	2172.6983 (29a)
Wl - Clad	64.6300	5.7480	58.8820	0.2200	12.9540	58.3400	3435.1759 (29a)
Wl - Dormer	4.2900	1.4760	2.8140	0.4300	1.2100	7.6200	21.4427 (29a)
Wl - Stud Ashlar	21.6080		21.6080	0.1440	3.1116	5.8200	125.7586 (29a)
Rf - Ins Joist	18.9410		18.9410	0.1000	1.8941	5.8200	110.2366 (30)
Rf - Ins Rafter	8.9840	1.5280	7.4560	0.1600	1.1930	1.8000	13.4208 (30)
Rf - Joist over Dormer	1.9000		1.9000	0.1000	0.1900	5.8200	11.0580 (30)
Rf - Ashlar behind Stud	10.0950		10.0950	0.1440	1.4537	5.8200	58.7529 (30)
Total net area of external elements Aum(A, m2)			212.8390				(31)
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	57.5437		(33)
Party Wall			63.3960	0.0000	0.0000	54.0300	3425.2859 (32)
Ground Floor Stud			73.3097			5.8200	426.6623 (32c)
1st Floor Stud			103.7514			5.8200	603.8331 (32c)
2nd Floor Stud			31.2878			5.8200	182.0951 (32c)
Internal Floor			64.4900			18.0000	1160.8200 (32d)
Internal Ceiling			64.4900			5.8200	375.3318 (32e)
Heat capacity Cm = Sum(A x k)							(28) ... (30) + (32) + (32a) ... (32e) = 14941.7716 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							146.8046 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.3383 (36)
Total fabric heat loss							(33) + (36) = 70.8820 (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	49.2784	48.7550	48.2317	45.6148	45.1736	45.1736	45.1736	45.1736	45.1736	45.1736	46.1382	47.1849 (38)
Heat transfer coeff	120.1604	119.6371	119.1137	116.4969	116.0556	116.0556	116.0556	116.0556	116.0556	116.0556	117.0202	118.0670 (39)
Average = Sum(39)m / 12 =												117.2358 (39)
HLP	1.1806	1.1754	1.1703	1.1446	1.1403	1.1403	1.1403	1.1403	1.1403	1.1403	1.1497	1.1600 (40)
HLP (average)												1.1519 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

Assumed occupancy												2.7554 (42)	
Average daily hot water use (litres/day)												99.6408 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.6049	105.6193	101.6337	97.6480	93.6624	89.6768	89.6768	93.6624	97.6480	101.6337	105.6193	109.6049	(44)
Energy content (annual)	162.5409	142.1593	146.6957	127.8929	122.7163	105.8948	98.1271	112.6023	113.9471	132.7944	144.9554	157.4122	(45)
Distribution loss (46)m = 0.15 x (45)m	24.3811	21.3239	22.0044	19.1839	18.4074	15.8842	14.7191	16.8903	17.0921	19.9192	21.7433	23.6118	(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)
Combi loss	14.1467	12.7665	14.1086	13.6125	14.0324	13.5407	13.9678	14.0097	13.5798	14.0753	13.6607	14.1343	(61)
Total heat required for water heating calculated for each month	176.6876	154.9258	160.8043	141.5054	136.7487	119.4355	112.0949	126.6120	127.5269	146.8696	158.6161	171.5466	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	176.6876	154.9258	160.8043	141.5054	136.7487	119.4355	112.0949	126.6120	127.5269	146.8696	158.6161	171.5466	(64)
Heat gains from water heating, kWh/month	57.5815	50.4596	52.3035	45.9275	44.3113	38.5952	36.1192	40.9427	41.2824	47.6729	51.6129	55.8732	(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	165.3242	165.3242	165.3242	165.3242	165.3242	165.3242	165.3242	165.3242	165.3242	165.3242	165.3242	165.3242	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.1295	54.2946	44.1554	33.4285	24.9882	21.0961	22.7950	29.6298	39.7691	50.4960	58.9363	62.8284	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	386.8264	390.8404	380.7252	359.1909	332.0079	306.4596	289.3918	285.3778	295.4930	317.0272	344.2103	369.7586	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.2878	54.2878	54.2878	54.2878	54.2878	54.2878	54.2878	54.2878	54.2878	54.2878	54.2878	54.2878	(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)	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	(71)
Water heating gains (Table 5)	77.3945	75.0887	70.3004	63.7882	59.5581	53.6044	48.5473	55.0305	57.3366	64.0765	71.6845	75.0983	(72)
Total internal gains	637.7463	632.6197	607.5768	568.8035	528.9501	493.5560	473.1301	482.4340	504.9947	543.9957	587.2271	620.0812	(73)

#### 6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
	m <sup>2</sup>	Table 6a	Specific data	Specific data	factor	W
		W/m <sup>2</sup>	or Table 6b	or Table 6c	Table 6d	
North	1.3440	10.6334	0.7600	0.7200	0.7700	5.4194 (74)
East	6.2880	19.6403	0.7600	0.7200	0.7700	46.8316 (76)
West	5.2920	19.6403	0.7600	0.7200	0.7700	39.4136 (80)
East	1.5280	25.9287	0.7600	0.7200	1.0000	19.5116 (82)

Solar gains	111.1763	218.1081	361.9546	534.0665	661.1929	680.0814	646.1184	550.3294	422.8146	259.4209	138.7063	91.3893	(83)
Total gains	748.9225	850.7278	969.5314	1102.8700	1190.1430	1173.6374	1119.2484	1032.7634	927.8093	803.4166	725.9334	711.4705	(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	34.5413	34.6924	34.8448	35.6275	35.7630	35.7630	35.7630	35.7630	35.7630	35.7630	35.4682	35.1537	(86)
alpha	3.3028	3.3128	3.3230	3.3752	3.3842	3.3842	3.3842	3.3842	3.3842	3.3842	3.3645	3.3436	(87)
util living area	0.9755	0.9616	0.9298	0.8556	0.7328	0.5758	0.4382	0.4886	0.7121	0.8986	0.9622	0.9789	(88)
MIT	19.2664	19.4926	19.8753	20.3608	20.7155	20.9080	20.9723	20.9598	20.8077	20.3340	19.7287	19.2419	(89)
Th 2	19.9356	19.9397	19.9438	19.9646	19.9681	19.9681	19.9681	19.9681	19.9681	19.9681	19.9604	19.9521	(90)
util rest of house	0.9706	0.9541	0.9159	0.8275	0.6829	0.4997	0.3427	0.3899	0.6416	0.8723	0.9535	0.9748	(91)
MIT 2	18.3708	18.5962	18.9721	19.4483	19.7665	19.9179	19.9581	19.9523	19.8504	19.4375	18.8472	18.3590	(92)
Living area fraction	18.4771	18.7026	19.0793	19.5566	19.8791	20.0354	20.0784	20.0719	19.9640	19.5439	18.9518	18.4638	(93)
MIT	18.4771	18.7026	19.0793	19.5566	19.8791	20.0354	20.0784	20.0719	19.9640	19.5439	18.9518	18.4638	(94)
Temperature adjustment	18.3271	18.5526	18.9293	19.4066	19.7291	19.8854	19.9284	19.9219	19.8140	19.3939	18.8018	18.3138	(95)
adjusted MIT	18.3271	18.5526	18.9293	19.4066	19.7291	19.8854	19.9284	19.9219	19.8140	19.3939	18.8018	18.3138	(96)

#### 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9607	0.9413	0.8993	0.8099	0.6701	0.4932	0.3389	0.3852	0.6298	0.8543	0.9407	0.9659	(97)
Useful gains	719.4670	800.7645	871.9067	893.1680	797.5206	578.8094	379.3079	397.8279	584.3627	686.3220	682.9147	687.1811	(98)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF ENERGY RATINGS 09 Jan 2014

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	1685.5017	1633.3559	1480.5026	1223.9900	931.8242	613.4010	386.2840	408.7385	663.1428	1020.5790	1369.3454	1666.3698 (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	718.7298	559.5014	452.7953	238.1918	99.9219	0.0000	0.0000	0.0000	0.0000	248.6872	494.2301	728.5164 (98)
Space heating												3540.5741 (98)
Space heating per m2												(98) / (4) = 34.7865 (99)

#### 8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3912.2366 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	718.7298	559.5014	452.7953	238.1918	99.9219	0.0000	0.0000	0.0000	0.0000	248.6872	494.2301	728.5164 (98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)
Space heating fuel (main heating system)	794.1766	618.2336	500.3263	263.1954	110.4109	0.0000	0.0000	0.0000	0.0000	274.7925	546.1107	804.9905 (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	176.6876	154.9258	160.8043	141.5054	136.7487	119.4355	112.0949	126.6120	127.5269	146.8696	158.6161	171.5466 (64)
Efficiency of water heater (217)m	89.8501	89.7863	89.6389	89.2804	88.6230	87.3000	87.3000	87.3000	87.3000	89.2848	89.7011	89.8721 (217)
Fuel for water heating, kWh/month	196.6470	172.5495	179.3912	158.4955	154.3038	136.8104	128.4019	145.0309	146.0790	164.4956	176.8273	190.8785 (219)
Water heating fuel used												1949.9107 (219)
Annual totals kWh/year												
Space heating fuel - main system												3912.2366 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 6.9550, total flow = 29.0000, SFP = 0.2398)												
mechanical ventilation fans (SFP = 0.2398)												80.1050 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												155.1050 (231)
Electricity for lighting (calculated in Appendix L)												431.8261 (232)
Total delivered energy for all uses												6449.0784 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3912.2366	3.4800	136.1458 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1949.9107	3.4800	67.8569 (247)
Mechanical ventilation fans	80.1050	13.1900	10.5659 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	431.8261	13.1900	56.9579 (250)
Additional standing charges			120.0000 (251)
Total energy cost			401.4189 (255)

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

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.1486 (257)
SAP value		83.9766
SAP rating (Section 12)		84 (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	3912.2366	0.2160	845.0431 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1949.9107	0.2160	421.1807 (264)
Space and water heating			1266.2238 (265)
Pumps and fans	155.1050	0.5190	80.4995 (267)
Energy for lighting	431.8261	0.5190	224.1177 (268)
Total kg/year			1570.8411 (272)
CO2 emissions per m2			15.4300 (273)
EI value			85.6593
EI rating			86 (274)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF ENERGY RATINGS 09 Jan 2014

EI band

B

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

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Main heating energy efficiency  $3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$ , stars = 4  
Main heating environmental impact  $0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$ , stars = 4  
Water heating energy efficiency  $3.48 / 0.8877 = 3.920$ , stars = 4  
Water heating environmental impact  $0.216 / 0.8877 = 0.2433$ , 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	37.2900 (1b)	x 2.6100 (2b)	= 97.3269 (1b) - (3b)
First floor	37.2900 (1c)	x 2.8500 (2c)	= 106.2765 (1c) - (3c)
Second floor	27.2000 (1d)	x 2.5800 (2d)	= 70.1760 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.7800		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 273.7794 (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)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.2505 (18)
Number of sides sheltered					1 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.2317 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.2433	0.2317	0.2317	0.2143	0.2143	0.1912	0.1970	0.1854	0.1912	0.2027	0.2027	0.2201 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	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
Windows (Uw = 1.40)			12.9200	1.3258	17.1420		(27)
Solid Door			2.1500	1.2000	2.5800		(26)
Roof Window (Uw = 1.40)			1.5300	1.3258	2.0284		(27a)
Flr - Ground			37.2910	0.1500	5.5937	75.6000	2819.1996 (28a)
Wl - Brick	45.0900	7.8480	37.2420	0.2200	8.1932	58.3400	2172.6983 (29a)
Wl - Clad	64.6300	5.7480	58.8820	0.2200	12.9540	58.3400	3435.1759 (29a)
Wl - Dormer	4.2900	1.4760	2.8140	0.4300	1.2100	7.6200	21.4427 (29a)
Wl - Stud Ashlar	21.6080		21.6080	0.1440	3.1116	5.8200	125.7586 (29a)
Rf - Ins Joist	18.9410		18.9410	0.1000	1.8941	5.8200	110.2366 (30)
Rf - Ins Rafter	8.9840	1.5280	7.4560	0.1600	1.1930	1.8000	13.4208 (30)
Rf - Joist over Dormer	1.9000		1.9000	0.1000	0.1900	5.8200	11.0580 (30)
Rf - Ashlar behind Stud	10.0950		10.0950	0.1440	1.4537	5.8200	58.7529 (30)
Total net area of external elements Aum(A, m2)			212.8390				(31)
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	57.5437		(33)
Party Wall			63.3960	0.0000	0.0000	54.0300	3425.2859 (32)
Ground Floor Stud			73.3097			5.8200	426.6623 (32c)
1st Floor Stud			103.7514			5.8200	603.8331 (32c)
2nd Floor Stud			31.2878			5.8200	182.0951 (32c)
Internal Floor			64.4900			18.0000	1160.8200 (32d)
Internal Ceiling			64.4900			5.8200	375.3318 (32e)
Heat capacity Cm = Sum(A x k)							(28) ... (30) + (32) + (32a) ... (32e) = 14941.7716 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							146.8046 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.3383 (36)
Total fabric heat loss							(33) + (36) = 70.8820 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	45.1736	45.1736	45.1736	45.1736	45.1736	45.1736	45.1736	45.1736	45.1736	45.1736	45.1736	45.1736 (38)
Average = Sum(39)m / 12 =	116.0556	116.0556	116.0556	116.0556	116.0556	116.0556	116.0556	116.0556	116.0556	116.0556	116.0556	116.0556 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1403	1.1403	1.1403	1.1403	1.1403	1.1403	1.1403	1.1403	1.1403	1.1403	1.1403	1.1403 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

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

Assumed occupancy												2.7554 (42)	
Average daily hot water use (litres/day)												99.6408 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.6049	105.6193	101.6337	97.6480	93.6624	89.6768	89.6768	93.6624	97.6480	101.6337	105.6193	109.6049	(44)
Energy content (annual)	162.5409	142.1593	146.6957	127.8929	122.7163	105.8948	98.1271	112.6023	113.9471	132.7944	144.9554	157.4122	(45)
Distribution loss (46)m = 0.15 x (45)m	24.3811	21.3239	22.0044	19.1839	18.4074	15.8842	14.7191	16.8903	17.0921	19.9192	21.7433	23.6118	(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)
Combi loss	14.1467	12.7665	14.1086	13.6125	14.0324	13.5407	13.9678	14.0097	13.5798	14.0753	13.6607	14.1343	(61)
Total heat required for water heating calculated for each month	176.6876	154.9258	160.8043	141.5054	136.7487	119.4355	112.0949	126.6120	127.5269	146.8696	158.6161	171.5466	(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	176.6876	154.9258	160.8043	141.5054	136.7487	119.4355	112.0949	126.6120	127.5269	146.8696	158.6161	171.5466	(64)
Total per year (kWh/year) = Sum(64)m =													1733.3734 (64)
Heat gains from water heating, kWh/month	57.5815	50.4596	52.3035	45.9275	44.3113	38.5952	36.1192	40.9427	41.2824	47.6729	51.6129	55.8732	(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	165.3242	165.3242	165.3242	165.3242	165.3242	165.3242	165.3242	165.3242	165.3242	165.3242	165.3242	165.3242	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.1295	54.2946	44.1554	33.4285	24.9882	21.0961	22.7950	29.6298	39.7691	50.4960	58.9363	62.8284	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	386.8264	390.8404	380.7252	359.1909	332.0079	306.4596	289.3918	285.3778	295.4930	317.0272	344.2103	369.7586	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.2878	54.2878	54.2878	54.2878	54.2878	54.2878	54.2878	54.2878	54.2878	54.2878	54.2878	54.2878	(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)	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	(71)
Water heating gains (Table 5)	77.3945	75.0887	70.3004	63.7882	59.5581	53.6044	48.5473	55.0305	57.3366	64.0765	71.6845	75.0983	(72)
Total internal gains	637.7463	632.6197	607.5768	568.8035	528.9501	493.5560	473.1301	482.4340	504.9947	543.9957	587.2271	620.0812	(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							
North	1.3440	11.9814	0.7600	0.7200	0.7700	6.1064 (74)							
East	6.2880	22.3313	0.7600	0.7200	0.7700	53.2484 (76)							
West	5.2920	22.3313	0.7600	0.7200	0.7700	44.8140 (80)							
East	1.5280	29.6355	0.7600	0.7200	1.0000	22.3010 (82)							
Solar gains	126.4698	223.3033	365.6386	554.6278	667.6114	734.2428	690.2826	602.2115	462.5567	283.5127	161.6720	102.9356	(83)
Total gains	764.2160	855.9230	973.2154	1123.4313	1196.5615	1227.7988	1163.4126	1084.6455	967.5514	827.5084	748.8991	723.0168	(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	35.7630	35.7630	35.7630	35.7630	35.7630	35.7630	35.7630	35.7630	35.7630	35.7630	35.7630	35.7630	
alpha	3.3842	3.3842	3.3842	3.3842	3.3842	3.3842	3.3842	3.3842	3.3842	3.3842	3.3842	3.3842	
util living area	0.9697	0.9551	0.9152	0.8216	0.6662	0.4521	0.3052	0.3364	0.6178	0.8651	0.9506	0.9740	(86)
MIT	19.4836	19.6682	20.0556	20.4985	20.8196	20.9654	20.9935	20.9910	20.8965	20.4849	19.9058	19.4330	(87)
Th 2	19.9681	19.9681	19.9681	19.9681	19.9681	19.9681	19.9681	19.9681	19.9681	19.9681	19.9681	19.9681	(88)
util rest of house	0.9636	0.9462	0.8981	0.7868	0.6049	0.3665	0.2055	0.2307	0.5315	0.8294	0.9390	0.9687	(89)
MIT 2	18.6097	18.7903	19.1653	19.5774	19.8516	19.9536	19.9668	19.9662	19.9144	19.5769	19.0263	18.5603	(90)
Living area fraction													0.1187 (91)
MIT	18.7134	18.8945	19.2710	19.6867	19.9665	20.0737	20.0887	20.0878	20.0309	19.6847	19.1307	18.6638	(92)
Temperature adjustment													-0.1500
adjusted MIT	18.5634	18.7445	19.1210	19.5367	19.8165	19.9237	19.9387	19.9378	19.8809	19.5347	18.9807	18.5138	(93)

#### 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9525	0.9326	0.8909	0.7702	0.5952	0.3626	0.2026	0.2275	0.5235	0.8113	0.9244	0.9586	(94)
Useful gains	727.9325	798.1946	857.3486	865.2333	712.1418	445.2506	235.7411	246.8055	506.5452	671.3479	692.3034	693.0876	(95)



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	1562.5045	1525.4890	1360.2850	1118.3929	791.0897	455.3651	236.6017	248.1069	543.2474	920.8623	1274.3703	1556.7529 (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	620.9216	488.7418	374.1847	182.2750	58.7373	0.0000	0.0000	0.0000	0.0000	185.6387	419.0881	642.5669 (98)
Space heating												2972.1542 (98)
Space heating per m2												(98) / (4) = 29.2018 (99)

#### 8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3284.1483 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	620.9216	488.7418	374.1847	182.2750	58.7373	0.0000	0.0000	0.0000	0.0000	185.6387	419.0881	642.5669 (98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)
Space heating fuel (main heating system)	686.1012	540.0462	413.4638	201.4088	64.9031	0.0000	0.0000	0.0000	0.0000	205.1257	463.0808	710.0187 (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	176.6876	154.9258	160.8043	141.5054	136.7487	119.4355	112.0949	126.6120	127.5269	146.8696	158.6161	171.5466 (64)
Efficiency of water heater (217)m	89.7711	89.7085	89.5138	89.0731	88.2375	87.3000	87.3000	87.3000	87.3000	89.0581	89.5983	89.8064 (217)
Fuel for water heating, kWh/month	196.8202	172.6991	179.6420	158.8644	154.9780	136.8104	128.4019	145.0309	146.0790	164.9144	177.0304	191.0183 (219)
Water heating fuel used												1952.2890 (219)
Annual totals kWh/year												
Space heating fuel - main system												3284.1483 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 6.9550, total flow = 29.0000, SFP = 0.2398)												
mechanical ventilation fans (SFP = 0.2398)												80.1050 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												155.1050 (231)
Electricity for lighting (calculated in Appendix L)												431.8261 (232)
Total delivered energy for all uses												5823.3684 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3284.1483	3.6300	119.2146 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1952.2890	3.6300	70.8681 (247)
Mechanical ventilation fans	80.1050	19.4400	15.5724 (249)
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)
Energy for lighting	431.8261	19.4400	83.9470 (250)
Additional standing charges			95.0000 (251)
Total energy cost			399.1821 (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	3284.1483	0.2160	709.3760 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1952.2890	0.2160	421.6944 (264)
Space and water heating			1131.0705 (265)
Pumps and fans	155.1050	0.5190	80.4995 (267)
Energy for lighting	431.8261	0.5190	224.1177 (268)
Total kg/year			1435.6877 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3284.1483	1.2200	4006.6609 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1952.2890	1.2200	2381.7926 (264)
Space and water heating			6388.4535 (265)
Pumps and fans	155.1050	3.0700	476.1724 (267)
Energy for lighting	431.8261	3.0700	1325.7061 (268)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Primary energy kWh/year  
Primary energy kWh/m<sup>2</sup>/year

8190.3320 (272)  
80.4709 (273)

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SAP 2012 EPC IMPROVEMENTS  
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Current energy efficiency rating: B 84  
Current environmental impact rating: B 86

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.1	-£ 27	-190 kg (13.2%)
U Solar photovoltaic panels	+ 9.1	-£ 355	-947 kg (76.0%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£27	1.87 kg/m <sup>2</sup>	B 85 B 87
Solar photovoltaic panels	£355	9.30 kg/m <sup>2</sup>	A 94 A 96
<b>Total Savings</b>	<b>£381</b>	<b>11.17 kg/m<sup>2</sup></b>	

Potential energy efficiency rating: A 94  
Potential environmental impact rating: A 96

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, Thames Valley):

	Current	Potential	Saving
Electricity	£114	£124	-£10
Mains gas	£285	£249	£36
Space heating	£244	£244	£0
Water heating	£71	£44	£27
Lighting	£84	£84	£0
Generated (PV)	-£0	-£355	£355
<b>Total cost of fuels</b>	<b>£399</b>	<b>£18</b>	<b>£381</b>
<b>Total cost of uses</b>	<b>£399</b>	<b>£17</b>	<b>£382</b>
Delivered energy	57 kWh/m <sup>2</sup>	30 kWh/m <sup>2</sup>	27 kWh/m <sup>2</sup>
Carbon dioxide emissions	1.4 tonnes	0.3 tonnes	1.1 tonnes
CO2 emissions per m <sup>2</sup>	14 kg/m <sup>2</sup>	3 kg/m <sup>2</sup>	11 kg/m <sup>2</sup>
Primary energy	80 kWh/m <sup>2</sup>	15 kWh/m <sup>2</sup>	65 kWh/m <sup>2</sup>

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

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

#### 1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	37.2900 (1b)	x 2.6100 (2b)	= 97.3269 (1b) - (3b)
First floor	37.2900 (1c)	x 2.8500 (2c)	= 106.2765 (1c) - (3c)
Second floor	27.2000 (1d)	x 2.5800 (2d)	= 70.1760 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.7800		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 273.7794 (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)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.2505 (18)
Number of sides sheltered					1 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.2317 (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	0.2954	0.2896	0.2838	0.2549	0.2491	0.2201	0.2201	0.2143	0.2317	0.2491	0.2607	0.2723 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5454	0.5396	0.5338	0.5049	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5107	0.5223 (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
Windows (Uw = 1.40)			12.9200	1.3258	17.1420		(27)
Solid Door			2.1500	1.2000	2.5800		(26)
Roof Window (Uw = 1.40)			1.5300	1.3258	2.0284		(27a)
F1r - Ground			37.2910	0.1500	5.5937	75.6000	2819.1996 (28a)
W1 - Brick	45.0900	7.8480	37.2420	0.2200	8.1932	58.3400	2172.6983 (29a)
W1 - Clad	64.6300	5.7480	58.8820	0.2200	12.9540	58.3400	3435.1759 (29a)
W1 - Dormer	4.2900	1.4760	2.8140	0.4300	1.2100	7.6200	21.4427 (29a)
W1 - Stud Ashlar	21.6080		21.6080	0.1440	3.1116	5.8200	125.7586 (29a)
Rf - Ins Joist	18.9410		18.9410	0.1000	1.8941	5.8200	110.2366 (30)
Rf - Ins Rafter	8.9840	1.5280	7.4560	0.1600	1.1930	1.8000	13.4208 (30)
Rf - Joist over Dormer	1.9000		1.9000	0.1000	0.1900	5.8200	11.0580 (30)
Rf - Ashlar behind Stud	10.0950		10.0950	0.1440	1.4537	5.8200	58.7529 (30)
Total net area of external elements Aum(A, m2)			212.8390				(31)
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	57.5437		(33)
Party Wall			63.3960	0.0000	0.0000	54.0300	3425.2859 (32)
Ground Floor Stud			73.3097			5.8200	426.6623 (32c)
1st Floor Stud			103.7514			5.8200	603.8331 (32c)
2nd Floor Stud			31.2878			5.8200	182.0951 (32c)
Internal Floor			64.4900			18.0000	1160.8200 (32d)
Internal Ceiling			64.4900			5.8200	375.3318 (32e)
Heat capacity Cm = Sum(A x k)							(28) ... (30) + (32) + (32a) ... (32e) = 14941.7716 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							146.8046 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.3383 (36)
Total fabric heat loss							(33) + (36) = 70.8820 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	49.2784	48.7550	48.2317	45.6148	45.1736	45.1736	45.1736	45.1736	45.1736	45.1736	46.1382	47.1849 (38)
Average = Sum(39)m / 12 =	120.1604	119.6371	119.1137	116.4969	116.0556	116.0556	116.0556	116.0556	116.0556	116.0556	117.0202	118.0670 (39)
												117.2358 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1806	1.1754	1.1703	1.1446	1.1403	1.1403	1.1403	1.1403	1.1403	1.1403	1.1497	1.1600 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

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

Assumed occupancy												2.7554 (42)
Average daily hot water use (litres/day)												99.6408 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.6049	105.6193	101.6337	97.6480	93.6624	89.6768	89.6768	93.6624	97.6480	101.6337	105.6193	109.6049 (44)
Energy content (annual)	162.5409	142.1593	146.6957	127.8929	122.7163	105.8948	98.1271	112.6023	113.9471	132.7944	144.9554	157.4122 (45)
Distribution loss (46)m = 0.15 x (45)m	24.3811	21.3239	22.0044	19.1839	18.4074	15.8842	14.7191	16.8903	17.0921	19.9192	21.7433	23.6118 (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)
Combi loss	14.1467	12.7665	14.1086	13.6125	14.0324	13.5407	13.9678	14.0097	13.5798	14.0753	13.6607	14.1343 (61)
Total heat required for water heating calculated for each month	176.6876	154.9258	160.8043	141.5054	136.7487	119.4355	112.0949	126.6120	127.5269	146.8696	158.6161	171.5466 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1568 (H8)
Utilisation factor												0.5787 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												99.6408 (H14)
Volume ratio Veff/V												0.7527 (H15)
Solar storage volume factor												0.9432 (H16)
Solar input												-870.4277 (H17)
Solar input	-25.2407	-42.1194	-71.7342	-96.1380	-118.7703	-116.7702	-115.2270	-100.6744	-78.8483	-53.8441	-29.9391	-21.1221 (63)
Solar input (sum of months) = Sum(63)m =												-870.4277 (63)
Output from w/h	151.4469	112.8064	89.0701	45.3674	17.9783	2.6653	0.0000	25.9375	48.6787	93.0256	128.6771	150.4244 (64)
Total per year (kWh/year) = Sum(64)m =												866.0779 (64)
Heat gains from water heating, kWh/month	57.5815	50.4596	52.3035	45.9275	44.3113	38.5952	36.1192	40.9427	41.2824	47.6729	51.6129	55.8732 (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	165.3242	165.3242	165.3242	165.3242	165.3242	165.3242	165.3242	165.3242	165.3242	165.3242	165.3242	165.3242 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.1295	54.2946	44.1554	33.4285	24.9882	21.0961	22.7950	29.6298	39.7691	50.4960	58.9363	62.8284 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	386.8264	390.8404	380.7252	359.1909	332.0079	306.4596	289.3918	285.3778	295.4930	317.0272	344.2103	369.7586 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.2878	54.2878	54.2878	54.2878	54.2878	54.2878	54.2878	54.2878	54.2878	54.2878	54.2878	54.2878 (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)	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162 (71)
Water heating gains (Table 5)	77.3945	75.0887	70.3004	63.7882	59.5581	53.6044	48.5473	55.0305	57.3366	64.0765	71.6845	75.0983 (72)
Total internal gains	637.7463	632.6197	607.5768	568.8035	528.9501	493.5560	473.1301	482.4340	504.9947	543.9957	587.2271	620.0812 (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
North	1.3440	10.6334	0.7600		0.7200	0.7700	5.4194 (74)	
East	6.2880	19.6403	0.7600		0.7200	0.7700	46.8316 (76)	
West	5.2920	19.6403	0.7600		0.7200	0.7700	39.4136 (80)	
East	1.5280	25.9287	0.7600		0.7200	1.0000	19.5116 (82)	

Solar gains	111.1763	218.1081	361.9546	534.0665	661.1929	680.0814	646.1184	550.3294	422.8146	259.4209	138.7063	91.3893 (83)
Total gains	748.9225	850.7278	969.5314	1102.8700	1190.1430	1173.6374	1119.2484	1032.7634	927.8093	803.4166	725.9334	711.4705 (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	34.5413	34.6924	34.8448	35.6275	35.7630	35.7630	35.7630	35.7630	35.7630	35.7630	35.4682	35.1537
alpha	3.3028	3.3128	3.3230	3.3752	3.3842	3.3842	3.3842	3.3842	3.3842	3.3842	3.3645	3.3436
util living area	0.9755	0.9616	0.9298	0.8556	0.7328	0.5758	0.4382	0.4886	0.7121	0.8986	0.9622	0.9789 (86)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

MIT	19.2664	19.4926	19.8753	20.3608	20.7155	20.9080	20.9723	20.9598	20.8077	20.3340	19.7287	19.2419 (87)
Th 2	19.9356	19.9397	19.9438	19.9646	19.9681	19.9681	19.9681	19.9681	19.9681	19.9681	19.9604	19.9521 (88)
util rest of house												
	0.9706	0.9541	0.9159	0.8275	0.6829	0.4997	0.3427	0.3899	0.6416	0.8723	0.9535	0.9748 (89)
MIT 2	18.3708	18.5962	18.9721	19.4483	19.7665	19.9179	19.9581	19.9523	19.8504	19.4375	18.8472	18.3590 (90)
Living area fraction									fLA = Living area / (4) =			0.1187 (91)
MIT	18.4771	18.7026	19.0793	19.5566	19.8791	20.0354	20.0784	20.0719	19.9640	19.5439	18.9518	18.4638 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.3271	18.5526	18.9293	19.4066	19.7291	19.8854	19.9284	19.9219	19.8140	19.3939	18.8018	18.3138 (93)

#### 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9607	0.9413	0.8993	0.8099	0.6701	0.4932	0.3389	0.3852	0.6298	0.8543	0.9407	0.9659 (94)
Useful gains	719.4670	800.7645	871.9067	893.1680	797.5206	578.8094	379.3079	397.8279	584.3627	686.3220	682.9147	687.1811 (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	1685.5017	1633.3559	1480.5026	1223.9900	931.8242	613.4010	386.2840	408.7385	663.1428	1020.5790	1369.3454	1666.3698 (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	718.7298	559.5014	452.7953	238.1918	99.9219	0.0000	0.0000	0.0000	0.0000	248.6872	494.2301	728.5164 (98)
Space heating												3540.5741 (98)
Space heating per m2												(98) / (4) = 34.7865 (99)

#### 8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3912.2366 (211)
Space heating requirement	718.7298	559.5014	452.7953	238.1918	99.9219	0.0000	0.0000	0.0000	0.0000	248.6872	494.2301	728.5164 (98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)
Space heating fuel (main heating system)	794.1766	618.2336	500.3263	263.1954	110.4109	0.0000	0.0000	0.0000	0.0000	274.7925	546.1107	804.9905 (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	151.4469	112.8064	89.0701	45.3674	17.9783	2.6653	0.0000	25.9375	48.6787	93.0256	128.6771	150.4244 (64)
Efficiency of water heater (217)m	89.9263	89.9468	89.9580	89.9724	89.9970	87.3000	87.3000	87.3000	87.3000	89.6058	89.8199	87.3000 (216)
Fuel for water heating, kWh/month	168.4123	125.4146	99.0131	50.4238	19.9766	3.0531	0.0000	29.7108	55.7602	103.8164	143.2612	167.2576 (219)
Water heating fuel used												966.0996 (219)
Annual totals kWh/year												
Space heating fuel - main system												3912.2366 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 6.9550, total flow = 29.0000, SFP = 0.2398)												
mechanical ventilation fans (SFP = 0.2398)												80.1050 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
pump for solar water heating												50.0000 (230g)
Total electricity for the above, kWh/year												205.1050 (231)
Electricity for lighting (calculated in Appendix L)												431.8261 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =										-1727.2394		-1727.2394 (233)
Total delivered energy for all uses												3788.0279 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3912.2366	3.4800	136.1458 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	966.0996	3.4800	33.6203 (247)
Mechanical ventilation fans	80.1050	13.1900	10.5659 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Pump for solar water heating	50.0000	13.1900	6.5950 (249)
Energy for lighting	431.8261	13.1900	56.9579 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			145.9544 (255)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

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 11a. SAP rating - Individual heating systems  
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Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.4176 (257)
SAP value		94.1740
SAP rating (Section 12)		94 (258)
SAP band		A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3912.2366	0.2160	845.0431 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	966.0996	0.2160	208.6775 (264)
Space and water heating			1053.7206 (265)
Pumps and fans	205.1050	0.5190	106.4495 (267)
Energy for lighting	431.8261	0.5190	224.1177 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			487.8506 (272)
CO2 emissions per m2			4.7900 (273)
EI value			95.5463
EI rating			96 (274)
EI band			A

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# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

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

#### 1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	37.2900 (1b)	x 2.6100 (2b)	= 97.3269 (1b) - (3b)
First floor	37.2900 (1c)	x 2.8500 (2c)	= 106.2765 (1c) - (3c)
Second floor	27.2000 (1d)	x 2.5800 (2d)	= 70.1760 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.7800		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 273.7794 (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					5.0100
Infiltration rate					0.2505 (18)
Number of sides sheltered					1 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.2317 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.2433	0.2317	0.2317	0.2143	0.2143	0.1912	0.1970	0.1854	0.1912	0.2027	0.2027	0.2201 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	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
Windows (Uw = 1.40)			12.9200	1.3258	17.1420		(27)
Solid Door			2.1500	1.2000	2.5800		(26)
Roof Window (Uw = 1.40)			1.5300	1.3258	2.0284		(27a)
Flr - Ground			37.2910	0.1500	5.5937	75.6000	2819.1996 (28a)
Wl - Brick	45.0900	7.8480	37.2420	0.2200	8.1932	58.3400	2172.6983 (29a)
Wl - Clad	64.6300	5.7480	58.8820	0.2200	12.9540	58.3400	3435.1759 (29a)
Wl - Dormer	4.2900	1.4760	2.8140	0.4300	1.2100	7.6200	21.4427 (29a)
Wl - Stud Ashlar	21.6080		21.6080	0.1440	3.1116	5.8200	125.7586 (29a)
Rf - Ins Joist	18.9410		18.9410	0.1000	1.8941	5.8200	110.2366 (30)
Rf - Ins Rafter	8.9840	1.5280	7.4560	0.1600	1.1930	1.8000	13.4208 (30)
Rf - Joist over Dormer	1.9000		1.9000	0.1000	0.1900	5.8200	11.0580 (30)
Rf - Ashlar behind Stud	10.0950		10.0950	0.1440	1.4537	5.8200	58.7529 (30)
Total net area of external elements Aum(A, m2)			212.8390				(31)
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	57.5437		(33)
Party Wall			63.3960	0.0000	0.0000	54.0300	3425.2859 (32)
Ground Floor Stud			73.3097			5.8200	426.6623 (32c)
1st Floor Stud			103.7514			5.8200	603.8331 (32c)
2nd Floor Stud			31.2878			5.8200	182.0951 (32c)
Internal Floor			64.4900			18.0000	1160.8200 (32d)
Internal Ceiling			64.4900			5.8200	375.3318 (32e)
Heat capacity Cm = Sum(A x k)						(28) ... (30) + (32) + (32a) ... (32e) =	14941.7716 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							146.8046 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.3383 (36)
Total fabric heat loss						(33) + (36) =	70.8820 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	45.1736	45.1736	45.1736	45.1736	45.1736	45.1736	45.1736	45.1736	45.1736	45.1736	45.1736	45.1736 (38)
Average = Sum(39)m / 12 =	116.0556	116.0556	116.0556	116.0556	116.0556	116.0556	116.0556	116.0556	116.0556	116.0556	116.0556	116.0556 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1403	1.1403	1.1403	1.1403	1.1403	1.1403	1.1403	1.1403	1.1403	1.1403	1.1403	1.1403 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

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

Assumed occupancy												2.7554 (42)
Average daily hot water use (litres/day)												99.6408 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.6049	105.6193	101.6337	97.6480	93.6624	89.6768	89.6768	93.6624	97.6480	101.6337	105.6193	109.6049 (44)
Energy content (annual)	162.5409	142.1593	146.6957	127.8929	122.7163	105.8948	98.1271	112.6023	113.9471	132.7944	144.9554	157.4122 (45)
Distribution loss (46)m = 0.15 x (45)m	24.3811	21.3239	22.0044	19.1839	18.4074	15.8842	14.7191	16.8903	17.0921	19.9192	21.7433	23.6118 (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)
Combi loss	14.1467	12.7665	14.1086	13.6125	14.0324	13.5407	13.9678	14.0097	13.5798	14.0753	13.6607	14.1343 (61)
Total heat required for water heating calculated for each month	176.6876	154.9258	160.8043	141.5054	136.7487	119.4355	112.0949	126.6120	127.5269	146.8696	158.6161	171.5466 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1140.0998 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1915.3676 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2217 (H8)
Utilisation factor												0.5589 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												99.6408 (H14)
Volume ratio Veff/V												0.7527 (H15)
Solar storage volume factor												0.9432 (H16)
Solar input												-887.8172 (H17)
Solar input	-27.3266	-41.0718	-69.1701	-95.6142	-115.1517	-121.1921	-118.2821	-105.6266	-82.4419	-56.0837	-33.2162	-22.6402 (63)
Solar input (sum of months) = Sum(63)m =												-887.8172 (63)
Output from w/h	149.3610	113.8540	91.6343	45.8912	21.5970	0.0000	0.0000	20.9854	45.0850	90.7859	125.4000	148.9063 (64)
Total per year (kWh/year) = Sum(64)m =												853.5001 (64)
Heat gains from water heating, kWh/month	57.5815	50.4596	52.3035	45.9275	44.3113	38.5952	36.1192	40.9427	41.2824	47.6729	51.6129	55.8732 (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	165.3242	165.3242	165.3242	165.3242	165.3242	165.3242	165.3242	165.3242	165.3242	165.3242	165.3242	165.3242 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.1295	54.2946	44.1554	33.4285	24.9882	21.0961	22.7950	29.6298	39.7691	50.4960	58.9363	62.8284 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	386.8264	390.8404	380.7252	359.1909	332.0079	306.4596	289.3918	285.3778	295.4930	317.0272	344.2103	369.7586 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.2878	54.2878	54.2878	54.2878	54.2878	54.2878	54.2878	54.2878	54.2878	54.2878	54.2878	54.2878 (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)	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162	-110.2162 (71)
Water heating gains (Table 5)	77.3945	75.0887	70.3004	63.7882	59.5581	53.6044	48.5473	55.0305	57.3366	64.0765	71.6845	75.0983 (72)
Total internal gains	637.7463	632.6197	607.5768	568.8035	528.9501	493.5560	473.1301	482.4340	504.9947	543.9957	587.2271	620.0812 (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
North	1.3440	11.9814	0.7600		0.7200	0.7700	6.1064 (74)	
East	6.2880	22.3313	0.7600		0.7200	0.7700	53.2484 (76)	
West	5.2920	22.3313	0.7600		0.7200	0.7700	44.8140 (80)	
East	1.5280	29.6355	0.7600		0.7200	1.0000	22.3010 (82)	

Solar gains	126.4698	223.3033	365.6386	554.6278	667.6114	734.2428	690.2826	602.2115	462.5567	283.5127	161.6720	102.9356 (83)
Total gains	764.2160	855.9230	973.2154	1123.4313	1196.5615	1227.7988	1163.4126	1084.6455	967.5514	827.5084	748.8991	723.0168 (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	35.7630	35.7630	35.7630	35.7630	35.7630	35.7630	35.7630	35.7630	35.7630	35.7630	35.7630	35.7630
alpha	3.3842	3.3842	3.3842	3.3842	3.3842	3.3842	3.3842	3.3842	3.3842	3.3842	3.3842	3.3842
util living area	0.9697	0.9551	0.9152	0.8216	0.6662	0.4521	0.3052	0.3364	0.6178	0.8651	0.9506	0.9740 (86)



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

MIT	19.4836	19.6682	20.0556	20.4985	20.8196	20.9654	20.9935	20.9910	20.8965	20.4849	19.9058	19.4330 (87)
Th 2	19.9681	19.9681	19.9681	19.9681	19.9681	19.9681	19.9681	19.9681	19.9681	19.9681	19.9681	19.9681 (88)
util rest of house												
	0.9636	0.9462	0.8981	0.7868	0.6049	0.3665	0.2055	0.2307	0.5315	0.8294	0.9390	0.9687 (89)
MIT 2	18.6097	18.7903	19.1653	19.5774	19.8516	19.9536	19.9668	19.9662	19.9144	19.5769	19.0263	18.5603 (90)
Living area fraction									fLA = Living area / (4) =			0.1187 (91)
MIT	18.7134	18.8945	19.2710	19.6867	19.9665	20.0737	20.0887	20.0878	20.0309	19.6847	19.1307	18.6638 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.5634	18.7445	19.1210	19.5367	19.8165	19.9237	19.9387	19.9378	19.8809	19.5347	18.9807	18.5138 (93)

#### 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9525	0.9326	0.8809	0.7702	0.5952	0.3626	0.2026	0.2275	0.5235	0.8113	0.9244	0.9586	(94)
Useful gains	727.9325	798.1946	857.3486	865.2333	712.1418	445.2506	235.7411	246.8055	506.5452	671.3479	692.3034	693.0876	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W													
	1562.5045	1525.4890	1360.2850	1118.3929	791.0897	455.3651	236.6017	248.1069	543.2474	920.8623	1274.3703	1556.7529	(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													
	620.9216	488.7418	374.1847	182.2750	58.7373	0.0000	0.0000	0.0000	0.0000	185.6387	419.0881	642.5669	(98)
Space heating												2972.1542	(98)
Space heating per m2												(98) / (4) =	29.2018 (99)

#### 8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3284.1483 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	620.9216	488.7418	374.1847	182.2750	58.7373	0.0000	0.0000	0.0000	0.0000	185.6387	419.0881	642.5669	(98)
Space heating efficiency (main heating system 1)													
	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)													
	686.1012	540.0462	413.4638	201.4088	64.9031	0.0000	0.0000	0.0000	0.0000	205.1257	463.0808	710.0187	(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													
	149.3610	113.8540	91.6343	45.8912	21.5970	0.0000	0.0000	20.9854	45.0850	90.7859	125.4000	148.9063	(64)
Efficiency of water heater (217)m													
	89.8613	89.8775	89.8521	89.8377	89.6169	87.3000	87.3000	87.3000	87.3000	89.4235	89.7424	89.8802	(216)
Fuel for water heating, kWh/month													
	166.2128	126.6768	101.9834	51.0823	24.0993	0.0000	0.0000	24.0382	51.6438	101.5236	139.7333	165.6721	(219)
Water heating fuel used													
	952.6656												(219)
Annual totals kWh/year													
Space heating fuel - main system													3284.1483 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans: (MEV)Decentralised, Database: total watage = 6.9550, total flow = 29.0000, SFP = 0.2398													
mechanical ventilation fans (SFP = 0.2398)													80.1050 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													205.1050 (231)
Electricity for lighting (calculated in Appendix L)													431.8261 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1140 * 0.80) =										-1824.1596			-1824.1596 (233)
Total delivered energy for all uses													3049.5854 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3284.1483	3.6300	119.2146	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	952.6656	3.6300	34.5818	(247)
Mechanical ventilation fans	80.1050	19.4400	15.5724	(249)
Pumps and fans for heating	75.0000	19.4400	14.5800	(249)
Pump for solar water heating	50.0000	19.4400	9.7200	(249)
Energy for lighting	431.8261	19.4400	83.9470	(250)
Additional standing charges			95.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	19.4400	-354.6166	(252)
Total energy cost			17.9991	(255)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3284.1483	0.2160	709.3760 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	952.6656	0.2160	205.7758 (264)
Space and water heating			915.1518 (265)
Pumps and fans	205.1050	0.5190	106.4495 (267)
Energy for lighting	431.8261	0.5190	224.1177 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			298.9802 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3284.1483	1.2200	4006.6609 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	952.6656	1.2200	1162.2521 (264)
Space and water heating			5168.9130 (265)
Pumps and fans	205.1050	3.0700	629.6724 (267)
Energy for lighting	431.8261	3.0700	1325.7061 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			1524.1214 (272)
Primary energy kWh/m2/year			14.9747 (273)

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

#### Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	3
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	146.8 (calculated from construction elements)
Night ventilation	Yes
Ventilation rate during hot weather (ach)	4.21 (Calculated rate)

#### Overheating Calculation

Summer ventilation heat loss coefficient	380.31 (P1)
Transmission heat loss coefficient	70.88 (37)
Summer heat loss coefficient	451.19 (P2)

#### Overhangs

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

#### Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	0.850	0.90	1.000	0.765 (P8)
East	0.850	0.90	1.000	0.765 (P8)
East	0.850	1.00	1.000	0.850 (P8)
West	0.850	0.90	1.000	0.765 (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	1.3440	81.1852	0.7600	0.7200	0.7650	41.1080
East	6.2880	117.5071	0.7600	0.7200	0.7650	278.3726
West	5.2920	117.5071	0.7600	0.7200	0.7650	234.2793
East	1.5280	176.6135	0.7600	0.7200	0.8500	112.9678

total: 666.7277

Solar gains	709	667	582	(P3)
Internal gains	491	470	479	
Total summer gains	1200	1137	1061	(P5)
Summer gain/loss ratio	2.66	2.52	2.35	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 146.8)	0.97	0.97	0.97	
Threshold temperature	19.63	21.39	21.12	(P7)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Likelihood of high internal temperature	Not significant	Slight	Slight
Assessment of likelihood of high internal temperature:	Slight		

# BASIC COMPLIANCE REPORT

## Calculation Type: New Build (As Designed)

<b>Property Reference</b>	243 - PRJ012318		<b>Issued on Date</b>	13/07/2022	
<b>Assessment Reference</b>	243 S	<b>Prop Type Ref</b>	Penrith		
<b>Property</b>	243 - PRJ012318				
<b>SAP Rating</b>	84 B	<b>DER</b>	17.04	<b>TER</b>	18.17
<b>Environmental</b>	86 B	<b>% DER&lt;TER</b>	6.20		
<b>CO<sub>2</sub> Emissions (t/year)</b>	1.44	<b>DFEE</b>	48.76	<b>TFEE</b>	56.97
<b>General Requirements Compliance</b>	Pass	<b>% DFEE&lt;TFEE</b>	14.41		
<b>Assessor Details</b>	Chris Nicholls, , Tel: ,			<b>Assessor ID</b>	U903-0001
<b>Client</b>					

### SUMMARY FOR INPUT DATA FOR New Build (As Designed)

#### Criterion 1 – Achieving the TER and TFEE rate

##### 1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.17	kgCO <sub>2</sub> /m <sup>2</sup>	
Dwelling Carbon Dioxide Emission Rate (DER)	17.04	kgCO <sub>2</sub> /m <sup>2</sup>	Pass
	-1.13 (-6.2%)	kgCO <sub>2</sub> /m <sup>2</sup>	

##### 1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	56.97	kWh/m <sup>2</sup> /yr	
Dwelling Fabric Energy Efficiency (DFEE)	48.76	kWh/m <sup>2</sup> /yr	
	-8.2 (-14.4%)	kWh/m <sup>2</sup> /yr	Pass

#### Criterion 2 – Limits on design flexibility

##### Limiting Fabric Standards

##### 2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.43 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	Pass
Roof	0.12 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.37 (max. 2.00)	1.40 (max. 3.30)	Pass

##### 2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

##### 3 Air permeability

Air permeability at 50 pascals	5.01 (design value)	
Maximum	10.0	Pass

##### Limiting System Efficiencies

##### 4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Ideal LOGIC COMBI ESP1 35 Combi boiler Efficiency: 89.6% SEDBUK2009 Minimum: 88.0%	Pass
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# BASIC COMPLIANCE REPORT

## Calculation Type: New Build (As Designed)

Secondary heating system

None

### 5 Cylinder insulation

Hot water storage

No cylinder

### 6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

### 7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

### 8 Mechanical ventilation

Continuous extract system (decentralised)

Specific fan power

0.1900 0.1800

Maximum

0.7

Pass

## Criterion 3 – Limiting the effects of heat gains in summer

### 9 Summertime temperature

Overheating risk (Thames Valley)

Slight

Pass

Based on:

Overshading

Average

Windows facing North

1.34 m<sup>2</sup>, No overhang

Windows facing East

6.29 m<sup>2</sup>, No overhang

Windows facing West

5.29 m<sup>2</sup>, No overhang

Air change rate

4.21 ach

Blinds/curtains

Dark-coloured curtain or roller blind, closed 100% of daylight hours

## Criterion 4 – Building performance consistent with DER and DFEE rate

### Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m<sup>2</sup>K

Pass

### Air permeability and pressure testing

#### 3 Air permeability

Air permeability at 50 pascals

5.01 (design value)

Maximum

10.0

Pass

### 10 Key features

External wall U-value

0.14

W/m<sup>2</sup>K

Party wall U-value

0.00

W/m<sup>2</sup>K

Roof U-value

0.10

W/m<sup>2</sup>K

Roof U-value

0.10

W/m<sup>2</sup>K