

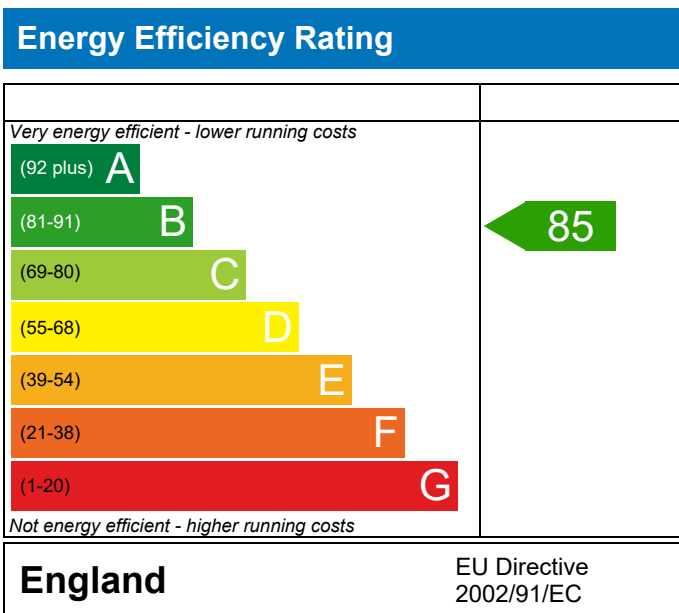
# PREDICTED ENERGY ASSESSMENT

041 - PRJ012701

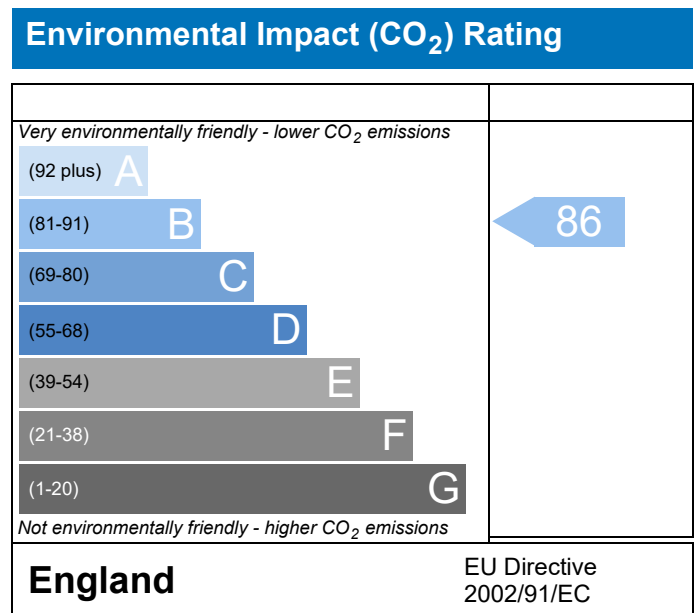
Dwelling type: House, End-Terrace  
 Date of assessment: 23/09/2022  
 Produced by: Gareth Thomas  
 Total floor area: 111.38 m<sup>2</sup>

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	041 - PRJ012701			Issued on Date	23/09/2022
Assessment Reference	041 E	Prop Type Ref	3D		
Property	041 - PRJ012701				
SAP Rating	85 B	DER	16.03	TER	16.65
Environmental	86 B	% DER<TER	3.72		
CO <sub>2</sub> Emissions (t/year)	1.46	DFEE	46.47	TFEE	52.80
General Requirements Compliance	Pass	% DFEE<TFEE	11.99		
Assessor Details	Chris Nicholls, , Tel: ,			Assessor ID	W933-0001
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

End-Terrace House, total floor area 111 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) 16.65 kgCO<sub>2</sub>/m<sup>2</sup>  
Dwelling Carbon Dioxide Emission Rate (DER) 16.03 kgCO<sub>2</sub>/m<sup>2</sup>OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 52.8 kWh/m<sup>2</sup>/yr  
Dwelling Fabric Energy Efficiency (DFEE) 46.5 kWh/m<sup>2</sup>/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (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	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.38 (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 ESP1 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

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading:

Average

Windows facing North:

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

Windows facing East:

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

Windows facing South:

9.52 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

Party wall U-value

0.00 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 (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	55.6900 (1b)	2.4000 (2b)	133.6560 (1b) - (3b)
First floor	55.6900 (1c)	2.7600 (2c)	153.7044 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.3800		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 287.3604 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m <sup>3</sup> per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				4 * 10 =	40.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1392 (8)							
Pressure test					Yes							
Measured/design AP50					5.0100							
Infiltration rate					0.3897 (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) =	0.3605 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4596	0.4506	0.4416	0.3965	0.3875	0.3424	0.3424	0.3334	0.3605	0.3875	0.4055	0.4236 (22b)
Effective ac	0.6056	0.6015	0.5975	0.5786	0.5751	0.5586	0.5586	0.5556	0.5650	0.5751	0.5822	0.5897 (25)

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

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K
Windows (Uw = 1.40)			26.2600	1.3258	34.8011		(27)
Solid Door			2.1300	1.2000	2.5560		(26)
Flr - Ground			55.6850	0.1500	8.3528	75.6000	4209.7860 (28a)
Wl - Brick	111.7400	28.3910	83.3490	0.2500	20.8373	51.1800	4265.8018 (29a)
RF - Ins Joist	55.6850		55.6850	0.1000	5.5685	5.8200	324.0867 (30)
Total net area of external elements Aum(A, m <sup>2</sup> )			223.0990				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	72.1156		(33)
Party Wall			47.5450	0.0000	0.0000	54.0300	2568.8564 (32)
Ground Floor Block			49.8672			54.0300	2694.3248 (32c)
Ground Floor Stud			40.1424			5.8200	233.6288 (32c)
1st Floor Stud			136.2833			5.8200	793.1687 (32c)
Internal Floor			55.6800			18.0000	1002.2400 (32d)
Internal Ceiling			55.6800			5.8200	324.0576 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16415.9507 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							147.3869 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.2820 (36)
Total fabric heat loss							(33) + (36) = 86.3977 (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	57.4299	57.0410	56.6598	54.8693	54.5343	52.9748	52.9748	52.6860	53.5755	54.5343	55.2120	55.9205 (38)
Average = Sum(39)m / 12 =	143.8276	143.4387	143.0575	141.2669	140.9319	139.3724	139.3724	139.0836	139.9731	140.9319	141.6096	142.3182 (39)
HLP	1.2913	1.2878	1.2844	1.2683	1.2653	1.2513	1.2513	1.2487	1.2567	1.2653	1.2714	1.2778 (40)
HLP (average)												1.2683 (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												2.8229 (42)
Average daily hot water use (litres/day)												101.2429 (43)
Daily hot water use	111.3672	107.3175	103.2678	99.2181	95.1684	91.1186	91.1186	95.1684	99.2181	103.2678	107.3175	111.3672 (44)
Energy conte	165.1544	144.4451	149.0544	129.9492	124.6894	107.5974	99.7049	114.4128	115.7792	134.9295	147.2861	159.9432 (45)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Energy content (annual)													Total = Sum(45)m =	1592.9456 (45)
Distribution loss (46)m = 0.15 x (45)m														
	24.7732	21.6668	22.3582	19.4924	18.7034	16.1396	14.9557	17.1619	17.3669	20.2394	22.0929	23.9915	23.9915	(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	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	0.0000	(57)
Combi loss	14.1529	12.7719	14.1143	13.6222	14.0414	13.5481	13.9746	14.0179	13.5885	14.0804	13.6663	14.1404	14.1404	(61)
Total heat required for water heating calculated for each month	179.3073	157.2170	163.1687	143.5715	138.7307	121.1455	113.6795	128.4307	129.3677	149.0099	160.9524	174.0836	174.0836	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =													0.0000 (63)	
Output from w/h	179.3073	157.2170	163.1687	143.5715	138.7307	121.1455	113.6795	128.4307	129.3677	149.0099	160.9524	174.0836	174.0836	(64)
Total per year (kWh/year) = Sum(64)m =													1758.6646 (64)	
Heat gains from water heating, kWh/month	58.4521	51.2210	53.0892	46.6137	44.9696	39.1632	36.6455	41.5467	41.8937	48.3842	52.3892	56.7162	56.7162	(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	141.1430	141.1430	141.1430	141.1430	141.1430	141.1430	141.1430	141.1430	141.1430	141.1430	141.1430	141.1430	141.1430	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.3849	21.6584	17.6138	13.3348	9.9679	8.4153	9.0931	11.8195	15.8641	20.1431	23.5100	25.0626	25.0626	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	273.5240	276.3623	269.2098	253.9830	234.7619	216.6968	204.6282	201.7899	208.9424	224.1692	243.3903	261.4554	261.4554	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1143	37.1143	37.1143	37.1143	37.1143	37.1143	37.1143	37.1143	37.1143	37.1143	37.1143	37.1143	37.1143	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	(71)
Water heating gains (Table 5)	78.5646	76.2217	71.3564	64.7412	60.4430	54.3933	49.2547	55.8424	58.1857	65.0325	72.7628	76.2315	76.2315	(72)
Total internal gains	444.8163	442.5853	426.5229	400.4019	373.5157	347.8484	331.3189	337.7947	351.3351	377.6877	408.0060	431.0923	431.0923	(73)

#### 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W								
North	4.4940	10.6334	0.5000	0.0000	0.7700	18.3978 (74)								
East	12.2420	19.6403	0.5000	0.0000	0.7700	92.5679 (76)								
South	9.5240	46.7521	0.5000	0.0000	0.7700	171.4277 (78)								
Solar gains	282.3934	496.9959	715.5922	935.0967	1083.4999	1089.3860	1044.7336	933.3517	792.2583	559.5418	341.3176	239.5899	239.5899	(83)
Total gains	727.2097	939.5812	1142.1151	1335.4987	1457.0156	1437.2344	1376.0525	1271.1464	1143.5934	937.2295	749.3235	670.6823	670.6823	(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	31.7045	31.7905	31.8752	32.2792	32.3559	32.7180	32.7180	32.7859	32.5776	32.3559	32.2011	32.0408	32.0408	
alpha	3.1136	3.1194	3.1250	3.1519	3.1571	3.1812	3.1812	3.1857	3.1718	3.1571	3.1467	3.1361	3.1361	
util living area	0.9830	0.9632	0.9239	0.8433	0.7178	0.5609	0.4261	0.4736	0.6927	0.8959	0.9698	0.9866	0.9866	(86)
MIT	18.9714	19.3099	19.7724	20.2946	20.6795	20.8957	20.9673	20.9540	20.7893	20.2421	19.4992	18.9134	18.9134	(87)
Th 2	19.8476	19.8504	19.8531	19.8657	19.8681	19.8792	19.8792	19.8812	19.8749	19.8681	19.8633	19.8583	19.8583	(88)
util rest of house	0.9794	0.9557	0.9084	0.8122	0.6639	0.4803	0.3254	0.3698	0.6167	0.8676	0.9624	0.9837	0.9837	(89)
MIT 2	18.0152	18.3502	18.8018	19.3039	19.6455	19.8240	19.8679	19.8641	19.7498	19.2713	18.5503	17.9654	17.9654	(90)
Living area fraction													fLA = Living area / (4) =	
MIT	18.2150	18.5507	19.0046	19.5109	19.8615	20.0479	20.0976	20.0918	19.9670	19.4741	18.7486	18.1635	18.1635	(92)
Temperature adjustment													-0.1500	
adjusted MIT	18.0650	18.4007	18.8546	19.3609	19.7115	19.8979	19.9476	19.9418	19.8170	19.3241	18.5986	18.0135	18.0135	(93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	706.5246	886.1884	1018.4524	1063.1693	955.2326	692.3860	456.5753	477.5977	700.2599	797.4303	712.6809	655.3456	655.3456	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	4.2000	(96)
Heat loss rate W	1979.7840	1936.5229	1767.4165	1477.7808	1129.0763	738.3749	466.5645	492.6058	800.2244	1229.5082	1628.3115	1965.9049	1965.9049	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	947.3050	705.8248	557.2293	298.5203	129.3397	0.0000	0.0000	0.0000	0.0000	321.4660	659.2540	975.0561	975.0561	(98)
Space heating													4593.9952 (98)	
Space heating per m2													(98) / (4) =	41.2461 (99)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5076.2378 (211)
Space heating requirement	947.3050	705.8248	557.2293	298.5203	129.3397	0.0000	0.0000	0.0000	0.0000	321.4660	659.2540	975.0561	(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)	1046.7458	779.9169	615.7229	329.8567	142.9168	0.0000	0.0000	0.0000	0.0000	355.2110	728.4575	1077.4101	(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	179.3073	157.2170	163.1687	143.5715	138.7307	121.1455	113.6795	128.4307	129.3677	149.0099	160.9524	174.0836	(64)
Efficiency of water heater (217)m	89.9751	89.8997	89.7548	89.4354	88.8152	87.3000	87.3000	87.3000	87.3000	89.4614	89.8537	90.0002	(217)
Fuel for water heating, kWh/month	199.2855	174.8805	181.7938	160.5310	156.2016	138.7692	130.2170	147.1142	148.1875	166.5634	179.1272	193.4257	(219)
Water heating fuel used													1976.0965 (219)
Annual totals kWh/year													
Space heating fuel - main system													5076.2378 (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)													430.6443 (232)
Total delivered energy for all uses													7557.9786 (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	5076.2378	0.2160	1096.4674	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1976.0965	0.2160	426.8369	(264)
Space and water heating			1523.3042	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	430.6443	0.5190	223.5044	(268)
Total CO2, kg/year			1785.7336	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.0300	(273)

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

DER			16.0300	ZC1
Total Floor Area		TFA	111.3800	
Assumed number of occupants		N	2.8229	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			14.5524	ZC2
CO2 emissions from cooking, equation (L16)			1.6767	ZC3
Total CO2 emissions			32.2591	ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000	ZC5
Additional allowable electricity generation, kWh/m <sup>2</sup> /year			0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000	ZC7
Net CO2 emissions			32.2591	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 (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	55.6900 (1b)	2.4000 (2b)	133.6560 (1b) - (3b)
First floor	55.6900 (1c)	2.7600 (2c)	153.7044 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.3800		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 287.3604 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m <sup>3</sup> per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				4 * 10 =	40.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1392 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3892 (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) =		0.3600 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4590	0.4500	0.4410	0.3960	0.3870	0.3420	0.3420	0.3330	0.3600	0.3870	0.4050	0.4230 (22b)
Effective ac	0.6053	0.6013	0.5972	0.5784	0.5749	0.5585	0.5585	0.5554	0.5648	0.5749	0.5820	0.5895 (25)

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

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K					
TER Opaque door			2.1300	1.0000	2.1300		(26)					
TER Opening Type (Uw = 1.40)			25.7200	1.3258	34.0985		(27)					
Flr - Ground			55.6850	0.1300	7.2391		(28a)					
Wl - Brick	111.7400	27.8510	83.8890	0.1800	15.1000		(29a)					
RF - Ins Joist	55.6850		55.6850	0.1300	7.2391		(30)					
Total net area of external elements Aum(A, m <sup>2</sup> )			223.1090				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	65.8066	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.6000 (36)					
Total fabric heat loss							(33) + (36) = 78.4066 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 57.4042	Feb 57.0163	Mar 56.6361	Apr 54.8502	May 54.5160	Jun 52.9605	Jul 52.9605	Aug 52.6724	Sep 53.5597	Oct 54.5160	Nov 55.1920	Dec 55.8987 (38)
Heat transfer coeff	135.8109	135.4229	135.0427	133.2568	132.9226	131.3671	131.3671	131.0791	131.9663	132.9226	133.5986	134.3053 (39)
Average = Sum(39)m / 12 =												133.2552 (39)
HLP	Jan 1.2193	Feb 1.2159	Mar 1.2125	Apr 1.1964	May 1.1934	Jun 1.1794	Jul 1.1794	Aug 1.1769	Sep 1.1848	Oct 1.1934	Nov 1.1995	Dec 1.2058 (40)
HLP (average)												1.1964 (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												2.8229 (42)
Average daily hot water use (litres/day)												101.2429 (43)
Daily hot water use	111.3672	107.3175	103.2678	99.2181	95.1684	91.1186	91.1186	95.1684	99.2181	103.2678	107.3175	111.3672 (44)
Energy conte	165.1544	144.4451	149.0544	129.9492	124.6894	107.5974	99.7049	114.4128	115.7792	134.9295	147.2861	159.9432 (45)
Energy content (annual)												Total = Sum(45)m = 1592.9456 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	24.7732	21.6668	22.3582	19.4924	18.7034	16.1396	14.9557	17.1619	17.3669	20.2394	22.0929	23.9915 (46)
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												

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)	
Total heat required for water heating calculated for each month	50.9589	46.0274	50.9589	48.9295	48.4968	44.9352	46.4331	48.4968	48.9295	50.9589	49.3151	50.9589	49.3151	50.9589	49.3151	50.9589	49.3151	50.9589	49.3151	50.9589	49.3151	50.9589	49.3151	(61)
Solar input	216.1133	190.4725	200.0133	178.8787	173.1861	152.5327	146.1379	162.9095	164.7087	185.8884	196.6012	210.9021	210.9021	210.9021	210.9021	210.9021	210.9021	210.9021	210.9021	210.9021	210.9021	210.9021	210.9021	(62)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Heat gains from water heating, kWh/month	216.1133	190.4725	200.0133	178.8787	173.1861	152.5327	146.1379	162.9095	164.7087	185.8884	196.6012	210.9021	210.9021	210.9021	210.9021	210.9021	210.9021	210.9021	210.9021	210.9021	210.9021	210.9021	210.9021	(64)
	67.6536	59.5348	62.3003	55.4405	53.5834	47.0100	44.7601	50.1664	50.7290	57.6038	61.3014	65.9208	65.9208	65.9208	65.9208	65.9208	65.9208	65.9208	65.9208	65.9208	65.9208	65.9208	65.9208	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	141.1430	141.1430	141.1430	141.1430	141.1430	141.1430	141.1430	141.1430	141.1430	141.1430	141.1430	141.1430	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.3849	21.6584	17.6138	13.3348	9.9679	8.4153	9.0931	11.8195	15.8641	20.1431	23.5100	25.0626	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	273.5240	276.3623	269.2098	253.9830	234.7619	216.6968	204.6282	201.7899	208.9424	224.1692	243.3903	261.4554	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1143	37.1143	37.1143	37.1143	37.1143	37.1143	37.1143	37.1143	37.1143	37.1143	37.1143	37.1143	(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)	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	(71)
Water heating gains (Table 5)	90.9322	88.5935	83.7370	77.0007	72.0207	65.2916	60.1615	67.4280	70.4569	77.4245	85.1408	88.6033	(72)
Total internal gains	457.1839	454.9571	438.9035	412.6614	385.0935	358.7467	342.2257	349.3803	363.6063	390.0797	420.3840	443.4641	(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	(74)				
North	4.4000	10.6334	0.6300	0.7000	0.7700	14.2987			(74)				
East	11.9900	19.6403	0.6300	0.7000	0.7700	71.9678			(76)				
South	9.3300	46.7521	0.6300	0.7000	0.7700	133.3074			(78)				
Solar gains	219.5739	386.4330	556.3895	727.0438	842.4155	846.9866	812.2719	725.6821	615.9939	435.0620	265.3894	186.2928	(83)
Total gains	676.7578	841.3901	995.2930	1139.7052	1227.5089	1205.7332	1154.4976	1075.0624	979.6001	825.1416	685.7734	629.7569	(84)

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

Temperature during heating periods in the living area from Table 9, Thl (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	0.9979	0.9937	0.9808	0.9378	0.8328	0.6568	0.4922	0.5462	0.7990	0.9659	0.9950	0.9985	(86)
MIT	19.6738	19.8800	20.1813	20.5454	20.8211	20.9590	20.9918	20.9868	20.8929	20.5102	20.0184	19.6415	(87)
Th 2	19.9046	19.9073	19.9101	19.9229	19.9253	19.9365	19.9365	19.9386	19.9322	19.9253	19.9204	19.9153	(88)
util rest of house	0.9971	0.9915	0.9740	0.9159	0.7786	0.5639	0.3776	0.4275	0.7178	0.9495	0.9930	0.9980	(89)
MIT 2	18.1429	18.4452	18.8825	19.4024	19.7567	19.9105	19.9336	19.9334	19.8506	19.3664	18.6575	18.1033	(90)
Living area fraction	18.4628	18.7450	19.1539	19.6412	19.9790	20.1296	20.1547	20.1535	20.0683	19.6054	18.9418	18.4247	(92)
MIT	18.4628	18.7450	19.1539	19.6412	19.9790	20.1296	20.1547	20.1535	20.0683	19.6054	18.9418	18.4247	(92)
Temperature adjustment													0.0000
adjusted MIT	18.4628	18.7450	19.1539	19.6412	19.9790	20.1296	20.1547	20.1535	20.0683	19.6054	18.9418	18.4247	(93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(94)
Useful gains	673.8265	831.4479	963.1790	1035.8780	959.4524	701.3538	463.7366	486.3052	714.5559	778.1353	679.0374	627.7902	(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	1923.4559	1874.9278	1708.8107	1431.3349	1100.4709	726.4011	466.9733	492.0013	787.6168	1197.0211	1582.0464	1910.4473	(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	929.7243	701.2185	554.7500	284.7290	104.9177	0.0000	0.0000	0.0000	0.0000	311.6510	650.1665	954.2969	(98)
Space heating												4491.4539	(98)
Space heating per m2												40.3255	(99)

#### 8c. Space cooling requirement

Not applicable



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

#### 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													4808.8371 (211)
Space heating requirement	929.7243	701.2185	554.7500	284.7290	104.9177	0.0000	0.0000	0.0000	0.0000	311.6510	650.1665	954.2969	(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)	995.4221	750.7692	593.9507	304.8490	112.3316	0.0000	0.0000	0.0000	0.0000	333.6735	696.1097	1021.7312	(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	216.1133	190.4725	200.0133	178.8787	173.1861	152.5327	146.1379	162.9095	164.7087	185.8884	196.6012	210.9021	(64)
Efficiency of water heater (217)m	88.3052	88.0347	87.4840	86.2159	83.8336	80.3000	80.3000	80.3000	80.3000	86.3425	87.8350	88.3878	(216)
Fuel for water heating, kWh/month	244.7346	216.3606	228.6283	207.4776	206.5833	189.9535	181.9899	202.8761	205.1167	215.2919	223.8303	238.6101	(219)
Water heating fuel used												2561.4528	(219)
Annual totals kWh/year													
Space heating fuel - main system													4808.8371 (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)													430.6443 (232)
Total delivered energy for all uses													7875.9342 (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	4808.8371	0.2160	1038.7088 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2561.4528	0.2160	553.2738 (264)
Space and water heating			1591.9826 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	430.6443	0.5190	223.5044 (268)
Total CO2, kg/m2/year			1854.4120 (272)
Emissions per m2 for space and water heating			14.2933 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.0067 (272b)
Emissions per m2 for pumps and fans			0.3495 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.2933 * 1.00) + 2.0067 + 0.3495, rounded to 2 d.p.			16.6500 (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	55.6900 (1b)	2.4000 (2b)	133.6560 (1b) - (3b)
First floor	55.6900 (1c)	2.7600 (2c)	153.7044 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.3800		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 287.3604 (5)
Dwelling volume			

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				4 * 10 =	40.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1392 (8)							
Pressure test					Yes							
Measured/design AP50					5.0100							
Infiltration rate					0.3897 (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) =	0.3605 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4596	0.4506	0.4416	0.3965	0.3875	0.3424	0.3424	0.3334	0.3605	0.3875	0.4055	0.4236 (22b)
	0.6056	0.6015	0.5975	0.5786	0.5751	0.5586	0.5586	0.5556	0.5650	0.5751	0.5822	0.5897 (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)			26.2600	1.3258	34.8011		(27)
Solid Door			2.1300	1.2000	2.5560		(26)
Flr - Ground			55.6850	0.1500	8.3528	75.6000	4209.7860 (28a)
Wl - Brick	111.7400	28.3910	83.3490	0.2500	20.8373	51.1800	4265.8018 (29a)
RF - Ins Joist	55.6850		55.6850	0.1000	5.5685	5.8200	324.0867 (30)
Total net area of external elements Aum(A, m2)			223.0990				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	72.1156	(33)
Party Wall			47.5450	0.0000	0.0000	54.0300	2568.8564 (32)
Ground Floor Block			49.8672			54.0300	2694.3248 (32c)
Ground Floor Stud			40.1424			5.8200	233.6288 (32c)
1st Floor Stud			136.2833			5.8200	793.1687 (32c)
Internal Floor			55.6800			18.0000	1002.2400 (32d)
Internal Ceiling			55.6800			5.8200	324.0576 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16415.9507 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							147.3869 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.2820 (36)
Total fabric heat loss							(33) + (36) = 86.3977 (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	57.4299	57.0410	56.6598	54.8693	54.5343	52.9748	52.9748	52.6860	53.5755	54.5343	55.2120	55.9205 (38)
Average = Sum(39)m / 12 =	143.8276	143.4387	143.0575	141.2669	140.9319	139.3724	139.3724	139.0836	139.9731	140.9319	141.6096	142.3182 (39)
												141.2653 (39)
HLP	1.2913	1.2878	1.2844	1.2683	1.2653	1.2513	1.2513	1.2487	1.2567	1.2653	1.2714	1.2778 (40)
HLP (average)												1.2683 (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												2.8229 (42)
Average daily hot water use (litres/day)												101.2429 (43)
Daily hot water use	111.3672	107.3175	103.2678	99.2181	95.1684	91.1186	91.1186	95.1684	99.2181	103.2678	107.3175	111.3672 (44)
Energy conte	165.1544	144.4451	149.0544	129.9492	124.6894	107.5974	99.7049	114.4128	115.7792	134.9295	147.2861	159.9432 (45)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)													Total = Sum(45)m =	1592.9456 (45)									
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water storage loss:																							
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Heat gains from water heating, kWh/month	35.0953	30.6946	31.6741	27.6142	26.4965	22.8645	21.1873	24.3127	24.6031	28.6725	31.2983	33.9879	65										

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	141.1430	141.1430	141.1430	141.1430	141.1430	141.1430	141.1430	141.1430	141.1430	141.1430	141.1430	141.1430	141.1430
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	24.3849	21.6584	17.6138	13.3348	9.9679	8.4153	9.0931	11.8195	15.8641	20.1431	23.5100	25.0626	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	273.5240	276.3623	269.2098	253.9830	234.7619	216.6968	204.6282	201.7899	208.9424	224.1692	243.3903	261.4554	(68)
Pumps, fans	37.1143	37.1143	37.1143	37.1143	37.1143	37.1143	37.1143	37.1143	37.1143	37.1143	37.1143	37.1143	(69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Water heating gains (Table 5)	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	(71)
Total internal gains	47.1711	45.6765	42.5727	38.3531	35.6136	31.7562	28.4775	32.6784	34.1710	38.5383	43.4699	45.6827	(72)
	410.4228	409.0401	394.7392	371.0138	345.6863	322.2112	307.5417	311.6307	324.3204	348.1935	375.7130	397.5436	(73)

#### 6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains							
	m2	Table 6a	Specific data	Specific data	factor	W							
		W/m2	or Table 6b	or Table 6c	Table 6d								
North	4.4940	10.6334	0.5000	0.0000	0.7700	18.3978 (74)							
East	12.2420	19.6403	0.5000	0.0000	0.7700	92.5679 (76)							
South	9.5240	46.7521	0.5000	0.0000	0.7700	171.4277 (78)							
Solar gains	282.3934	496.9959	715.5922	935.0967	1083.4999	1089.3860	1044.7336	933.3517	792.2583	559.5418	341.3176	239.5899	(83)
Total gains	692.8162	906.0360	1110.3313	1306.1105	1429.1862	1411.5972	1352.2753	1244.9824	1116.5787	907.7354	717.0306	637.1335	(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	31.7045	31.7905	31.8752	32.2792	32.3559	32.7180	32.7180	32.7859	32.5776	32.3559	32.2011	32.0408	
alpha	3.1136	3.1194	3.1250	3.1519	3.1571	3.1812	3.1812	3.1857	3.1718	3.1571	3.1467	3.1361	
util living area	0.9851	0.9665	0.9287	0.8498	0.7256	0.5686	0.4327	0.4820	0.7026	0.9029	0.9731	0.9884	(86)
MIT	18.9325	19.2745	19.7434	20.2750	20.6688	20.8914	20.9658	20.9517	20.7800	20.2178	19.4642	18.8748	(87)
Th 2	19.8476	19.8504	19.8531	19.8657	19.8681	19.8792	19.8792	19.8812	19.8749	19.8681	19.8633	19.8583	(88)
util rest of house	0.9819	0.9595	0.9140	0.8195	0.6720	0.4876	0.3308	0.3769	0.6270	0.8760	0.9664	0.9858	(89)
MIT 2	17.9768	18.3158	18.7745	19.2866	19.6372	19.8215	19.8674	19.8631	19.7436	19.2495	18.5163	17.9272	(90)
Living area fraction													fLA = Living area / (4) =
MIT	18.1765	18.5161	18.9769	19.4931	19.8528	20.0451	20.0969	20.0905	19.9601	19.4518	18.7143	18.1252	(92)
Temperature adjustment													0.0000
adjusted MIT	18.1765	18.5161	18.9769	19.4931	19.8528	20.0451	20.0969	20.0905	19.9601	19.4518	18.7143	18.1252	(93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9755	0.9490	0.9002	0.8080	0.6712	0.5003	0.3513	0.3975	0.6333	0.8639	0.9573	0.9805	(94)
Ext temp.	675.8203	859.8403	999.4987	1055.3913	959.3165	706.2345	475.0660	494.9091	707.1831	784.1772	686.3823	624.7102	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1995.8195	1953.0772	1784.9127	1496.4599	1148.9833	758.8903	487.3675	513.2933	820.2613	1247.4990	1644.7002	1981.8081	(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	982.0795	734.6552	584.3480	317.5694	141.1121	0.0000	0.0000	0.0000	0.0000	344.7114	689.9888	1009.6808	(98)
Space heating per m2													(98) / (4) =
													43.1329 (99)

#### 8c. Space cooling requirement

Calculated for June, July and August. See Table 10b													
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
	0.0000	0.0000	0.0000	0.0000	0.0000	1310.1008	1031.3560	1057.0356	0.0000	0.0000	0.0000	0.0000	(100)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8592	0.9071	0.8848	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1125.5749	935.5548	935.2642	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1760.7482	1688.9599	1565.5539	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	457.3248	560.5333	468.9355	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1486.7936	(104)
Cooled fraction												1.0000	(105)
Intermittency factor (Table 10b)													
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	114.3312	140.1333	117.2339	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												371.6984	(107)
Space cooling per m2												3.3372	(108)
Energy for space heating												43.1329	(99)
Energy for space cooling												3.3372	(108)
Total												46.4701	(109)
Dwelling Fabric Energy Efficiency (DFEE)												46.5	(109)

-----

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

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

#### 1. Overall dwelling dimensions

	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	55.6900 (1b)	2.4000 (2b)	133.6560 (1b) - (3b)
First floor	55.6900 (1c)	2.7600 (2c)	153.7044 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.3800		(3a) + (3b) + (3c) + (3d) + (3e)...(3n) = 287.3604 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m <sup>3</sup> per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				4 * 10 =	40.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1392 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3892 (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) =	0.3600 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4590	0.4500	0.4410	0.3960	0.3870	0.3420	0.3420	0.3330	0.3600	0.3870	0.4050	0.4230 (22b)
Effective ac	0.6053	0.6013	0.5972	0.5784	0.5749	0.5585	0.5585	0.5554	0.5648	0.5749	0.5820	0.5895 (25)

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

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K					
TER Opaque door			2.1300	1.0000	2.1300		(26)					
TER Opening Type (Uw = 1.40)			25.7200	1.3258	34.0985		(27)					
Flr - Ground			55.6850	0.1300	7.2391		(28a)					
Wl - Brick	111.7400	27.8510	83.8890	0.1800	15.1000		(29a)					
RF - Ins Joist	55.6850		55.6850	0.1300	7.2391		(30)					
Total net area of external elements Aum(A, m <sup>2</sup> )			223.1090				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 65.8066		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.6000 (36)					
Total fabric heat loss							(33) + (36) = 78.4066 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 57.4042	Feb 57.0163	Mar 56.6361	Apr 54.8502	May 54.5160	Jun 52.9605	Jul 52.9605	Aug 52.6724	Sep 53.5597	Oct 54.5160	Nov 55.1920	Dec 55.8987 (38)
Heat transfer coeff	135.8109	135.4229	135.0427	133.2568	132.9226	131.3671	131.3671	131.0791	131.9663	132.9226	133.5986	134.3053 (39)
Average = Sum(39)m / 12 =												133.2552 (39)
HLP	Jan 1.2193	Feb 1.2159	Mar 1.2125	Apr 1.1964	May 1.1934	Jun 1.1794	Jul 1.1794	Aug 1.1769	Sep 1.1848	Oct 1.1934	Nov 1.1995	Dec 1.2058 (40)
HLP (average)												1.1964 (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												2.8229 (42)
Average daily hot water use (litres/day)												101.2429 (43)
Daily hot water use	111.3672	107.3175	103.2678	99.2181	95.1684	91.1186	91.1186	95.1684	99.2181	103.2678	107.3175	111.3672 (44)
Energy conte	165.1544	144.4451	149.0544	129.9492	124.6894	107.5974	99.7049	114.4128	115.7792	134.9295	147.2861	159.9432 (45)
Energy content (annual)												Total = Sum(45)m = 1592.9456 (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												

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	35.0953	30.6946	31.6741	27.6142	26.4965	22.8645	21.1873	24.3127	24.6031	28.6725	31.2983	33.9879	(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	141.1430	141.1430	141.1430	141.1430	141.1430	141.1430	141.1430	141.1430	141.1430	141.1430	141.1430	141.1430	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.3849	21.6584	17.6138	13.3348	9.9679	8.4153	9.0931	11.8195	15.8641	20.1431	23.5100	25.0626	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	273.5240	276.3623	269.2098	253.9830	234.7619	216.6968	204.6282	201.7899	208.9424	224.1692	243.3903	261.4554	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1143	37.1143	37.1143	37.1143	37.1143	37.1143	37.1143	37.1143	37.1143	37.1143	37.1143	37.1143	(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)	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	(71)
Water heating gains (Table 5)	47.1711	45.6765	42.5727	38.3531	35.6136	31.7562	28.4775	32.6784	34.1710	38.5383	43.4699	45.6827	(72)
Total internal gains	410.4228	409.0401	394.7392	371.0138	345.6863	322.2112	307.5417	311.6307	324.3204	348.1935	375.7130	397.5436	(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	4.4000	10.6334	0.6300	0.7000	0.7700	14.2987 (74)							
East	11.9900	19.6403	0.6300	0.7000	0.7700	71.9678 (76)							
South	9.3300	46.7521	0.6300	0.7000	0.7700	133.3074 (78)							
Solar gains	219.5739	386.4330	556.3895	727.0438	842.4155	846.9866	812.2719	725.6821	615.9939	435.0620	265.3894	186.2928	(83)
Total gains	629.9968	795.4731	951.1286	1098.0576	1188.1018	1169.1978	1119.8137	1037.3128	940.3142	783.2555	641.1025	583.8364	(84)

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

Temperature during heating periods in the living area from Table 9, Thl (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)	0.9984	0.9950	0.9839	0.9451	0.8459	0.6727	0.5064	0.5638	0.8171	0.9719	0.9963	0.9989	(86)
MIT	19.6352	19.8428	20.1477	20.5195	20.8067	20.9545	20.9908	20.9848	20.8808	20.4804	19.9819	19.6034	(87)
Th 2	19.9046	19.9073	19.9101	19.9229	19.9253	19.9365	19.9365	19.9386	19.9322	19.9253	19.9204	19.9153	(88)
util rest of house	0.9979	0.9933	0.9782	0.9252	0.7937	0.5793	0.3891	0.4424	0.7384	0.9580	0.9947	0.9986	(89)
MIT 2	18.6634	18.8723	19.1759	19.5442	19.7995	19.9166	19.9343	19.9345	19.8690	19.5160	19.0220	18.6402	(90)
Living area fraction	fLA = Living area / (4) =												
MIT	18.8664	19.0751	19.3789	19.7480	20.0099	20.1334	20.1550	20.1539	20.0804	19.7175	19.2225	18.8414	(92)
Temperature adjustment	0.0000												
adjusted MIT	18.8664	19.0751	19.3789	19.7480	20.0099	20.1334	20.1550	20.1539	20.0804	19.7175	19.2225	18.8414	(93)

#### 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9972	0.9915	0.9745	0.9213	0.7983	0.5976	0.4137	0.4680	0.7508	0.9545	0.9933	0.9980	(94)
Useful gains	628.2200	788.6894	926.8817	1011.6618	948.4716	698.7582	463.3223	485.4535	705.9462	747.5870	636.7961	582.6843	(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	1978.2759	1919.6301	1739.2053	1445.5628	1104.5736	726.9086	467.0096	492.0588	789.2114	1211.9202	1619.5546	1966.4206	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1004.4416	759.9921	604.3687	312.4088	116.1399	0.0000	0.0000	0.0000	0.0000	345.4639	707.5861	1029.4998	(98)
Space heating													
Space heating per m2	(98) / (4) =												

#### 8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1234.8508	972.1166	996.2008	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8963	0.9451	0.9251	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1106.7865	918.7135	921.6301	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1477.4241	1417.2514	1322.8232	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	266.8591	370.9122	298.4876	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
	936.2589 (104)												

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Cooled fraction											FC = cooled area / (4) =	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	66.7148	92.7281	74.6219	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											234.0647 (107)	
Space cooling per m2											2.1015 (108)	
Energy for space heating											43.8131 (99)	
Energy for space cooling											2.1015 (108)	
Total											45.9146 (109)	
Target Fabric Energy Efficiency (TFEE)											52.8 (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	55.6900 (1b)	2.4000 (2b)	133.6560 (1b) - (3b)
First floor	55.6900 (1c)	2.7600 (2c)	153.7044 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.3800		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 287.3604 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				4 * 10 =	40.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1392 (8)							
Pressure test					Yes							
Measured/design AP50					5.0100							
Infiltration rate					0.3897 (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) =	0.3605 (21)							
Wind speed	Jan 5.1000	Feb 4.7000	Mar 4.6000	Apr 4.3000	May 4.3000	Jun 4.0000	Jul 4.0000	Aug 3.9000	Sep 4.0000	Oct 4.5000	Nov 4.4000	Dec 4.7000 (22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750 (22a)
Adj infilt rate	0.4596	0.4236	0.4145	0.3875	0.3875	0.3605	0.3605	0.3515	0.3605	0.4055	0.3965	0.4236 (22b)
Effective ac	0.6056	0.5897	0.5859	0.5751	0.5751	0.5650	0.5650	0.5618	0.5650	0.5822	0.5786	0.5897 (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)			26.2600	1.3258	34.8011		(27)
Solid Door			2.1300	1.2000	2.5560		(26)
Flr - Ground			55.6850	0.1500	8.3528	75.6000	4209.7860 (28a)
Wl - Brick	111.7400	28.3910	83.3490	0.2500	20.8373	51.1800	4265.8018 (29a)
RF - Ins Joist	55.6850		55.6850	0.1000	5.5685	5.8200	324.0867 (30)
Total net area of external elements Aum(A, m2)			223.0990				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	72.1156		(33)
Party Wall			47.5450	0.0000	0.0000	54.0300	2568.8564 (32)
Ground Floor Block			49.8672			54.0300	2694.3248 (32c)
Ground Floor Stud			40.1424			5.8200	233.6288 (32c)
1st Floor Stud			136.2833			5.8200	793.1687 (32c)
Internal Floor			55.6800			18.0000	1002.2400 (32d)
Internal Ceiling			55.6800			5.8200	324.0576 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16415.9507 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							147.3869 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.2820 (36)
Total fabric heat loss							(33) + (36) = 86.3977 (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	57.4299	55.9205	55.5624	54.5343	54.5343	53.5755	53.5755	53.2713	53.5755	55.2120	54.8693	55.9205 (38)
Average = Sum(39)m / 12 =	143.8276	142.3182	141.9600	140.9319	140.9319	139.9731	139.9731	139.6689	139.9731	141.6096	141.2669	142.3182 (39)
HLP	1.2913	1.2778	1.2746	1.2653	1.2653	1.2567	1.2567	1.2540	1.2567	1.2714	1.2683	1.2778 (40)
HLP (average)												1.2680 (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												2.8229 (42)
Average daily hot water use (litres/day)												101.2429 (43)
Daily hot water use	111.3672	107.3175	103.2678	99.2181	95.1684	91.1186	91.1186	95.1684	99.2181	103.2678	107.3175	111.3672 (44)
Energy conte	165.1544	144.4451	149.0544	129.9492	124.6894	107.5974	99.7049	114.4128	115.7792	134.9295	147.2861	159.9432 (45)



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)													Total = Sum(45)m =	1592.9456 (45)
Distribution loss (46)m = 0.15 x (45)m														
	24.7732	21.6668	22.3582	19.4924	18.7034	16.1396	14.9557	17.1619	17.3669	20.2394	22.0929	23.9915	23.9915	(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	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	0.0000	(57)
Combi loss	14.1529	12.7719	14.1143	13.6222	14.0414	13.5481	13.9746	14.0179	13.5885	14.0804	13.6663	14.1404	14.1404	(61)
Total heat required for water heating calculated for each month	179.3073	157.2170	163.1687	143.5715	138.7307	121.1455	113.6795	128.4307	129.3677	149.0099	160.9524	174.0836	174.0836	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
													Solar input (sum of months) = Sum(63)m =	0.0000 (63)
Output from w/h	179.3073	157.2170	163.1687	143.5715	138.7307	121.1455	113.6795	128.4307	129.3677	149.0099	160.9524	174.0836	174.0836	(64)
													Total per year (kWh/year) = Sum(64)m =	1758.6646 (64)
RHI water heating demand														1759 (64)
Heat gains from water heating, kWh/month	58.4521	51.2210	53.0892	46.6137	44.9696	39.1632	36.6455	41.5467	41.8937	48.3842	52.3892	56.7162	56.7162	(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	169.3716	169.3716	169.3716	169.3716	169.3716	169.3716	169.3716	169.3716	169.3716	169.3716	169.3716	169.3716	169.3716	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	60.9622	54.1460	44.0345	33.3370	24.9198	21.0383	22.7326	29.5488	39.6603	50.3578	58.7750	62.6565	62.6565	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	408.2447	412.4810	401.8057	379.0791	350.3909	323.4281	305.4153	301.1790	311.8543	334.5808	363.2690	390.2319	390.2319	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7600	54.7600	54.7600	54.7600	54.7600	54.7600	54.7600	54.7600	54.7600	54.7600	54.7600	54.7600	54.7600	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	(71)
Water heating gains (Table 5)	78.5646	76.2217	71.3564	64.7412	60.4430	54.3933	49.2547	55.8424	58.1857	65.0325	72.7628	76.2315	76.2315	(72)
Total internal gains	661.9887	657.0660	631.4138	591.3745	549.9709	513.0769	491.6199	500.7873	523.9175	564.1884	609.0241	643.3371	643.3371	(73)

#### 6. Solar gains

[Jan]		Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W							
North		4.4940	13.8645	0.5000	0.0000	0.7700	23.9883 (74)							
East		12.2420	25.9136	0.5000	0.0000	0.7700	122.1354 (76)							
South		9.5240	58.2505	0.5000	0.0000	0.7700	213.5895 (78)							
Solar gains	359.7132	541.4443	777.0603	1038.0683	1153.4206	1257.3507	1176.0123	1069.4902	913.4547	645.0996	430.8676	291.3841	291.3841	(83)
Total gains	1021.7019	1198.5103	1408.4741	1629.4429	1703.3915	1770.4276	1667.6321	1570.2775	1437.3722	1209.2880	1039.8917	934.7212	934.7212	(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	31.7045	32.0408	32.1216	32.3559	32.3559	32.5776	32.5776	32.6485	32.5776	32.2011	32.2792	32.0408	32.0408	
alpha	3.1136	3.1361	3.1414	3.1571	3.1571	3.1718	3.1718	3.1766	3.1718	3.1467	3.1519	3.1361	3.1361	
util living area	0.9510	0.9245	0.8642	0.7541	0.6088	0.4235	0.3053	0.3226	0.5349	0.7863	0.9144	0.9598	0.9598	(86)
MIT	19.4705	19.7095	20.1213	20.5425	20.8223	20.9586	20.9893	20.9875	20.9138	20.5746	19.9971	19.4208	19.4208	(87)
Th 2	19.8476	19.8583	19.8608	19.8681	19.8681	19.8749	19.8749	19.8771	19.8749	19.8633	19.8657	19.8583	19.8583	(88)
util rest of house	0.9411	0.9101	0.8394	0.7126	0.5466	0.3452	0.2148	0.2276	0.4502	0.7366	0.8947	0.9514	0.9514	(89)
MIT 2	18.5052	18.7430	19.1351	19.5220	19.7552	19.8565	19.8722	19.8739	19.8320	19.5599	19.0319	18.4656	18.4656	(90)
Living area fraction													fLA = Living area / (4) =	
MIT	18.7069	18.9449	19.3412	19.7352	19.9782	20.0867	20.1056	20.1066	20.0580	19.7719	19.2336	18.6652	18.6652	(92)
Temperature adjustment													-0.1500	
adjusted MIT	18.5569	18.7949	19.1912	19.5852	19.8282	19.9367	19.9556	19.9566	19.9080	19.6219	19.0836	18.5152	18.5152	(93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	0.9267	0.8934	0.8223	0.7012	0.5443	0.3497	0.2214	0.2344	0.4528	0.7246	0.8779	0.9384	0.9384	(94)
Useful gains	946.7852	1070.8032	1158.1303	1142.5312	927.0871	619.0418	369.2382	368.1375	650.8407	876.2058	912.8775	877.1022	877.1022	(95)
Ext temp.	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000	5.5000	(96)
Heat loss rate W	1892.3213	1863.6490	1688.0703	1407.2332	1018.6782	635.0205	371.7147	371.0423	686.9950	1107.6562	1509.2329	1852.2965	1852.2965	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	703.4788	532.7924	394.2754	190.5854	68.1438	0.0000	0.0000	0.0000	0.0000	172.1991	429.3758	725.5446	725.5446	(98)
Space heating													3216.3954 (98)	
RHI space heating demand													3216 (98)	

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

---

# 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	55.6900 (1b)	2.4000 (2b)	133.6560 (1b) - (3b)
First floor	55.6900 (1c)	2.7600 (2c)	153.7044 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.3800		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 287.3604 (5)
Dwelling volume			

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				4 * 10 =	40.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1392 (8)							
Pressure test					Yes							
Measured/design AP50					5.0100							
Infiltration rate					0.3897 (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) =	0.3605 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4596	0.4506	0.4416	0.3965	0.3875	0.3424	0.3424	0.3334	0.3605	0.3875	0.4055	0.4236 (22b)
Effective ac	0.6056	0.6015	0.5975	0.5786	0.5751	0.5586	0.5586	0.5556	0.5650	0.5751	0.5822	0.5897 (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)			26.2600	1.3258	34.8011		(27)
Solid Door			2.1300	1.2000	2.5560		(26)
Flr - Ground			55.6850	0.1500	8.3528	75.6000	4209.7860 (28a)
Wl - Brick	111.7400	28.3910	83.3490	0.2500	20.8373	51.1800	4265.8018 (29a)
RF - Ins Joist	55.6850		55.6850	0.1000	5.5685	5.8200	324.0867 (30)
Total net area of external elements Aum(A, m2)			223.0990				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	72.1156		(33)
Party Wall			47.5450	0.0000	0.0000	54.0300	2568.8564 (32)
Ground Floor Block			49.8672			54.0300	2694.3248 (32c)
Ground Floor Stud			40.1424			5.8200	233.6288 (32c)
1st Floor Stud			136.2833			5.8200	793.1687 (32c)
Internal Floor			55.6800			18.0000	1002.2400 (32d)
Internal Ceiling			55.6800			5.8200	324.0576 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16415.9507 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							147.3869 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.2820 (36)
Total fabric heat loss							(33) + (36) = 86.3977 (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	57.4299	57.0410	56.6598	54.8693	54.5343	52.9748	52.9748	52.6860	53.5755	54.5343	55.2120	55.9205 (38)
Average = Sum(39)m / 12 =	143.8276	143.4387	143.0575	141.2669	140.9319	139.3724	139.3724	139.0836	139.9731	140.9319	141.6096	142.3182 (39)
HLP	1.2913	1.2878	1.2844	1.2683	1.2653	1.2513	1.2513	1.2487	1.2567	1.2653	1.2714	1.2778 (40)
HLP (average)												1.2683 (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												2.8229 (42)
Average daily hot water use (litres/day)												101.2429 (43)
Daily hot water use	111.3672	107.3175	103.2678	99.2181	95.1684	91.1186	91.1186	95.1684	99.2181	103.2678	107.3175	111.3672 (44)
Energy conte	165.1544	144.4451	149.0544	129.9492	124.6894	107.5974	99.7049	114.4128	115.7792	134.9295	147.2861	159.9432 (45)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)													Total = Sum(45)m =	1592.9456 (45)
Distribution loss (46)m = 0.15 x (45)m														
	24.7732	21.6668	22.3582	19.4924	18.7034	16.1396	14.9557	17.1619	17.3669	20.2394	22.0929	23.9915	23.9915	(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	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	0.0000	(57)
Combi loss	14.1529	12.7719	14.1143	13.6222	14.0414	13.5481	13.9746	14.0179	13.5885	14.0804	13.6663	14.1404	14.1404	(61)
Total heat required for water heating calculated for each month	179.3073	157.2170	163.1687	143.5715	138.7307	121.1455	113.6795	128.4307	129.3677	149.0099	160.9524	174.0836	174.0836	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =													0.0000 (63)	
Output from w/h	179.3073	157.2170	163.1687	143.5715	138.7307	121.1455	113.6795	128.4307	129.3677	149.0099	160.9524	174.0836	174.0836	(64)
Total per year (kWh/year) = Sum(64)m =													1758.6646 (64)	
Heat gains from water heating, kWh/month	58.4521	51.2210	53.0892	46.6137	44.9696	39.1632	36.6455	41.5467	41.8937	48.3842	52.3892	56.7162	56.7162	(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	169.3716	169.3716	169.3716	169.3716	169.3716	169.3716	169.3716	169.3716	169.3716	169.3716	169.3716	169.3716	169.3716	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	60.9622	54.1460	44.0345	33.3370	24.9198	21.0383	22.7326	29.5488	39.6603	50.3578	58.7750	62.6565	62.6565	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	408.2447	412.4810	401.8057	379.0791	350.3909	323.4281	305.4153	301.1790	311.8543	334.5808	363.2690	390.2319	390.2319	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7600	54.7600	54.7600	54.7600	54.7600	54.7600	54.7600	54.7600	54.7600	54.7600	54.7600	54.7600	54.7600	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	(71)
Water heating gains (Table 5)	78.5646	76.2217	71.3564	64.7412	60.4430	54.3933	49.2547	55.8424	58.1857	65.0325	72.7628	76.2315	76.2315	(72)
Total internal gains	661.9887	657.0660	631.4138	591.3745	549.9709	513.0769	491.6199	500.7873	523.9175	564.1884	609.0241	643.3371	643.3371	(73)

#### 6. Solar gains

[Jan]		Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W							
North		4.4940	10.6334	0.5000	0.0000	0.7700	18.3978 (74)							
East		12.2420	19.6403	0.5000	0.0000	0.7700	92.5679 (76)							
South		9.5240	46.7521	0.5000	0.0000	0.7700	171.4277 (78)							
Solar gains	282.3934	496.9959	715.5922	935.0967	1083.4999	1089.3860	1044.7336	933.3517	792.2583	559.5418	341.3176	239.5899	239.5899	(83)
Total gains	944.3821	1154.0619	1347.0060	1526.4713	1633.4708	1602.4629	1536.3535	1434.1391	1316.1759	1123.7302	950.3417	882.9270	882.9270	(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	31.7045	31.7905	31.8752	32.2792	32.3559	32.7180	32.7180	32.7859	32.5776	32.3559	32.2011	32.0408	32.0408	
alpha	3.1136	3.1194	3.1250	3.1519	3.1571	3.1812	3.1812	3.1857	3.1718	3.1571	3.1467	3.1361	3.1361	
util living area	0.9661	0.9390	0.8906	0.8002	0.6704	0.5147	0.3860	0.4266	0.6329	0.8492	0.9450	0.9718	0.9718	(86)
MIT	19.2089	19.5249	19.9464	20.4099	20.7390	20.9184	20.9754	20.9659	20.8388	20.3808	19.7064	19.1503	19.1503	(87)
Th 2	19.8476	19.8504	19.8531	19.8657	19.8681	19.8792	19.8792	19.8812	19.8749	19.8681	19.8633	19.8583	19.8583	(88)
util rest of house	0.9594	0.9275	0.8704	0.7647	0.6148	0.4374	0.2930	0.3305	0.5561	0.8132	0.9326	0.9662	0.9662	(89)
MIT 2	18.2482	18.5577	18.9642	19.4039	19.6903	19.8369	19.8709	19.8688	19.7821	19.3931	18.7500	18.1986	18.1986	(90)
Living area fraction	18.4490	18.7598	19.1694	19.6141	19.9094	20.0628	20.1016	20.0980	20.0029	19.5995	18.9498	18.3975	18.3975	(92)
Temperature adjustment	18.2990	18.6098	19.0194	19.4641	19.7594	19.9128	19.9516	19.9480	19.8529	19.4495	18.7998	-0.1500	-0.1500	(93)
adjusted MIT	18.2990	18.6098	19.0194	19.4641	19.7594	19.9128	19.9516	19.9480	19.8529	19.4495	18.7998	18.2475	18.2475	(93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	0.9474	0.9118	0.8528	0.7505	0.6090	0.4399	0.2992	0.3365	0.5544	0.7974	0.9176	0.9554	0.9554	(94)
Ext temp.	894.6993	1052.3104	1148.6793	1145.6182	994.8008	704.8860	459.7081	482.5305	729.7386	896.0999	872.0436	843.5909	843.5909	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	4.2000	(96)
Month fracti	2013.4360	1966.5161	1790.9972	1492.3543	1135.8239	740.4641	467.1237	493.4724	805.2525	1247.1704	1656.8014	1999.2089	1999.2089	(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	1.0000	(97a)
Space heating per m2	832.3400	614.3463	477.8845	249.6500	104.9212	0.0000	0.0000	0.0000	0.0000	261.1965	565.0256	859.7798	859.7798	(98)
(98) / (4) =													35.6001 (99)	

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF ENERGY RATINGS 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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4381.3746 (211)
Space heating requirement	832.3400	614.3463	477.8845	249.6500	104.9212	0.0000	0.0000	0.0000	0.0000	261.1965	565.0256	859.7798	(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)	919.7127	678.8356	528.0492	275.8564	115.9351	0.0000	0.0000	0.0000	0.0000	288.6149	624.3377	950.0329	(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	179.3073	157.2170	163.1687	143.5715	138.7307	121.1455	113.6795	128.4307	129.3677	149.0099	160.9524	174.0836	(64)
Efficiency of water heater (217)m	89.9158	89.8291	89.6634	89.3048	88.6498	87.3000	87.3000	87.3000	87.3000	89.3108	89.7705	89.9449	(217)
Fuel for water heating, kWh/month	199.4169	175.0180	181.9790	160.7657	156.4930	138.7692	130.2170	147.1142	148.1875	166.8442	179.2933	193.5448	(219)
Water heating fuel used													1977.6428 (219)
Annual totals kWh/year													
Space heating fuel - main system													4381.3746 (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)													430.6443 (232)
Total delivered energy for all uses													6864.6617 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4381.3746	3.4800	152.4718	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1977.6428	3.4800	68.8220	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	430.6443	13.1900	56.8020	(250)
Additional standing charges			120.0000	(251)
Total energy cost			407.9883	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.0958	(257)
SAP value		84.7141	
SAP rating (Section 12)		85	(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	4381.3746	0.2160	946.3769	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1977.6428	0.2160	427.1709	(264)
Space and water heating			1373.5478	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	430.6443	0.5190	223.5044	(268)
Total kg/year			1635.9771	(272)
CO2 emissions per m2			14.6900	(273)
EI value			85.9815	
EI rating			86	(274)
EI band			B	

Calculation of stars for heating and DHW

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	$3.48 / 0.8880 = 3.919$ , stars = 4
Water heating environmental impact	$0.216 / 0.8880 = 0.2432$ , stars = 4

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

# 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	55.6900 (1b)	x 2.4000 (2b)	= 133.6560 (1b) - (3b)
First floor	55.6900 (1c)	x 2.7600 (2c)	= 153.7044 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.3800		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 287.3604 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				4 * 10 =	40.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1392 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3897 (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) =		0.3605 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000 (22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4596	0.4236	0.4145	0.3875	0.3875	0.3605	0.3605	0.3515	0.3605	0.4055	0.3965	0.4236 (22b)
	0.6056	0.5897	0.5859	0.5751	0.5751	0.5650	0.5650	0.5618	0.5650	0.5822	0.5786	0.5897 (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)			26.2600	1.3258	34.8011		(27)
Solid Door			2.1300	1.2000	2.5560		(26)
Flr - Ground			55.6850	0.1500	8.3528	75.6000	4209.7860 (28a)
Wl - Brick	111.7400	28.3910	83.3490	0.2500	20.8373	51.1800	4265.8018 (29a)
RF - Ins Joist	55.6850		55.6850	0.1000	5.5685	5.8200	324.0867 (30)
Total net area of external elements Aum(A, m2)			223.0990				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	72.1156		(33)
Party Wall			47.5450	0.0000	0.0000	54.0300	2568.8564 (32)
Ground Floor Block			49.8672			54.0300	2694.3248 (32c)
Ground Floor Stud			40.1424			5.8200	233.6288 (32c)
1st Floor Stud			136.2833			5.8200	793.1687 (32c)
Internal Floor			55.6800			18.0000	1002.2400 (32d)
Internal Ceiling			55.6800			5.8200	324.0576 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16415.9507 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							147.3869 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.2820 (36)
Total fabric heat loss							(33) + (36) = 86.3977 (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	57.4299	55.9205	55.5624	54.5343	54.5343	53.5755	53.5755	53.2713	53.5755	55.2120	54.8693	55.9205 (38)
Average = Sum(39)m / 12 =	143.8276	142.3182	141.9600	140.9319	140.9319	139.9731	139.9731	139.6689	139.9731	141.6096	141.2669	142.3182 (39)
												141.2294 (39)
HLP	1.2913	1.2778	1.2746	1.2653	1.2653	1.2567	1.2567	1.2540	1.2567	1.2714	1.2683	1.2778 (40)
HLP (average)												1.2680 (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												2.8229 (42)
Average daily hot water use (litres/day)												101.2429 (43)
Daily hot water use	111.3672	107.3175	103.2678	99.2181	95.1684	91.1186	91.1186	95.1684	99.2181	103.2678	107.3175	111.3672 (44)
Energy conte	165.1544	144.4451	149.0544	129.9492	124.6894	107.5974	99.7049	114.4128	115.7792	134.9295	147.2861	159.9432 (45)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Energy content (annual)													Total = Sum(45)m =	1592.9456 (45)
Distribution loss (46)m = 0.15 x (45)m														
	24.7732	21.6668	22.3582	19.4924	18.7034	16.1396	14.9557	17.1619	17.3669	20.2394	22.0929	23.9915	23.9915	(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	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	0.0000	(57)
Combi loss	14.1529	12.7719	14.1143	13.6222	14.0414	13.5481	13.9746	14.0179	13.5885	14.0804	13.6663	14.1404	14.1404	(61)
Total heat required for water heating calculated for each month	179.3073	157.2170	163.1687	143.5715	138.7307	121.1455	113.6795	128.4307	129.3677	149.0099	160.9524	174.0836	174.0836	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =													0.0000 (63)	
Output from w/h	179.3073	157.2170	163.1687	143.5715	138.7307	121.1455	113.6795	128.4307	129.3677	149.0099	160.9524	174.0836	174.0836	(64)
Total per year (kWh/year) = Sum(64)m =													1758.6646 (64)	
Heat gains from water heating, kWh/month	58.4521	51.2210	53.0892	46.6137	44.9696	39.1632	36.6455	41.5467	41.8937	48.3842	52.3892	56.7162	56.7162	(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	169.3716	169.3716	169.3716	169.3716	169.3716	169.3716	169.3716	169.3716	169.3716	169.3716	169.3716	169.3716	169.3716	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	60.9622	54.1460	44.0345	33.3370	24.9198	21.0383	22.7326	29.5488	39.6603	50.3578	58.7750	62.6565	62.6565	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	408.2447	412.4810	401.8057	379.0791	350.3909	323.4281	305.4153	301.1790	311.8543	334.5808	363.2690	390.2319	390.2319	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7600	54.7600	54.7600	54.7600	54.7600	54.7600	54.7600	54.7600	54.7600	54.7600	54.7600	54.7600	54.7600	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	(71)
Water heating gains (Table 5)	78.5646	76.2217	71.3564	64.7412	60.4430	54.3933	49.2547	55.8424	58.1857	65.0325	72.7628	76.2315	76.2315	(72)
Total internal gains	661.9887	657.0660	631.4138	591.3745	549.9709	513.0769	491.6199	500.7873	523.9175	564.1884	609.0241	643.3371	643.3371	(73)

#### 6. Solar gains

[Jan]	Area m <sup>2</sup>	Solar flux Table 6a W/m <sup>2</sup>	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W								
North	4.4940	13.8645	0.5000	0.0000	0.7700	23.9883 (74)								
East	12.2420	25.9136	0.5000	0.0000	0.7700	122.1354 (76)								
South	9.5240	58.2505	0.5000	0.0000	0.7700	213.5895 (78)								
Solar gains	359.7132	541.4443	777.0603	1038.0683	1153.4206	1257.3507	1176.0123	1069.4902	913.4547	645.0996	430.8676	291.3841	291.3841	(83)
Total gains	1021.7019	1198.5103	1408.4741	1629.4429	1703.3915	1770.4276	1667.6321	1570.2775	1437.3722	1209.2880	1039.8917	934.7212	934.7212	(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	31.7045	32.0408	32.1216	32.3559	32.3559	32.5776	32.5776	32.6485	32.5776	32.2011	32.2792	32.0408	32.0408	
alpha	3.1136	3.1361	3.1414	3.1571	3.1571	3.1718	3.1718	3.1766	3.1718	3.1467	3.1519	3.1361	3.1361	
util living area	0.9510	0.9245	0.8642	0.7541	0.6088	0.4235	0.3053	0.3226	0.5349	0.7863	0.9144	0.9598	0.9598	(86)
MIT	19.4705	19.7095	20.1213	20.5425	20.8223	20.9586	20.9893	20.9875	20.9138	20.5746	19.9971	19.4208	19.4208	(87)
Th 2	19.8476	19.8583	19.8608	19.8681	19.8681	19.8749	19.8749	19.8771	19.8749	19.8633	19.8657	19.8583	19.8583	(88)
util rest of house	0.9411	0.9101	0.8394	0.7126	0.5466	0.3452	0.2148	0.2276	0.4502	0.7366	0.8947	0.9514	0.9514	(89)
MIT 2	18.5052	18.7430	19.1351	19.5220	19.7552	19.8565	19.8722	19.8739	19.8320	19.5599	19.0319	18.4656	18.4656	(90)
Living area fraction	18.7069	18.9449	19.3412	19.7352	19.9782	20.0867	20.1056	20.1066	20.0580	19.7719	19.2336	18.6652	18.6652	(91)
Temperature adjustment	18.5569	18.7949	19.1912	19.5852	19.8282	19.9367	19.9556	19.9566	19.9080	19.6219	19.0836	-0.1500	-0.1500	(92)
adjusted MIT	18.5569	18.7949	19.1912	19.5852	19.8282	19.9367	19.9556	19.9566	19.9080	19.6219	19.0836	18.5152	18.5152	(93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	946.7852	1070.8032	1158.1303	1142.5312	927.0871	619.0418	369.2382	368.1375	650.8407	876.2058	912.8775	877.1022	877.1022	(95)
Ext temp.	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000	5.5000	(96)
Heat loss rate W	1892.3213	1863.6490	1688.0703	1407.2332	1018.6782	635.0205	371.7147	371.0423	686.9950	1107.6562	1509.2329	1852.2965	1852.2965	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	703.4788	532.7924	394.2754	190.5854	68.1438	0.0000	0.0000	0.0000	0.0000	172.1991	429.3758	725.5446	725.5446	(98)
Space heating													3216.3954 (98)	
Space heating per m <sup>2</sup>													(98) / (4) = 28.8777 (99)	



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3554.0281 (211)
Space heating requirement	703.4788	532.7924	394.2754	190.5854	68.1438	0.0000	0.0000	0.0000	0.0000	172.1991	429.3758	725.5446	(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)	777.3247	588.7209	435.6634	210.5916	75.2970	0.0000	0.0000	0.0000	0.0000	190.2753	474.4485	801.7067	(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	179.3073	157.2170	163.1687	143.5715	138.7307	121.1455	113.6795	128.4307	129.3677	149.0099	160.9524	174.0836	(64)
Efficiency of water heater (217)m	89.8312	89.7504	89.5393	89.0968	88.3288	87.3000	87.3000	87.3000	87.3000	88.9868	89.6045	89.8626	(217)
Fuel for water heating, kWh/month	199.6047	175.1714	182.2313	161.1410	157.0617	138.7692	130.2170	147.1142	148.1875	167.4517	179.6254	193.7220	(219)
Water heating fuel used													1980.2971 (219)
Annual totals kWh/year													
Space heating fuel - main system													3554.0281 (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)													430.6443 (232)
Total delivered energy for all uses													6039.9695 (238)

10a. Fuel costs - using BEDF prices (495)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3554.0281	3.6300	129.0112	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1980.2971	3.6300	71.8848	(247)
Pumps and fans for heating	75.0000	19.4400	14.5800	(249)
Energy for lighting	430.6443	19.4400	83.7172	(250)
Additional standing charges			95.0000	(251)
Total energy cost			394.1932	(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	3554.0281	0.2160	767.6701	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1980.2971	0.2160	427.7442	(264)
Space and water heating			1195.4142	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	430.6443	0.5190	223.5044	(268)
Total kg/year			1457.8436	(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	3554.0281	1.2200	4335.9143	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1980.2971	1.2200	2415.9625	(264)
Space and water heating			6751.8768	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	430.6443	3.0700	1322.0779	(268)
Primary energy kWh/year			8304.2046	(272)
Primary energy kWh/m2/year			74.5574	(273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 85  
Current environmental impact rating: B 86

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

(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	+ 1.0	-£ 28	-197 kg (13.5%)
U Solar photovoltaic panels	+ 8.5	-£ 384	-1025 kg (81.3%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£28	1.77 kg/m <sup>2</sup>	B 86 B 88
Solar photovoltaic panels	£384	9.20 kg/m <sup>2</sup>	A 94 A 95
Total Savings	£412	10.97 kg/m <sup>2</sup>	

Potential energy efficiency rating: A 94  
 Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 495 TEST (29 Apr 2022)  
 Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£98	£108	-£10
Mains gas	£296	£258	£37
Space heating	£239	£239	£0
Water heating	£72	£44	£28
Lighting	£84	£84	£0
Generated (PV)	-£0	-£384	£384
Total cost of fuels	£394	-£18	£411
Total cost of uses	£395	-£17	£412
Delivered energy	54 kWh/m <sup>2</sup>	28 kWh/m <sup>2</sup>	27 kWh/m <sup>2</sup>
Carbon dioxide emissions	1.5 tonnes	0.2 tonnes	1.2 tonnes
CO2 emissions per m <sup>2</sup>	13 kg/m <sup>2</sup>	2 kg/m <sup>2</sup>	11 kg/m <sup>2</sup>
Primary energy	75 kWh/m <sup>2</sup>	10 kWh/m <sup>2</sup>	64 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	55.6900 (1b)	2.4000 (2b)	133.6560 (1b) - (3b)
First floor	55.6900 (1c)	2.7600 (2c)	153.7044 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.3800		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 287.3604 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				4 * 10 =	40.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1392 (8)							
Pressure test					Yes							
Measured/design AP50					5.0100							
Infiltration rate					0.3897 (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) =	0.3605 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4596	0.4506	0.4416	0.3965	0.3875	0.3424	0.3424	0.3334	0.3605	0.3875	0.4055	0.4236 (22b)
Effective ac	0.6056	0.6015	0.5975	0.5786	0.5751	0.5586	0.5586	0.5556	0.5650	0.5751	0.5822	0.5897 (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)			26.2600	1.3258	34.8011		(27)
Solid Door			2.1300	1.2000	2.5560		(26)
Flr - Ground			55.6850	0.1500	8.3528	75.6000	4209.7860 (28a)
Wl - Brick	111.7400	28.3910	83.3490	0.2500	20.8373	51.1800	4265.8018 (29a)
RF - Ins Joist	55.6850		55.6850	0.1000	5.5685	5.8200	324.0867 (30)
Total net area of external elements Aum(A, m2)			223.0990				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	72.1156		(33)
Party Wall			47.5450	0.0000	0.0000	54.0300	2568.8564 (32)
Ground Floor Block			49.8672			54.0300	2694.3248 (32c)
Ground Floor Stud			40.1424			5.8200	233.6288 (32c)
1st Floor Stud			136.2833			5.8200	793.1687 (32c)
Internal Floor			55.6800			18.0000	1002.2400 (32d)
Internal Ceiling			55.6800			5.8200	324.0576 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16415.9507 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							147.3869 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.2820 (36)
Total fabric heat loss							(33) + (36) = 86.3977 (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	57.4299	57.0410	56.6598	54.8693	54.5343	52.9748	52.9748	52.6860	53.5755	54.5343	55.2120	55.9205 (38)
Average = Sum(39)m / 12 =	143.8276	143.4387	143.0575	141.2669	140.9319	139.3724	139.3724	139.0836	139.9731	140.9319	141.6096	142.3182 (39)
HLP	1.2913	1.2878	1.2844	1.2683	1.2653	1.2513	1.2513	1.2487	1.2567	1.2653	1.2714	1.2778 (40)
HLP (average)												1.2683 (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												2.8229 (42)
Average daily hot water use (litres/day)												101.2429 (43)
Daily hot water use	111.3672	107.3175	103.2678	99.2181	95.1684	91.1186	91.1186	95.1684	99.2181	103.2678	107.3175	111.3672 (44)
Energy conte	165.1544	144.4451	149.0544	129.9492	124.6894	107.5974	99.7049	114.4128	115.7792	134.9295	147.2861	159.9432 (45)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Energy content (annual)												Total = Sum(45)m =	1592.9456 (45)
Distribution loss (46)m = 0.15 x (45)m													
	24.7732	21.6668	22.3582	19.4924	18.7034	16.1396	14.9557	17.1619	17.3669	20.2394	22.0929	23.9915	23.9915 (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	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	0.0000 (57)
Combi loss	14.1529	12.7719	14.1143	13.6222	14.0414	13.5481	13.9746	14.0179	13.5885	14.0804	13.6663	14.1404	14.1404 (61)
Total heat required for water heating calculated for each month	179.3073	157.2170	163.1687	143.5715	138.7307	121.1455	113.6795	128.4307	129.3677	149.0099	160.9524	174.0836	174.0836 (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													1.1385 (H8)
Utilisation factor													0.5845 (H9)
Collector performance factor													0.8793 (H10)
Dedicated solar storage volume													75.0000 (H11)
Effective solar volume													75.0000 (H13)
Daily hot water demand													101.2429 (H14)
Volume ratio Veff/V													0.7408 (H15)
Solar storage volume factor													0.9400 (H16)
Solar input	-25.4081	-42.3988	-72.2099	-96.7755	-119.5580	-117.5446	-115.9912	-101.3421	-79.3712	-54.2012	-30.1376	-876.2003	-876.2003 (H17)
Solar input (sum of months) = Sum(63)m =													-876.2003 (63)
Output from w/h	153.8993	114.8183	90.9587	46.7959	19.1727	3.6010	0.0000	27.0886	49.9966	94.8088	130.8148	152.8214	152.8214 (64)
Total per year (kWh/year) = Sum(64)m =													884.7760 (64)
Heat gains from water heating, kWh/month	58.4521	51.2210	53.0892	46.6137	44.9696	39.1632	36.6455	41.5467	41.8937	48.3842	52.3892	56.7162	56.7162 (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	169.3716	169.3716	169.3716	169.3716	169.3716	169.3716	169.3716	169.3716	169.3716	169.3716	169.3716	169.3716	169.3716 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	60.9622	54.1460	44.0345	33.3370	24.9198	21.0383	22.7326	29.5488	39.6603	50.3578	58.7750	62.6565	62.6565 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	408.2447	412.4810	401.8057	379.0791	350.3909	323.4281	305.4153	301.1790	311.8543	334.5808	363.2690	390.2319	390.2319 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7600	54.7600	54.7600	54.7600	54.7600	54.7600	54.7600	54.7600	54.7600	54.7600	54.7600	54.7600	54.7600 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144 (71)
Water heating gains (Table 5)	78.5646	76.2217	71.3564	64.7412	60.4430	54.3933	49.2547	55.8424	58.1857	65.0325	72.7628	76.2315	76.2315 (72)
Total internal gains	661.9887	657.0660	631.4138	591.3745	549.9709	513.0769	491.6199	500.7873	523.9175	564.1884	609.0241	643.3371	643.3371 (73)

#### 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W							
North	4.4940	10.6334	0.5000	0.0000	0.7700	18.3978 (74)							
East	12.2420	19.6403	0.5000	0.0000	0.7700	92.5679 (76)							
South	9.5240	46.7521	0.5000	0.0000	0.7700	171.4277 (78)							
Solar gains	282.3934	496.9959	715.5922	935.0967	1083.4999	1089.3860	1044.7336	933.3517	792.2583	559.5418	341.3176	239.5899	239.5899 (83)
Total gains	944.3821	1154.0619	1347.0060	1526.4713	1633.4708	1602.4629	1536.3535	1434.1391	1316.1759	1123.7302	950.3417	882.9270	882.9270 (84)

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

Temperature during heating periods in the living area from Table 9, T <sub>hl</sub> (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	31.7045	31.7905	31.8752	32.2792	32.3559	32.7180	32.7180	32.7859	32.5776	32.3559	32.2011	32.0408	
alpha	3.1136	3.1194	3.1250	3.1519	3.1571	3.1812	3.1812	3.1857	3.1718	3.1571	3.1467	3.1361	
util living area	0.9661	0.9390	0.8906	0.8002	0.6704	0.5147	0.3860	0.4266	0.6329	0.8492	0.9450	0.9718	0.9718 (86)
MIT	19.2089	19.5249	19.9464	20.4099	20.7390	20.9184	20.9754	20.9659	20.8388	20.3808	19.7064	19.1503	19.1503 (87)
Th 2	19.8476	19.8504	19.8531	19.8657	19.8681	19.8792	19.8792	19.8812	19.8749	19.8681	19.8633	19.8583	19.8583 (88)
util rest of house	0.9594	0.9275	0.8704	0.7647	0.6148	0.4374	0.2930	0.3305	0.5561	0.8132	0.9326	0.9662	0.9662 (89)
MIT 2	18.2482	18.5577	18.9642	19.4039	19.6903	19.8369	19.8709	19.8688	19.7821	19.3931	18.7500	18.1986	18.1986 (90)
Living area fraction													fLA = Living area / (4) =
MIT	18.4490	18.7598	19.1694	19.6141	19.9094	20.0628	20.1016	20.0980	20.0029	19.5995	18.9498	18.3975	18.3975 (92)
Temperature adjustment													-0.1500
adjusted MIT	18.2990	18.6098	19.0194	19.4641	19.7594	19.9128	19.9516	19.9480	19.8529	19.4495	18.7998	18.2475	18.2475 (93)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

#### 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9474	0.9118	0.8528	0.7505	0.6090	0.4399	0.2992	0.3365	0.5544	0.7974	0.9176	0.9554	(94)
Useful gains	894.6993	1052.3104	1148.6793	1145.6182	994.8008	704.8860	459.7081	482.5305	729.7386	896.0999	872.0436	843.5909	(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													
2013.4360	1966.5161	1790.9972	1492.3543	1135.8239	740.4641	467.1237	493.4724	805.2525	1247.1704	1656.8014	1999.2089	1999.2089	(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													
832.3400	614.3463	477.8845	249.6500	104.9212	0.0000	0.0000	0.0000	0.0000	0.0000	261.1965	565.0256	859.7798	(98)
Space heating													
Space heating per m2													
													(98) / (4) = 35.6001 (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													4381.3746 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	832.3400	614.3463	477.8845	249.6500	104.9212	0.0000	0.0000	0.0000	0.0000	261.1965	565.0256	859.7798	(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)	919.7127	678.8356	528.0492	275.8564	115.9351	0.0000	0.0000	0.0000	0.0000	288.6149	624.3377	950.0329	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	153.8993	114.8183	90.9587	46.7959	19.1727	3.6010	0.0000	27.0886	49.9966	94.8088	130.8148	152.8214	(64)
Efficiency of water heater (217)m	89.9853	89.9806	89.9727	89.9794	89.9904	87.3000	87.3000	87.3000	87.3000	89.6251	89.8806	90.0021	(216)
Fuel for water heating, kWh/month	171.0271	127.6033	101.0960	52.0074	21.3053	4.1248	0.0000	31.0293	57.2698	105.7837	145.5428	169.7976	(219)
Water heating fuel used													(219)
Annual totals kWh/year													
Space heating fuel - main system													4381.3746 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													125.0000 (231)
Electricity for lighting (calculated in Appendix L)													430.6443 (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													4196.3666 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4381.3746	3.4800	152.4718	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	986.5872	3.4800	34.3332	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	430.6443	13.1900	56.8020	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit		-1727.2394	13.1900	-227.8229 (252)
Total energy cost			152.2717	(255)

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

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)		0.4090 (257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	94.2949
SAP rating (Section 12)		94 (258)
SAP band		A

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

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4381.3746	0.2160	946.3769 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	986.5872	0.2160	213.1028 (264)
Space and water heating			1159.4797 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	430.6443	0.5190	223.5044 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			551.4219 (272)
CO2 emissions per m2			4.9500 (273)
EI value			95.2749
EI rating			95 (274)
EI band			A

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

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

#### 1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	55.6900 (1b)	2.4000 (2b)	133.6560 (1b) - (3b)
First floor	55.6900 (1c)	2.7600 (2c)	153.7044 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.3800		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 287.3604 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				4 * 10 =	40.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1392 (8)							
Pressure test					Yes							
Measured/design AP50					5.0100							
Infiltration rate					0.3897 (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) =	0.3605 (21)							
Wind speed	Jan 5.1000	Feb 4.7000	Mar 4.6000	Apr 4.3000	May 4.3000	Jun 4.0000	Jul 4.0000	Aug 3.9000	Sep 4.0000	Oct 4.5000	Nov 4.4000	Dec 4.7000 (22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750 (22a)
Adj infilt rate	0.4596	0.4236	0.4145	0.3875	0.3875	0.3605	0.3605	0.3515	0.3605	0.4055	0.3965	0.4236 (22b)
Effective ac	0.6056	0.5897	0.5859	0.5751	0.5751	0.5650	0.5650	0.5618	0.5650	0.5822	0.5786	0.5897 (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)			26.2600	1.3258	34.8011		(27)
Solid Door			2.1300	1.2000	2.5560		(26)
Flr - Ground			55.6850	0.1500	8.3528	75.6000	4209.7860 (28a)
Wl - Brick	111.7400	28.3910	83.3490	0.2500	20.8373	51.1800	4265.8018 (29a)
RF - Ins Joist	55.6850		55.6850	0.1000	5.5685	5.8200	324.0867 (30)
Total net area of external elements Aum(A, m2)			223.0990				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	72.1156		(33)
Party Wall			47.5450	0.0000	0.0000	54.0300	2568.8564 (32)
Ground Floor Block			49.8672			54.0300	2694.3248 (32c)
Ground Floor Stud			40.1424			5.8200	233.6288 (32c)
1st Floor Stud			136.2833			5.8200	793.1687 (32c)
Internal Floor			55.6800			18.0000	1002.2400 (32d)
Internal Ceiling			55.6800			5.8200	324.0576 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16415.9507 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							147.3869 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.2820 (36)
Total fabric heat loss							(33) + (36) = 86.3977 (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	57.4299	55.9205	55.5624	54.5343	54.5343	53.5755	53.5755	53.2713	53.5755	55.2120	54.8693	55.9205 (38)
Average = Sum(39)m / 12 =	143.8276	142.3182	141.9600	140.9319	140.9319	139.9731	139.9731	139.6689	139.9731	141.6096	141.2669	142.3182 (39)
HLP	1.2913	1.2778	1.2746	1.2653	1.2653	1.2567	1.2567	1.2540	1.2567	1.2714	1.2683	1.2778 (40)
HLP (average)												1.2680 (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												2.8229 (42)
Average daily hot water use (litres/day)												101.2429 (43)
Daily hot water use	111.3672	107.3175	103.2678	99.2181	95.1684	91.1186	91.1186	95.1684	99.2181	103.2678	107.3175	111.3672 (44)
Energy conte	165.1544	144.4451	149.0544	129.9492	124.6894	107.5974	99.7049	114.4128	115.7792	134.9295	147.2861	159.9432 (45)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Energy content (annual)													Total = Sum(45)m =	1592.9456 (45)
Distribution loss (46)m = 0.15 x (45)m														
	24.7732	21.6668	22.3582	19.4924	18.7034	16.1396	14.9557	17.1619	17.3669	20.2394	22.0929	23.9915	23.9915	(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	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	0.0000	(57)
Combi loss	14.1529	12.7719	14.1143	13.6222	14.0414	13.5481	13.9746	14.0179	13.5885	14.0804	13.6663	14.1404	14.1404	(61)
Total heat required for water heating calculated for each month														
	179.3073	157.2170	163.1687	143.5715	138.7307	121.1455	113.6795	128.4307	129.3677	149.0099	160.9524	174.0836	174.0836	(62)
Aperture area of solar collector														
Zero-loss collector efficiency														
Collector heat loss coefficient														
Collector 2nd order heat loss coefficient														
Collector effective heat loss coefficient														
Collector performance ratio														
Annual solar radiation per m2													1234.4649	(H5)
Overshading factor													0.8000	(H6)
Solar energy available													2073.9010	(H7)
Adjustment factor for showers													1.0000	(H7a)
Solar-to-load ratio													1.3019	(H8)
Utilisation factor													0.5361	(H9)
Collector performance factor													0.8793	(H10)
Dedicated solar storage volume													75.0000	(H11)
Effective solar volume													75.0000	(H13)
Daily hot water demand													101.2429	(H14)
Volume ratio Veff/V													0.7408	(H15)
Solar storage volume factor													0.9400	(H16)
Solar input													-918.9550	(H17)
Solar input	-30.1571	-43.0502	-72.9627	-99.5622	-117.5051	-125.0476	-120.4310	-107.4403	-85.0327	-58.2217	-35.4557	-24.0888	-24.0888	(63)
													Solar input (sum of months) = Sum(63)m =	-918.9550 (63)
Output from w/h														
	149.1502	114.1669	90.2059	44.0093	21.2256	0.0000	0.0000	20.9904	44.3350	90.7882	125.4967	149.9948	149.9948	(64)
													Total per year (kWh/year) = Sum(64)m =	850.3632 (64)
Heat gains from water heating, kWh/month														
	58.4521	51.2210	53.0892	46.6137	44.9696	39.1632	36.6455	41.5467	41.8937	48.3842	52.3892	56.7162	56.7162	(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	169.3716	169.3716	169.3716	169.3716	169.3716	169.3716	169.3716	169.3716	169.3716	169.3716	169.3716	169.3716	169.3716 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	60.9622	54.1460	44.0345	33.3370	24.9198	21.0383	22.7326	29.5488	39.6603	50.3578	58.7750	62.6565	62.6565 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	408.2447	412.4810	401.8057	379.0791	350.3909	323.4281	305.4153	301.1790	311.8543	334.5808	363.2690	390.2319	390.2319 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7600	54.7600	54.7600	54.7600	54.7600	54.7600	54.7600	54.7600	54.7600	54.7600	54.7600	54.7600	54.7600 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144	-112.9144 (71)
Water heating gains (Table 5)	78.5646	76.2217	71.3564	64.7412	60.4430	54.3933	49.2547	55.8424	58.1857	65.0325	72.7628	76.2315	76.2315 (72)
Total internal gains	661.9887	657.0660	631.4138	591.3745	549.9709	513.0769	491.6199	500.7873	523.9175	564.1884	609.0241	643.3371	643.3371 (73)

#### 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W							
North	4.4940	13.8645	0.5000	0.0000	0.7700	23.9883 (74)							
East	12.2420	25.9136	0.5000	0.0000	0.7700	122.1354 (76)							
South	9.5240	58.2505	0.5000	0.0000	0.7700	213.5895 (78)							
Solar gains	359.7132	541.4443	777.0603	1038.0683	1153.4206	1257.3507	1176.0123	1069.4902	913.4547	645.0996	430.8676	291.3841	291.3841 (83)
Total gains	1021.7019	1198.5103	1408.4741	1629.4429	1703.3915	1770.4276	1667.6321	1570.2775	1437.3722	1209.2880	1039.8917	934.7212	934.7212 (84)

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

Temperature during heating periods in the living area from Table 9, T <sub>hl</sub> (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	31.7045	32.0408	32.1216	32.3559	32.3559	32.5776	32.5776	32.6485	32.5776	32.2011	32.2792	32.0408	32.0408 (87)
alpha	3.1136	3.1361	3.1414	3.1571	3.1571	3.1718	3.1718	3.1766	3.1718	3.1467	3.1519	3.1361	3.1361 (88)
util living area	0.9510	0.9245	0.8642	0.7541	0.6088	0.4235	0.3053	0.3226	0.5349	0.7863	0.9144	0.9598	0.9598 (86)
MIT	19.4705	19.7095	20.1213	20.5425	20.8223	20.9586	20.9893	20.9875	20.9138	20.5746	19.9971	19.4208	19.4208 (87)
Th 2	19.8476	19.8583	19.8608	19.8681	19.8681	19.8749	19.8749	19.8771	19.8749	19.8633	19.8657	19.8583	19.8583 (88)
util rest of house	0.9411	0.9101	0.8394	0.7126	0.5466	0.3452	0.2148	0.2276	0.4502	0.7366	0.8947	0.9514	0.9514 (89)
MIT 2	18.5052	18.7430	19.1351	19.5220	19.7552	19.8565	19.8722	19.8739	19.8320	19.5599	19.0319	18.4656	18.4656 (90)
Living area fraction													fLA = Living area / (4) =
MIT	18.7069	18.9449	19.3412	19.7352	19.9782	20.0867	20.1056	20.1066	20.0580	19.7719	19.2336	18.6652	18.6652 (92)
Temperature adjustment													-0.1500
adjusted MIT	18.5569	18.7949	19.1912	19.5852	19.8282	19.9367	19.9556	19.9566	19.9080	19.6219	19.0836	18.5152	18.5152 (93)



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

#### 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9267	0.8934	0.8223	0.7012	0.5443	0.3497	0.2214	0.2344	0.4528	0.7246	0.8779	0.9384	(94)
Useful gains	946.7852	1070.8032	1158.1303	1142.5312	927.0871	619.0418	369.2382	368.1375	650.8407	876.2058	912.8775	877.1022	(95)
Ext temp.	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000	(96)
Heat loss rate W	1892.3213	1863.6490	1688.0703	1407.2332	1018.6782	635.0205	371.7147	371.0423	686.9950	1107.6562	1509.2329	1852.2965	(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	703.4788	532.7924	394.2754	190.5854	68.1438	0.0000	0.0000	0.0000	0.0000	172.1991	429.3758	725.5446	(98)
Space heating per m2													(98) / (4) = 28.8777 (99)

#### 8c. Space cooling requirement

Not applicable

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3554.0281 (211)
Space heating requirement	703.4788	532.7924	394.2754	190.5854	68.1438	0.0000	0.0000	0.0000	0.0000	172.1991	429.3758	725.5446	(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)	777.3247	588.7209	435.6634	210.5916	75.2970	0.0000	0.0000	0.0000	0.0000	190.2753	474.4485	801.7067	(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	149.1502	114.1669	90.2059	44.0093	21.2256	0.0000	0.0000	20.9904	44.3350	90.7882	125.4967	149.9948	(64)
Efficiency of water heater (217)m	89.9234	89.9184	89.8865	89.8819	89.7189	87.3000	87.3000	87.3000	87.3000	89.3691	89.7559	89.9352	(216)
Fuel for water heating, kWh/month	165.8636	126.9672	100.3553	48.9635	23.6579	0.0000	0.0000	24.0440	50.7847	101.5879	139.8200	166.7809	(219)
Water heating fuel used													948.8251 (219)
Annual totals kWh/year													
Space heating fuel - main system													3554.0281 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													125.0000 (231)
Electricity for lighting (calculated in Appendix L)													430.6443 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1234 * 0.80) =										-1975.1438			-1975.1438 (233)
Total delivered energy for all uses													3083.3537 (238)

#### 10a. Fuel costs - using BEDF prices (495)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3554.0281	3.6300	129.0112	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	948.8251	3.6300	34.4424	(247)
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	430.6443	19.4400	83.7172	(250)
Additional standing charges			95.0000	(251)
Energy saving/generation technologies				
PV Unit		-1975.1438	19.4400	-383.9680 (252)
Total energy cost				-17.4971 (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	3554.0281	0.2160	767.6701	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	948.8251	0.2160	204.9462	(264)
Space and water heating			972.6163	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	430.6443	0.5190	223.5044	(268)
Energy saving/generation technologies				
PV Unit		-1975.1438	0.5190	-1025.0996 (269)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Total kg/year 235.8960 (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	3554.0281	1.2200	4335.9143 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	948.8251	1.2200	1157.5667 (264)
Space and water heating			5493.4809 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	430.6443	3.0700	1322.0779 (268)
Energy saving/generation technologies			
PV Unit	-1975.1438	3.0700	-6063.6915 (269)
Primary energy kWh/year			1135.6173 (272)
Primary energy kWh/m2/year			10.1959 (273)

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

#### Overheating Calculation Input Data

Dwelling type	EndTerrace House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	East
Overshading	Average or unknown
Thermal mass parameter	147.4 (calculated from construction elements)
Night ventilation	Yes
Ventilation rate during hot weather (ach)	4.21 (Calculated rate)

#### Overheating Calculation

Summer ventilation heat loss coefficient	399.18 (P1)
Transmission heat loss coefficient	86.40 (37)
Summer heat loss coefficient	485.57 (P2)

Overhangs Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	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)
South	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	4.4940	87.1704	0.5000	0.0000	0.7650	149.8421
East	12.2420	125.2818	0.5000	0.0000	0.7650	586.6401
South	9.5240	118.5567	0.5000	0.0000	0.7650	431.8937

total: 1168.3758

Solar gains	Jun 1249	Jul 1168	Aug 1063	(P4)
Internal gains	510	489	498	
Total summer gains	1759	1657	1560	(P5)

Summer gain/loss ratio	3.62	3.41	3.21	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 147.4)	0.97	0.97	0.97	
Threshold temperature	19.99	21.68	21.48	(P7)
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>	041 - PRJ012701		<b>Issued on Date</b>	23/09/2022	
<b>Assessment Reference</b>	041 E	<b>Prop Type Ref</b>	3D		
<b>Property</b>	041 - PRJ012701				
<b>SAP Rating</b>	85 B	<b>DER</b>	16.03	<b>TER</b>	16.65
<b>Environmental</b>	86 B	<b>% DER&lt;TER</b>	3.72		
<b>CO<sub>2</sub> Emissions (t/year)</b>	1.46	<b>DFEE</b>	46.47	<b>TFEE</b>	52.80
<b>General Requirements Compliance</b>	Pass	<b>% DFEE&lt;TFEE</b>	11.99		
<b>Assessor Details</b>	Chris Nicholls, , Tel: ,		<b>Assessor ID</b>	W933-0001	
<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)	16.65	kgCO <sub>2</sub> /m <sup>2</sup>	
Dwelling Carbon Dioxide Emission Rate (DER)	16.03	kgCO <sub>2</sub> /m <sup>2</sup>	Pass
	-0.62 (-3.7%)	kgCO <sub>2</sub> /m <sup>2</sup>	

##### 1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.80	kWh/m <sup>2</sup> /yr	
Dwelling Fabric Energy Efficiency (DFEE)	46.47	kWh/m <sup>2</sup> /yr	
	-6.3 (-11.9%)	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	0.25 (max. 0.30)	0.25 (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	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.38 (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
---------------------	---	------

# 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

Not applicable

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

### 9 Summertime temperature

Overheating risk (Southern England)

Slight

Pass

Based on:

Overshading

Average

Windows facing North

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

Windows facing East

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

Windows facing South

9.52 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

Party wall U-value

0.00

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

Roof U-value

0.10

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