

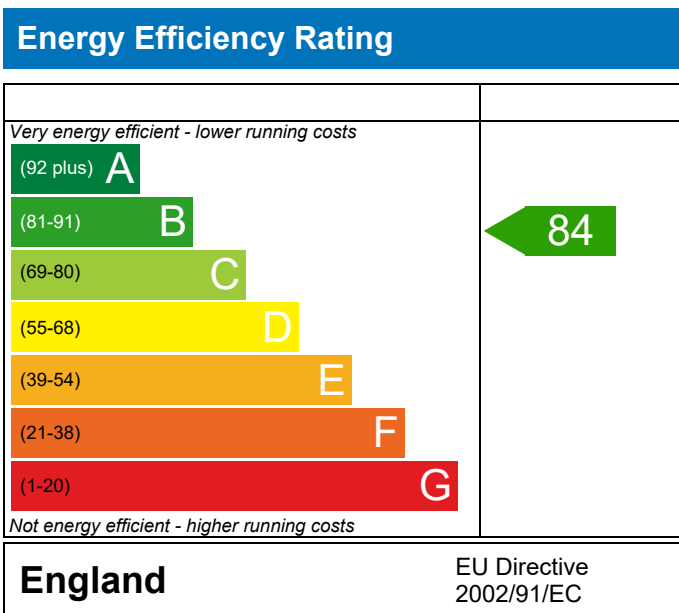
PREDICTED ENERGY ASSESSMENT

Lancing Phase 2,
BN15

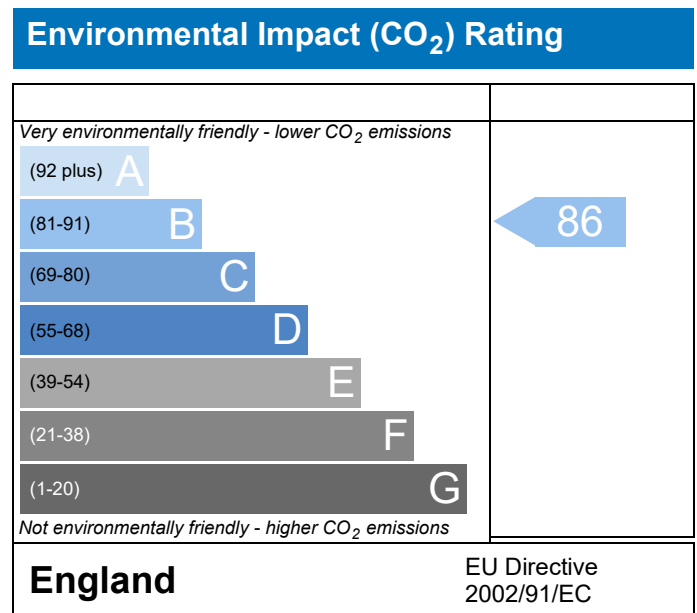
Dwelling type: House, Semi-Detached
Date of assessment: 01/02/2023
Produced by: Michael Juckes
Total floor area: 94.308 m²

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 (CO₂) 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 (CO₂) 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	631 - PRJ012992			Issued on Date	01/02/2023
Assessment Reference	631	Prop Type Ref	Daisy		
Property	Lancing Phase 2, BN15				
SAP Rating	84 B	DER	16.52	TER	17.39
Environmental	86 B	% DER<TER	5.01		
CO₂ Emissions (t/year)	1.29	DFEE	45.42	TFEE	51.73
General Requirements Compliance	Pass	% DFEE<TFEE	12.20		
Assessor Details	Chris Nicholls, , Tel: ,			Assessor ID	T850-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Semi-Detached House, total floor area 94 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.39 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.52 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)45.4 kWh/m²/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	0.16 (max. 0.25)	0.16 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.37 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 5.00 (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 30

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 (South East England): Slight OK

Based on:

Overshading:

Average

Windows facing North: 6.12 m², No overhang

Windows facing East: 6.63 m², No overhang

Windows facing South: 6.51 m², No overhang

Air change rate:

4.61 ach

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

10 Key features

Party wall U-value 0.00 W/m²K

Roof U-value 0.10 W/m²K

Door U-value 1.09 W/m²K

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 ²)	Storey height (m)	Volume (m ³)
Ground floor	47.1540 (1b)	x 2.3850 (2b)	= 112.4623 (1b) - (3b)
First floor	47.1540 (1c)	x 2.6830 (2c)	= 126.5142 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.3080		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 238.9765 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour							
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)							
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)							
Number of intermittent fans					2 * 10 = 20.0000 (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) =					20.0000 / (5) = 0.0837 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3337 (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) =	0.3087 (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	0.3935	0.3858	0.3781	0.3395	0.3318	0.2932	0.2932	0.2855	0.3087	0.3318	0.3472	0.3627 (22b)
	0.5774	0.5744	0.5715	0.5576	0.5551	0.5430	0.5430	0.5408	0.5476	0.5551	0.5603	0.5658 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1200	1.0900	2.3108		(26)
Windows (Uw = 1.40)			19.2600	1.3258	25.5341		(27)
Flr - Ground			47.1540	0.1586	7.4773	75.6000	3564.8424 (28a)
Brick	99.1610	21.3830	77.7780	0.2500	19.4445	51.1900	3981.4558 (29a)
RF - Ins Joist	47.1540		47.1540	0.1000	4.7154	7.4000	348.9396 (30)
Total net area of external elements Aum(A, m ²)			193.4660				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	59.4821	(33)
Party Wall			43.5850	0.0000	0.0000	7.4000	322.5290 (32)
Stud			28.2861			7.4000	209.3171 (32c)
Stud			102.7589			7.4000	760.4159 (32c)
Block			56.2145			54.0300	3037.2667 (32c)
Internal Floor			47.1540			7.4000	348.9396 (32d)
Internal Ceiling			47.1540			7.4000	348.9396 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 12922.6458 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							137.0260 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0867 (36)
Total fabric heat loss							(33) + (36) = 69.5688 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	45.5381	45.3010	45.0686	43.9768	43.7725	42.8216	42.8216	42.6455	43.1878	43.7725	44.1857	44.6177 (38)
Average = Sum(39)m / 12 =	115.1070	114.8698	114.6374	113.5456	113.3413	112.3904	112.3904	112.2143	112.7567	113.3413	113.7545	114.1866 (39)
												113.5446 (39)
HLP	1.2205	1.2180	1.2156	1.2040	1.2018	1.1917	1.1917	1.1899	1.1956	1.2018	1.2062	1.2108 (40)
HLP (average)												1.2040 (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												2.6802 (42)
Average daily hot water use (litres/day)												97.8552 (43)
Daily hot water use	107.6407	103.7265	99.8123	95.8981	91.9839	88.0697	88.0697	91.9839	95.8981	99.8123	103.7265	107.6407 (44)
Energy conte	159.6281	139.6117	144.0668	125.6009	120.5171	103.9971	96.3686	110.5844	111.9051	130.4146	142.3577	154.5913 (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 =	1539.6432 (45)
Distribution loss (46)m = 0.15 x (45)m														
	23.9442	20.9418	21.6100	18.8401	18.0776	15.5996	14.4553	16.5877	16.7858	19.5622	21.3537	23.1887	(46)	
Water storage loss:														
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)	
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)	
Combi loss	14.6958	13.2599	14.6483	14.1196	14.5495	14.0331	14.4715	14.5221	14.0802	14.6074	14.1854	14.6807	(61)	
Total heat required for water heating calculated for each month	174.3239	152.8716	158.7151	139.7206	135.0666	118.0301	110.8401	125.1064	125.9853	145.0220	156.5431	169.2719	(62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)	
Solar input (sum of months) = Sum(63)m =	0.0000 (63)													
Output from w/h	174.3239	152.8716	158.7151	139.7206	135.0666	118.0301	110.8401	125.1064	125.9853	145.0220	156.5431	169.2719	(64)	
Total per year (kWh/year) = Sum(64)m =	1711.4968 (64)													
Heat gains from water heating, kWh/month	56.7503	49.7359	51.5643	45.2922	43.7093	38.0873	35.6604	40.3998	40.7285	47.0147	50.8803	55.0718	(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	134.0109	134.0109	134.0109	134.0109	134.0109	134.0109	134.0109	134.0109	134.0109	134.0109	134.0109	134.0109	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.0607	19.5941	15.9350	12.0638	9.0179	7.6133	8.2264	10.6930	14.3521	18.2233	21.2693	22.6739	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	246.7841	249.3449	242.8917	229.1534	211.8114	195.5124	184.6236	182.0628	188.5160	202.2542	219.5962	235.8953	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4011	36.4011	36.4011	36.4011	36.4011	36.4011	36.4011	36.4011	36.4011	36.4011	36.4011	36.4011	(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)	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	(71)
Water heating gains (Table 5)	76.2773	74.0117	69.3068	62.9059	58.7491	52.8990	47.9307	54.3008	56.5674	63.1918	70.6671	74.0212	(72)
Total internal gains	411.3253	409.1540	394.3368	370.3264	345.7816	322.2279	306.9840	313.2599	325.6388	349.8726	377.7358	398.7936	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W							
North	6.1200	10.6334	0.7300	0.7200	0.7700	23.7035 (74)							
East	6.6320	19.6403	0.7300	0.7200	0.7700	47.4439 (76)							
South	6.5100	46.7521	0.7300	0.7200	0.7700	110.8589 (78)							
Solar gains	182.0062	319.6671	461.0917	607.9434	712.1278	720.0919	698.8324	609.4991	511.9043	359.8769	219.8038	154.5682	(83)
Total gains	593.3315	728.8212	855.4285	978.2699	1057.9095	1042.3199	995.8164	922.7590	837.5431	709.7495	597.5396	553.3618	(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	31.1851	31.2495	31.3129	31.6139	31.6709	31.9389	31.9389	31.9890	31.8351	31.6709	31.5559	31.4365	
alpha	3.0790	3.0833	3.0875	3.1076	3.1114	3.1293	3.1293	3.1326	3.1223	3.1114	3.1037	3.0958	
util living area	0.9813	0.9649	0.9332	0.8668	0.7554	0.6046	0.4670	0.5155	0.7288	0.9063	0.9691	0.9847	(86)
MIT	18.9645	19.2578	19.6858	20.1974	20.6107	20.8636	20.9548	20.9379	20.7436	20.1823	19.4717	18.9082	(87)
Th 2	19.9036	19.9056	19.9076	19.9168	19.9185	19.9266	19.9266	19.9281	19.9235	19.9185	19.9150	19.9114	(88)
util rest of house	0.9776	0.9581	0.9201	0.8403	0.7067	0.5264	0.3643	0.4112	0.6589	0.8817	0.9620	0.9817	(89)
MIT 2	18.0565	18.3470	18.7669	19.2624	19.6378	19.8500	19.9096	19.9029	19.7633	19.2614	18.5685	18.0063	(90)
Living area fraction	fLA = Living area / (4) =												0.1800 (91)
MIT	18.2200	18.5109	18.9323	19.4307	19.8129	20.0325	20.0978	20.0892	19.9397	19.4271	18.7311	18.1687	(92)
Temperature adjustment													-0.1500
adjusted MIT	18.0700	18.3609	18.7823	19.2807	19.6629	19.8825	19.9478	19.9392	19.7897	19.2771	18.5811	18.0187	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	574.9799	689.0822	772.5461	804.0138	733.9047	545.0277	364.9197	380.5101	543.6066	612.7900	567.7077	539.1501	(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	1585.0171	1546.2563	1408.0073	1178.6774	902.5240	593.6997	376.2580	397.1483	641.5544	983.4779	1306.0247	1577.9043	(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	751.4677	576.0210	472.7831	269.7578	125.4528	0.0000	0.0000	0.0000	0.0000	275.7918	531.5882	772.8331	(98)
Space heating													3775.6955 (98)
Space heating per m ²													(98) / (4) = 40.0358 (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													4172.0392 (211)
Space heating requirement	751.4677	576.0210	472.7831	269.7578	125.4528	0.0000	0.0000	0.0000	0.0000	275.7918	531.5882	772.8331	(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)	830.3510	636.4873	522.4123	298.0749	138.6219	0.0000	0.0000	0.0000	0.0000	304.7423	587.3903	853.9592	(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	174.3239	152.8716	158.7151	139.7206	135.0666	118.0301	110.8401	125.1064	125.9853	145.0220	156.5431	169.2719	(64)
Efficiency of water heater (217)m	89.8796	89.8096	89.6739	89.3821	88.8122	87.3000	87.3000	87.3000	87.3000	89.3710	89.7516	89.9079	(217)
Fuel for water heating, kWh/month	193.9526	170.2175	176.9915	156.3183	152.0811	135.2006	126.9646	143.3063	144.3131	162.2696	174.4182	188.2727	(219)
Water heating fuel used													1924.3060 (219)
Annual totals kWh/year													
Space heating fuel - main system													4172.0392 (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)													389.5993 (232)
Total delivered energy for all uses													6560.9445 (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	4172.0392	0.2160	901.1605	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1924.3060	0.2160	415.6501	(264)
Space and water heating			1316.8106	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	389.5993	0.5190	202.2020	(268)
Total CO2, kg/year			1557.9376	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.5200	(273)

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

DER			16.5200	ZC1
Total Floor Area		TFA	94.3080	
Assumed number of occupants		N	2.6802	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			15.5065	ZC2
CO2 emissions from cooking, equation (L16)			1.9439	ZC3
Total CO2 emissions			33.9704	ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000	ZC5
Additional allowable electricity generation, kWh/m ² /year			0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000	ZC7
Net CO2 emissions			33.9704	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 ²)	Storey height (m)	Volume (m ³)
Ground floor	47.1540 (1b)	2.3850 (2b)	112.4623 (1b) - (3b)
First floor	47.1540 (1c)	2.6830 (2c)	126.5142 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.3080		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 238.9765 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ 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				3 * 10 =	30.0000 (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) =				30.0000 / (5) =	0.1255 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3755 (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) =		0.3474 (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 infiltr rate	0.4429	0.4342	0.4255	0.3821	0.3734	0.3300	0.3300	0.3213	0.3474	0.3734	0.3908	0.4082 (22b)
Effective ac	0.5981	0.5943	0.5905	0.5730	0.5697	0.5545	0.5545	0.5516	0.5603	0.5697	0.5764	0.5833 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K					
TER Opaque door			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			19.2600	1.3258	25.5341		(27)					
Flr - Ground			47.1540	0.1300	6.1300		(28a)					
Brick	99.1610	21.3830	77.7780	0.1800	14.0000		(29a)					
RF - Ins Joist	47.1540		47.1540	0.1300	6.1300		(30)					
Total net area of external elements Aum(A, m ²)			193.4660				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 53.9142		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.6942 (36)					
Total fabric heat loss						(33) + (36) =	64.6084 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 47.1658	Feb 46.8655	Mar 46.5711	Apr 45.1883	May 44.9296	Jun 43.7252	Jul 43.7252	Aug 43.5022	Sep 44.1891	Oct 44.9296	Nov 45.4530	Dec 46.0001 (38)
Heat transfer coeff	111.7742	111.4739	111.1795	109.7967	109.5380	108.3336	108.3336	108.1106	108.7975	109.5380	110.0613	110.6085 (39)
Average = Sum(39)m / 12 =												109.7954 (39)
HLP	Jan 1.1852	Feb 1.1820	Mar 1.1789	Apr 1.1642	May 1.1615	Jun 1.1487	Jul 1.1487	Aug 1.1464	Sep 1.1536	Oct 1.1615	Nov 1.1670	Dec 1.1728 (40)
HLP (average)												1.1642 (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												2.6802 (42)
Average daily hot water use (litres/day)												97.8552 (43)
Daily hot water use	107.6407	103.7265	99.8123	95.8981	91.9839	88.0697	88.0697	91.9839	95.8981	99.8123	103.7265	107.6407 (44)
Energy conte	159.6281	139.6117	144.0668	125.6009	120.5171	103.9971	96.3686	110.5844	111.9051	130.4146	142.3577	154.5913 (45)
Energy content (annual)												Total = Sum(45)m = 1539.6432 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	23.9442	20.9418	21.6100	18.8401	18.0776	15.5996	14.4553	16.5877	16.7858	19.5622	21.3537	23.1887 (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	(57)
Total heat required for water heating calculated for each month	50.9589	46.0274	50.8633	47.2922	46.8740	43.4316	44.8793	46.8740	47.2922	50.8633	49.3151	50.9589	61)		
Solar input	210.5870	185.6391	194.9301	172.8931	167.3911	147.4287	141.2479	157.4583	159.1973	181.2778	191.6728	205.5502	(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	(63)		
Heat gains from water heating, kWh/month	210.5870	185.6391	194.9301	172.8931	167.3911	147.4287	141.2479	157.4583	159.1973	181.2778	191.6728	205.5502	(64)		
	65.8161	57.9277	60.6180	53.5854	51.7904	45.4369	43.2624	48.4878	49.0315	56.0787	59.6627	64.1413	(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	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	134.0109	134.0109	134.0109	134.0109	134.0109	134.0109	134.0109	134.0109	134.0109	134.0109	134.0109	134.0109	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	22.1107	19.6385	15.9711	12.0911	9.0383	7.6305	8.2450	10.7172	14.3846	18.2645	21.3174	22.7252	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	246.7841	249.3449	242.8917	229.1534	211.8114	195.5124	184.6236	182.0628	188.5160	202.2542	219.5962	235.8953	(68)
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	(69)
Losses e.g. evaporation (negative values) (Table 5)	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	(71)
Water heating gains (Table 5)	88.4624	86.2020	81.4758	74.4241	69.6108	63.1069	58.1484	65.1718	68.0993	75.3745	82.8649	86.2115	(72)
Total internal gains	423.5604	421.3887	406.5419	381.8720	356.6638	332.4530	317.2203	324.1550	337.2032	362.0966	389.9818	411.0352	(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	6.1200	10.6334	0.6300	0.7000	0.7700	19.8882 (74)							
East	6.6320	19.6403	0.6300	0.7000	0.7700	39.8074 (76)							
South	6.5100	46.7521	0.6300	0.7000	0.7700	93.0151 (78)							
Solar gains	152.7107	268.2138	386.8749	510.0895	597.5045	604.1867	577.9587	511.3948	429.5088	301.9515	184.4244	129.6891	(83)
Total gains	576.2711	689.6025	793.4167	891.9615	954.1683	936.6397	895.1790	835.5498	766.7119	664.0481	574.4062	540.7243	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.5928	58.7507	58.9063	59.6481	59.7890	60.4537	60.4537	60.5784	60.1959	59.7890	59.5047	59.2103	(85)
alpha	4.9062	4.9167	4.9271	4.9765	4.9859	5.0302	5.0302	5.0386	5.0131	4.9859	4.9670	4.9474	
util living area	0.9978	0.9944	0.9843	0.9501	0.8590	0.6896	0.5218	0.5767	0.8248	0.9706	0.9952	0.9984	(86)
MIT	19.7220	19.9020	20.1767	20.5222	20.8021	20.9528	20.9905	20.9846	20.8822	20.5084	20.0487	19.6926	(87)
Th 2	19.9319	19.9344	19.9369	19.9487	19.9509	19.9612	19.9612	19.9632	19.9573	19.9509	19.9465	19.9418	(88)
util rest of house	0.9971	0.9925	0.9788	0.9319	0.8096	0.5975	0.4041	0.4560	0.7484	0.9562	0.9932	0.9979	(89)
MIT 2	18.2324	18.4966	18.8961	19.3931	19.7598	19.9304	19.9578	19.9570	19.8648	19.3843	18.7201	18.1964	(90)
Living area fraction									fLA = Living area / (4) =				(91)
MIT	18.5005	18.7496	19.1266	19.5963	19.9474	20.1144	20.1437	20.1419	20.0479	19.5866	18.9593	18.4657	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5005	18.7496	19.1266	19.5963	19.9474	20.1144	20.1437	20.1419	20.0479	19.5866	18.9593	18.4657	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9956	0.9894	0.9729	0.9242	0.8094	0.6120	0.4254	0.4776	0.7560	0.9495	0.9904	0.9967	(94)
Useful gains	573.7184	682.2847	771.9463	824.3359	772.2812	573.2676	380.7810	399.0768	579.6431	630.5153	568.9107	538.9442	(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	1587.2500	1543.8654	1403.8181	1174.4202	903.4036	597.3999	383.9001	404.5441	647.1200	984.3750	1305.2461	1577.9126	(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	754.0675	578.9823	470.1126	252.0607	97.5550	0.0000	0.0000	0.0000	0.0000	263.2716	530.1615	772.9925	(98)
Space heating per m2												3719.2037	(98)
												39.4368	(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

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													3982.0168 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	754.0675	578.9823	470.1126	252.0607	97.5550	0.0000	0.0000	0.0000	0.0000	263.2716	530.1615	772.9925	(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)	807.3528	619.8953	503.3326	269.8722	104.4487	0.0000	0.0000	0.0000	0.0000	281.8754	567.6247	827.6151	(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	210.5870	185.6391	194.9301	172.8931	167.3911	147.4287	141.2479	157.4583	159.1973	181.2778	191.6728	205.5502	(64)
Efficiency of water heater (217)m	87.9841	87.7212	87.1857	85.9992	83.7451	80.3000	80.3000	80.3000	80.3000	85.9896	87.4783	88.0731	(216)
Fuel for water heating, kWh/month	239.3465	211.6239	223.5802	201.0405	199.8816	183.5974	175.9003	196.0876	198.2532	210.8136	219.1088	233.3860	(219)
Water heating fuel used													2492.6195 (219)
Annual totals kWh/year													
Space heating fuel - main system													3982.0168 (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)													390.4812 (232)
Total delivered energy for all uses													6940.1175 (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	3982.0168	0.2160	860.1156 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2492.6195	0.2160	538.4058 (264)
Space and water heating			1398.5214 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	390.4812	0.5190	202.6598 (268)
Total CO2, kg/m2/year			1640.1062 (272)
Emissions per m2 for space and water heating			14.8293 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1489 (272b)
Emissions per m2 for pumps and fans			0.4127 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.8293 * 1.00) + 2.1489 + 0.4127, rounded to 2 d.p.			17.3900 (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	47.1540 (1b)	2.3850 (2b)	112.4623 (1b) - (3b)
First floor	47.1540 (1c)	2.6830 (2c)	126.5142 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.3080		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 238.9765 (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				3 * 10 =	30.0000 (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) =				30.0000 / (5) =	0.1255 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3755 (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) =		0.3474 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4429	0.4342	0.4255	0.3821	0.3734	0.3300	0.3300	0.3213	0.3474	0.3734	0.3908	0.4082 (22b)
Effective ac	0.5981	0.5943	0.5905	0.5730	0.5697	0.5545	0.5545	0.5516	0.5603	0.5697	0.5764	0.5833 (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
Solid Door			2.1200	1.0900	2.3108		(26)
Windows (Uw = 1.40)			19.2600	1.3258	25.5341		(27)
Flr - Ground			47.1540	0.1586	7.4773	75.6000	3564.8424 (28a)
Brick	99.1610	21.3830	77.7780	0.2500	19.4445	51.1900	3981.4558 (29a)
RF - Ins Joist	47.1540		47.1540	0.1000	4.7154	7.4000	348.9396 (30)
Total net area of external elements Aum(A, m2)			193.4660				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 59.4821		(33)
Party Wall			43.5850	0.0000	0.0000	7.4000	322.5290 (32)
Stud			28.2861			7.4000	209.3171 (32c)
Stud			102.7589			7.4000	760.4159 (32c)
Block			56.2145			54.0300	3037.2667 (32c)
Internal Floor			47.1540			7.4000	348.9396 (32d)
Internal Ceiling			47.1540			7.4000	348.9396 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 12922.6458 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							137.0260 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0867 (36)
Total fabric heat loss							(33) + (36) = 69.5688 (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	47.1658	46.8655	46.5711	45.1883	44.9296	43.7252	43.7252	43.5022	44.1891	44.9296	45.4530	46.0001 (38)
Average = Sum(39)m / 12 =	116.7346	116.4343	116.1399	114.7571	114.4984	113.2940	113.2940	113.0710	113.7579	114.4984	115.0218	115.5689 (39)
HLP	1.2378	1.2346	1.2315	1.2168	1.2141	1.2013	1.2013	1.1990	1.2062	1.2141	1.2196	1.2254 (40)
HLP (average)												1.2168 (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												2.6802 (42)
Average daily hot water use (litres/day)												97.8552 (43)
Daily hot water use	107.6407	103.7265	99.8123	95.8981	91.9839	88.0697	88.0697	91.9839	95.8981	99.8123	103.7265	107.6407 (44)
Energy conte	159.6281	139.6117	144.0668	125.6009	120.5171	103.9971	96.3686	110.5844	111.9051	130.4146	142.3577	154.5913 (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 =	1539.6432 (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
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
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
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
Heat gains from water heating, kWh/month	33.9210	29.6675	30.6142	26.6902	25.6099	22.0994	20.4783	23.4992	23.7798	27.7131	30.2510	32.8506	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	134.0109	134.0109	134.0109	134.0109	134.0109	134.0109	134.0109	134.0109	134.0109	134.0109	134.0109	134.0109	134.0109
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	22.0607	19.5941	15.9350	12.0638	9.0179	7.6133	8.2264	10.6930	14.3521	18.2233	21.2693	22.6739	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	246.7841	249.3449	242.8917	229.1534	211.8114	195.5124	184.6236	182.0628	188.5160	202.2542	219.5962	235.8953	(68)
Pumps, fans	36.4011	36.4011	36.4011	36.4011	36.4011	36.4011	36.4011	36.4011	36.4011	36.4011	36.4011	36.4011	(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)	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	(71)
Total internal gains	45.5927	44.1481	41.1481	37.0697	34.4219	30.6936	27.5246	31.5849	33.0275	37.2488	42.0153	44.1541	(72)
	377.6408	376.2904	363.1781	341.4903	318.4545	297.0225	283.5779	287.5439	299.0989	320.9296	346.0841	365.9265	(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	6.1200	10.6334	0.7300	0.7200	0.7700	23.7035 (74)							
East	6.6320	19.6403	0.7300	0.7200	0.7700	47.4439 (76)							
South	6.5100	46.7521	0.7300	0.7200	0.7700	110.8589 (78)							
Solar gains	182.0062	319.6671	461.0917	607.9434	712.1278	720.0919	688.8324	609.4991	511.9043	359.8769	219.8038	154.5682	(83)
Total gains	559.6470	695.9575	824.2698	949.4337	1030.5823	1017.1144	972.4103	897.0431	811.0032	680.8064	565.8879	520.4947	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	30.7503	30.8296	30.9078	31.2802	31.3509	31.6841	31.6841	31.7466	31.5549	31.3509	31.2082	31.0605		
alpha	3.0500	3.0553	3.0605	3.0853	3.0901	3.1123	3.1123	3.1164	3.1037	3.0901	3.0805	3.0707		
util living area	0.9841	0.9690	0.9393	0.8759	0.7677	0.6179	0.4793	0.5300	0.7438	0.9153	0.9733	0.9871	(86)	
MIT	18.8855	19.1840	19.6223	20.1531	20.5836	20.8524	20.9505	20.9317	20.7229	20.1362	19.4077	18.8342	(87)	
Th 2	19.8899	19.8924	19.8949	19.9066	19.9087	19.9189	19.9189	19.9208	19.9150	19.9087	19.9043	19.8997	(88)	
util rest of house	0.9809	0.9629	0.9272	0.8505	0.7197	0.5389	0.3741	0.4234	0.6747	0.8924	0.9670	0.9845	(89)	
MIT 2	17.9686	18.2651	18.6964	19.2138	19.6071	19.8357	19.9003	19.8929	19.7406	19.2113	18.4981	17.9247	(90)	
Living area fraction	18.1336	18.4305	18.8630	19.3829	19.7829	20.0187	20.0893	20.0799	fLA = Living area / (4) =	19.9174	19.3778	18.6618	0.1800	(91)
MIT	18.1336	18.4305	18.8630	19.3829	19.7829	20.0187	20.0893	20.0799	19.9174	19.3778	18.6618	18.0884	(92)	
Temperature adjustment	18.1336	18.4305	18.8630	19.3829	19.7829	20.0187	20.0893	20.0799	19.9174	19.3778	18.6618	0.0000	(93)	
adjusted MIT	18.1336	18.4305	18.8630	19.3829	19.7829	20.0187	20.0893	20.0799	19.9174	19.3778	18.6618	18.0884	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9738	0.9523	0.9129	0.8362	0.7135	0.5467	0.3915	0.4401	0.6748	0.8785	0.9574	0.9785	(94)
Useful gains	545.0111	662.7340	752.5072	793.8804	735.2955	556.0952	380.7083	394.8321	547.3021	598.0728	541.7673	509.3047	(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	1614.8616	1575.4168	1435.8416	1202.9844	925.4780	613.9102	395.3164	416.0908	661.7802	1005.0460	1329.8576	1605.0716	(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	795.9688	613.3228	508.4008	294.5548	141.4958	0.0000	0.0000	0.0000	0.0000	302.7881	567.4250	815.2506	(98)
Space heating													4039.2066 (98)
Space heating per m2													(98) / (4) = 42.8299 (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	
	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	1064.9638	838.3758	859.3395	0.0000	0.0000	0.0000	0.0000	(100)

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Calculation Type: New Build (As Designed)

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Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8240	0.8795	0.8540	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	877.5388	737.3397	733.9045	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1290.5681	1236.1429	1149.8203	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	297.3811	371.1096	309.4414	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction												977.9320	(104)
Intermittency factor (Table 10b)												1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	74.3453	92.7774	77.3603	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2												244.4830	(107)
Space cooling per m2												2.5924	(108)
Energy for space heating												42.8299	(99)
Energy for space heating												42.8299	(99)
Energy for space cooling												2.5924	(108)
Energy for space cooling												2.5924	(108)
Total												45.4223	(109)
Total												45.4223	(109)
Dwelling Fabric Energy Efficiency (DFEE)												45.4	(109)
Dwelling Fabric Energy Efficiency (DFEE)												45.4	(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 ²)	Storey height (m)	Volume (m ³)
Ground floor	47.1540 (1b)	2.3850 (2b)	112.4623 (1b) - (3b)
First floor	47.1540 (1c)	2.6830 (2c)	126.5142 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.3080		(4)
Dwelling volume			(3a) + (3b) + (3c) + (3d) + (3e)...(3n) = 238.9765 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ 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				3 * 10 =	30.0000 (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) =				30.0000 / (5) =	0.1255 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3755 (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) =	0.3474 (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	0.4429	0.4342	0.4255	0.3821	0.3734	0.3300	0.3300	0.3213	0.3474	0.3734	0.3908	0.4082 (22b)
Effective ac	0.5981	0.5943	0.5905	0.5730	0.5697	0.5545	0.5545	0.5516	0.5603	0.5697	0.5764	0.5833 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K					
TER Opaque door			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			19.2600	1.3258	25.5341		(27)					
Flr - Ground			47.1540	0.1300	6.1300		(28a)					
Brick	99.1610	21.3830	77.7780	0.1800	14.0000		(29a)					
RF - Ins Joist	47.1540		47.1540	0.1300	6.1300		(30)					
Total net area of external elements Aum(A, m ²)			193.4660				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 53.9142		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.6942 (36)					
Total fabric heat loss							(33) + (36) = 64.6084 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 47.1658	Feb 46.8655	Mar 46.5711	Apr 45.1883	May 44.9296	Jun 43.7252	Jul 43.7252	Aug 43.5022	Sep 44.1891	Oct 44.9296	Nov 45.4530	Dec 46.0001 (38)
Heat transfer coeff	111.7742	111.4739	111.1795	109.7967	109.5380	108.3336	108.3336	108.1106	108.7975	109.5380	110.0613	110.6085 (39)
Average = Sum(39)m / 12 =												109.7954 (39)
HLP	Jan 1.1852	Feb 1.1820	Mar 1.1789	Apr 1.1642	May 1.1615	Jun 1.1487	Jul 1.1487	Aug 1.1464	Sep 1.1536	Oct 1.1615	Nov 1.1670	Dec 1.1728 (40)
HLP (average)												1.1642 (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												2.6802 (42)
Average daily hot water use (litres/day)												97.8552 (43)
Daily hot water use	107.6407	103.7265	99.8123	95.8981	91.9839	88.0697	88.0697	91.9839	95.8981	99.8123	103.7265	107.6407 (44)
Energy conte	159.6281	139.6117	144.0668	125.6009	120.5171	103.9971	96.3686	110.5844	111.9051	130.4146	142.3577	154.5913 (45)
Energy content (annual)												Total = Sum(45)m = 1539.6432 (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 (46)
If cylinder contains dedicated solar storage												

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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)
	33.9210	29.6675	30.6142	26.6902	25.6099	22.0994	20.4783	23.4992	23.7798	27.7131	30.2510	32.8506	32.8506	(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	134.0109	134.0109	134.0109	134.0109	134.0109	134.0109	134.0109	134.0109	134.0109	134.0109	134.0109	134.0109	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.1107	19.6385	15.9711	12.0911	9.0383	7.6305	8.2450	10.7172	14.3846	18.2645	21.3174	22.7252	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	246.7841	249.3449	242.8917	229.1534	211.8114	195.5124	184.6236	182.0628	188.5160	202.2542	219.5962	235.8953	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4011	36.4011	36.4011	36.4011	36.4011	36.4011	36.4011	36.4011	36.4011	36.4011	36.4011	36.4011	(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)	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	(71)
Water heating gains (Table 5)	45.5927	44.1481	41.1481	37.0697	34.4219	30.6936	27.5246	31.5849	33.0275	37.2488	42.0153	44.1541	(72)
Total internal gains	377.6907	376.3347	363.2141	341.5176	318.4749	297.0397	283.5965	287.5681	299.1314	320.9708	346.1322	365.9778	(73)

6. Solar gains

[Jan]	Area m ²			Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W					
North	6.1200	10.6334	0.6300	0.7000	0.7700	19.8882	(74)						
East	6.6320	19.6403	0.6300	0.7000	0.7700	39.8074	(76)						
South	6.5100	46.7521	0.6300	0.7000	0.7700	93.0151	(78)						
Solar gains	152.7107	268.2138	386.8749	510.0895	597.5045	604.1867	577.9587	511.3948	429.5088	301.9515	184.4244	129.6891	(83)
Total gains	530.4014	644.5486	750.0890	851.6071	915.9794	901.2265	861.5552	798.9630	728.6402	622.9223	530.5566	495.6669	(84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)														
tau	58.5928	58.7507	58.9063	59.6481	59.7890	60.4537	60.4537	60.5784	60.1959	59.7890	59.5047	59.2103		
alpha	4.9062	4.9167	4.9271	4.9765	4.9859	5.0302	5.0302	5.0386	5.0131	4.9859	4.9670	4.9474		
util living area	0.9985	0.9958	0.9875	0.9578	0.8739	0.7096	0.5403	0.5996	0.8459	0.9770	0.9966	0.9989	(86)	
MIT	19.6770	19.8586	20.1368	20.4906	20.7831	20.9464	20.9889	20.9818	20.8663	20.4727	20.0061	19.6482	(87)	
Th 2	19.9319	19.9344	19.9369	19.9487	19.9509	19.9612	19.9612	19.9632	19.9573	19.9509	19.9465	19.9418	(88)	
util rest of house	0.9980	0.9944	0.9830	0.9417	0.8273	0.6174	0.4194	0.4757	0.7733	0.9654	0.9952	0.9986	(89)	
MIT 2	18.7267	18.9097	19.1874	19.5404	19.8059	19.9370	19.9585	19.9581	19.8838	19.5307	19.0670	18.7059	(90)	
Living area fraction	fLA = Living area / (4) =													
MIT	18.8978	19.0805	19.3583	19.7114	19.9818	20.1187	20.1439	20.1423	20.0607	19.7002	19.2360	18.8755	(92)	
Temperature adjustment	0.0000													
adjusted MIT	18.8978	19.0805	19.3583	19.7114	19.9818	20.1187	20.1439	20.1423	20.0607	19.7002	19.2360	18.8755	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9973	0.9928	0.9797	0.9373	0.8289	0.6324	0.4414	0.4981	0.7817	0.9617	0.9938	0.9980	(94)
Useful gains	528.9556	639.8892	734.8963	798.1741	759.2460	569.9721	380.2503	397.9991	569.5492	599.0786	527.2832	494.6931	(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	1631.6564	1580.7516	1429.5815	1187.0557	907.1671	597.8554	383.9283	404.5849	648.5062	996.8207	1335.7067	1623.2358	(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	820.4094	632.2595	516.8458	279.9948	110.0533	0.0000	0.0000	0.0000	0.0000	295.9202	582.0649	839.6358	(98)
Space heating	4077.1836 (98)												
Space heating per m ²	(98) / (4) = 43.2326 (99)												

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1018.3359	801.6687	821.6403	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8820	0.9365	0.9144	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	898.1776	750.7247	751.2950	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1155.1375	1106.5968	1035.2135	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	185.0112	264.7689	211.2353	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling	661.0153 (104)												

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Calculation Type: New Build (As Designed)

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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	46.2528	66.1922	52.8088	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											165.2538 (107)	
Space cooling per m2											1.7523 (108)	
Energy for space heating											43.2326 (99)	
Energy for space cooling											1.7523 (108)	
Total											44.9849 (109)	
Target Fabric Energy Efficiency (TFEE)											51.7 (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	47.1540 (1b)	2.3850 (2b)	112.4623 (1b) - (3b)
First floor	47.1540 (1c)	2.6830 (2c)	126.5142 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.3080		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 238.9765 (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				2 * 10 =	20.0000 (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) =				20.0000 / (5) =	0.0837 (8)							
Pressure test				Yes								
Measured/design AP50				5.0000								
Infiltration rate				0.3337 (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) =		0.3087 (21)							
Wind speed	Jan 5.7000	Feb 5.2000	Mar 4.9000	Apr 4.5000	May 4.6000	Jun 4.2000	Jul 4.3000	Aug 4.2000	Sep 4.5000	Oct 4.9000	Nov 4.9000	Dec 5.2000 (22)
Wind factor	1.4250	1.3000	1.2250	1.1250	1.1500	1.0500	1.0750	1.0500	1.1250	1.2250	1.2250	1.3000 (22a)
Adj infilt rate												
Effective ac	0.4398	0.4013	0.3781	0.3472	0.3550	0.3241	0.3318	0.3241	0.3472	0.3781	0.3781	0.4013 (22b)
	0.5967	0.5805	0.5715	0.5603	0.5630	0.5525	0.5551	0.5525	0.5603	0.5715	0.5715	0.5805 (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
Solid Door			2.1200	1.0900	2.3108		(26)
Windows (Uw = 1.40)			19.2600	1.3258	25.5341		(27)
Flr - Ground			47.1540	0.1586	7.4773	75.6000	3564.8424 (28a)
Brick	99.1610	21.3830	77.7780	0.2500	19.4445	51.1900	3981.4558 (29a)
RF - Ins Joist	47.1540		47.1540	0.1000	4.7154	7.4000	348.9396 (30)
Total net area of external elements Aum(A, m2)			193.4660				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	59.4821	(33)
Party Wall			43.5850	0.0000	0.0000	7.4000	322.5290 (32)
Stud			28.2861			7.4000	209.3171 (32c)
Stud			102.7589			7.4000	760.4159 (32c)
Block			56.2145			54.0300	3037.2667 (32c)
Internal Floor			47.1540			7.4000	348.9396 (32d)
Internal Ceiling			47.1540			7.4000	348.9396 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 12922.6458 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							137.0260 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0867 (36)
Total fabric heat loss							(33) + (36) = 69.5688 (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	47.0596	45.7800	45.0686	44.1857	44.3994	43.5729	43.7725	43.5729	44.1857	45.0686	45.0686	45.7800 (38)
Average = Sum(39)m / 12 =	116.6284	115.3488	114.6374	113.7545	113.9682	113.1417	113.3413	113.1417	113.7545	114.6374	114.6374	115.3488 (39)
HLP	1.2367	1.2231	1.2156	1.2062	1.2085	1.1997	1.2018	1.1997	1.2062	1.2156	1.2156	1.2231 (40)
HLP (average)												1.2126 (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												2.6802 (42)
Average daily hot water use (litres/day)												97.8552 (43)
Daily hot water use	107.6407	103.7265	99.8123	95.8981	91.9839	88.0697	88.0697	91.9839	95.8981	99.8123	103.7265	107.6407 (44)
Energy conte	159.6281	139.6117	144.0668	125.6009	120.5171	103.9971	96.3686	110.5844	111.9051	130.4146	142.3577	154.5913 (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 =	1539.6432 (45)
Distribution loss (46)m = 0.15 x (45)m														
	23.9442	20.9418	21.6100	18.8401	18.0776	15.5996	14.4553	16.5877	16.7858	19.5622	21.3537	23.1887	23.1887	(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	14.6958	13.2599	14.6483	14.1196	14.5495	14.0331	14.4715	14.5221	14.0802	14.6074	14.1854	14.6807	14.6807	(61)
Total heat required for water heating calculated for each month	174.3239	152.8716	158.7151	139.7206	135.0666	118.0301	110.8401	125.1064	125.9853	145.0220	156.5431	169.2719	169.2719	(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	174.3239	152.8716	158.7151	139.7206	135.0666	118.0301	110.8401	125.1064	125.9853	145.0220	156.5431	169.2719	169.2719	(64)
Total per year (kWh/year) = Sum(64)m =													1711.4968 (64)	
RHI water heating demand													1711 (64)	
Heat gains from water heating, kWh/month	56.7503	49.7359	51.5643	45.2922	43.7093	38.0873	35.6604	40.3998	40.7285	47.0147	50.8803	55.0718	55.0718	(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	160.8131	160.8131	160.8131	160.8131	160.8131	160.8131	160.8131	160.8131	160.8131	160.8131	160.8131	160.8131	160.8131	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.1518	48.9853	39.8376	30.1596	22.5447	19.0331	20.5660	26.7324	35.8802	45.5582	53.1731	56.6846	56.6846	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	368.3344	372.1566	362.5249	342.0201	316.1365	291.8095	275.5576	271.7355	281.3672	301.8720	327.7556	352.0825	352.0825	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.7615	53.7615	53.7615	53.7615	53.7615	53.7615	53.7615	53.7615	53.7615	53.7615	53.7615	53.7615	53.7615	(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)	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	(71)
Water heating gains (Table 5)	76.2773	74.0117	69.3068	62.9059	58.7491	52.8990	47.9307	54.3008	56.5674	63.1918	70.6671	74.0212	74.0212	(72)
Total internal gains	610.1294	605.5196	582.0352	545.4514	507.7961	474.1076	454.4202	463.1347	484.1807	520.9879	561.9617	593.1543	593.1543	(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		6.1200	13.4530	0.7300	0.7200	0.7700	29.9889 (74)							
East		6.6320	25.1540	0.7300	0.7200	0.7700	60.7631 (76)							
South		6.5100	56.4170	0.7300	0.7200	0.7700	133.7764 (78)							
Solar gains	224.5284	341.9146	500.5835	691.8407	785.6480	861.9276	806.2956	718.9486	590.5985	414.2932	270.4012	187.3722	187.3722	(83)
Total gains	834.6578	947.4342	1082.6187	1237.2922	1293.4441	1336.0352	1260.7158	1182.0832	1074.7791	935.2811	832.3629	780.5265	780.5265	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	30.7783	31.1197	31.3129	31.5559	31.4967	31.7268	31.6709	31.7268	31.5559	31.3129	31.3129	31.1197	31.1197	
alpha	3.0519	3.0746	3.0875	3.1037	3.0998	3.1151	3.1114	3.1151	3.1037	3.0875	3.0875	3.0746	3.0746	
util living area	0.9476	0.9268	0.8776	0.7770	0.6334	0.4555	0.3418	0.3363	0.5609	0.7911	0.9106	0.9536	0.9536	(86)
MIT	19.4447	19.6365	20.0214	20.4710	20.7895	20.9445	20.9830	20.9851	20.8958	20.5561	19.9906	19.4335	19.4335	(87)
Th 2	19.8908	19.9016	19.9076	19.9150	19.9132	19.9202	19.9185	19.9202	19.9150	19.9076	19.9076	19.9016	19.9016	(88)
util rest of house	0.9376	0.9136	0.8560	0.7397	0.5741	0.3782	0.2507	0.2390	0.4767	0.7434	0.8910	0.9446	0.9446	(89)
MIT 2	18.5186	18.7114	19.0840	19.5039	19.7747	19.8935	19.9134	19.9163	19.8611	19.5863	19.0640	18.5167	18.5167	(90)
Living area fraction													fLA = Living area / (4) = 0.1800 (91)	
MIT	18.6853	18.8779	19.2527	19.6780	19.9574	20.0827	20.1059	20.1087	20.0473	19.7609	19.2308	18.6817	18.6817	(92)
Temperature adjustment													-0.1500	
adjusted MIT	18.5353	18.7279	19.1027	19.5280	19.8074	19.9327	19.9559	19.9587	19.8973	19.6109	19.0808	18.5317	18.5317	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	0.9220	0.8961	0.8372	0.7248	0.5679	0.3791	0.2540	0.2426	0.4752	0.7285	0.8727	0.9299	0.9299	(94)
Useful gains	769.5627	848.9942	906.3969	896.7533	734.5295	506.5080	320.1840	286.7521	510.7762	681.3577	726.3869	725.8233	725.8233	(95)
Ext temp.	5.4000	5.6000	7.1000	9.5000	12.6000	15.3000	17.1000	17.4000	15.1000	12.0000	8.6000	5.6000	5.6000	(96)
Heat loss rate W	1531.9475	1514.2908	1375.9582	1140.7316	821.4089	524.1525	323.6970	289.4911	545.7181	872.4910	1201.4877	1491.6559	1491.6559	(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	567.2143	447.0793	349.3536	175.6644	64.6383	0.0000	0.0000	0.0000	0.0000	142.2031	342.0726	569.7795	569.7795	(98)
Space heating													2658.0050 (98)	
RHI space heating demand													2658 (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	47.1540 (1b)	2.3850 (2b)	112.4623 (1b) - (3b)
First floor	47.1540 (1c)	2.6830 (2c)	126.5142 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.3080		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 238.9765 (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				2 * 10 =	20.0000 (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) =				20.0000 / (5) =	0.0837 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3337 (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) =		0.3087 (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	0.3935	0.3858	0.3781	0.3395	0.3318	0.2932	0.2932	0.2855	0.3087	0.3318	0.3472	0.3627 (22b)
Effective ac	0.5774	0.5744	0.5715	0.5576	0.5551	0.5430	0.5430	0.5408	0.5476	0.5551	0.5603	0.5658 (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
Solid Door			2.1200	1.0900	2.3108		(26)
Windows (Uw = 1.40)			19.2600	1.3258	25.5341		(27)
Flr - Ground			47.1540	0.1586	7.4773	75.6000	3564.8424 (28a)
Brick	99.1610	21.3830	77.7780	0.2500	19.4445	51.1900	3981.4558 (29a)
RF - Ins Joist	47.1540		47.1540	0.1000	4.7154	7.4000	348.9396 (30)
Total net area of external elements Aum(A, m2)			193.4660				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	59.4821	(33)
Party Wall			43.5850	0.0000	0.0000	7.4000	322.5290 (32)
Stud			28.2861			7.4000	209.3171 (32c)
Stud			102.7589			7.4000	760.4159 (32c)
Block			56.2145			54.0300	3037.2667 (32c)
Internal Floor			47.1540			7.4000	348.9396 (32d)
Internal Ceiling			47.1540			7.4000	348.9396 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 12922.6458 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							137.0260 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0867 (36)
Total fabric heat loss							(33) + (36) = 69.5688 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	45.5381	45.3010	45.0686	43.9768	43.7725	42.8216	42.8216	42.6455	43.1878	43.7725	44.1857	44.6177 (38)
Average = Sum(39)m / 12 =	115.1070	114.8698	114.6374	113.5456	113.3413	112.3904	112.3904	112.2143	112.7567	113.3413	113.7545	114.1866 (39)
HLP	1.2205	1.2180	1.2156	1.2040	1.2018	1.1917	1.1917	1.1899	1.1956	1.2018	1.2062	1.2108 (40)
HLP (average)												1.2040 (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												2.6802 (42)
Average daily hot water use (litres/day)												97.8552 (43)
Daily hot water use	107.6407	103.7265	99.8123	95.8981	91.9839	88.0697	88.0697	91.9839	95.8981	99.8123	103.7265	107.6407 (44)
Energy conte	159.6281	139.6117	144.0668	125.6009	120.5171	103.9971	96.3686	110.5844	111.9051	130.4146	142.3577	154.5913 (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 =	1539.6432 (45)
Distribution loss (46)m = 0.15 x (45)m														
	23.9442	20.9418	21.6100	18.8401	18.0776	15.5996	14.4553	16.5877	16.7858	19.5622	21.3537	23.1887	23.1887	(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	14.6958	13.2599	14.6483	14.1196	14.5495	14.0331	14.4715	14.5221	14.0802	14.6074	14.1854	14.6807	14.6807	(61)
Total heat required for water heating calculated for each month	174.3239	152.8716	158.7151	139.7206	135.0666	118.0301	110.8401	125.1064	125.9853	145.0220	156.5431	169.2719	169.2719	(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	174.3239	152.8716	158.7151	139.7206	135.0666	118.0301	110.8401	125.1064	125.9853	145.0220	156.5431	169.2719	169.2719	(64)
Total per year (kWh/year) = Sum(64)m =													1711.4968 (64)	
Heat gains from water heating, kWh/month	56.7503	49.7359	51.5643	45.2922	43.7093	38.0873	35.6604	40.3998	40.7285	47.0147	50.8803	55.0718	55.0718	(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	160.8131	160.8131	160.8131	160.8131	160.8131	160.8131	160.8131	160.8131	160.8131	160.8131	160.8131	160.8131	160.8131 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.1518	48.9853	39.8376	30.1596	22.5447	19.0331	20.5660	26.7324	35.8802	45.5582	53.1731	56.6846	56.6846 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	368.3344	372.1566	362.5249	342.0201	316.1365	291.8095	275.5576	271.7355	281.3672	301.8720	327.7556	352.0825	352.0825 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.7615	53.7615	53.7615	53.7615	53.7615	53.7615	53.7615	53.7615	53.7615	53.7615	53.7615	53.7615	53.7615 (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)	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087 (71)
Water heating gains (Table 5)	76.2773	74.0117	69.3068	62.9059	58.7491	52.8990	47.9307	54.3008	56.5674	63.1918	70.6671	74.0212	74.0212 (72)
Total internal gains	610.1294	605.5196	582.0352	545.4514	507.7961	474.1076	454.4202	463.1347	484.1807	520.9879	561.9617	593.1543	593.1543 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W							
North	6.1200	10.6334	0.7300	0.7200	0.7700	23.7035 (74)							
East	6.6320	19.6403	0.7300	0.7200	0.7700	47.4439 (76)							
South	6.5100	46.7521	0.7300	0.7200	0.7700	110.8589 (78)							
Solar gains	182.0062	319.6671	461.0917	607.9434	712.1278	720.0919	698.8324	609.4991	511.9043	359.8769	219.8038	154.5682	154.5682 (83)
Total gains	792.1356	925.1867	1043.1268	1153.3949	1219.9239	1194.1995	1143.2526	1072.6338	996.0850	880.8648	781.7655	747.7225	747.7225 (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	31.1851	31.2495	31.3129	31.6139	31.6709	31.9389	31.9389	31.9890	31.8351	31.6709	31.5559	31.4365	31.4365
alpha	3.0790	3.0833	3.0875	3.1076	3.1114	3.1293	3.1293	3.1326	3.1223	3.1114	3.1037	3.0958	3.0958
util living area	0.9606	0.9372	0.8962	0.8182	0.6990	0.5464	0.4141	0.4547	0.6573	0.8538	0.9399	0.9663	0.9663 (86)
MIT	19.2359	19.5069	19.8935	20.3435	20.6925	20.8978	20.9678	20.9564	20.8115	20.3485	19.7091	19.1786	19.1786 (87)
Th 2	19.9036	19.9056	19.9076	19.9168	19.9185	19.9266	19.9266	19.9281	19.9235	19.9185	19.9150	19.9114	19.9114 (88)
util rest of house	0.9534	0.9262	0.8779	0.7863	0.6472	0.4707	0.3203	0.3587	0.5847	0.8205	0.9273	0.9601	0.9601 (89)
MIT 2	18.3226	18.5880	18.9625	19.3919	19.7018	19.8707	19.9148	19.9110	19.8099	19.4095	18.7975	18.2723	18.2723 (90)
Living area fraction	18.4870	18.7534	19.1301	19.5632	19.8801	20.0556	20.1044	20.0991	19.9902	19.5785	18.9616	18.4354	18.4354 (92)
Temperature adjustment	18.3370	18.6034	18.9801	19.4132	19.7301	19.9056	19.9544	19.9491	19.8402	19.4285	18.8116	-0.1500	-0.1500
adjusted MIT	18.3370	18.6034	18.9801	19.4132	19.7301	19.9056	19.9544	19.9491	19.8402	19.4285	18.8116	18.2854	18.2854 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9399	0.9096	0.8591	0.7694	0.6373	0.4692	0.3228	0.3606	0.5785	0.8027	0.9110	0.9478	0.9478 (94)
Ext temp.	744.5635	841.5504	896.2016	887.4101	777.4592	560.2716	369.0665	386.8352	576.2449	707.0363	712.2023	708.6687	708.6687 (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	1615.7526	1574.1087	1430.6879	1193.7281	910.1401	596.2956	376.9980	398.2645	647.2475	1000.6346	1332.2431	1608.3654	1608.3654 (97)
Space heating kWh	1.0000	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 per m ²	648.1647	492.2792	397.6578	220.5490	98.7146	0.0000	0.0000	0.0000	0.0000	218.4371	446.4294	669.3744	669.3744 (98)
(98) / (4) =													33.8424 (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

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													3526.6366 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	648.1647	492.2792	397.6578	220.5490	98.7146	0.0000	0.0000	0.0000	0.0000	218.4371	446.4294	669.3744	(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)	716.2041	543.9549	439.4009	243.7005	109.0769	0.0000	0.0000	0.0000	0.0000	241.3670	493.2921	739.6402	(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	174.3239	152.8716	158.7151	139.7206	135.0666	118.0301	110.8401	125.1064	125.9853	145.0220	156.5431	169.2719	(64)
Efficiency of water heater (217)m	89.8023	89.7207	89.5635	89.2315	88.6232	87.3000	87.3000	87.3000	87.3000	89.1955	89.6469	89.8354	(217)
Fuel for water heating, kWh/month	194.1195	170.3861	177.2096	156.5821	152.4054	135.2006	126.9646	143.3063	144.3131	162.5890	174.6219	188.4246	(219)
Water heating fuel used													1926.1230 (219)
Annual totals kWh/year													
Space heating fuel - main system													3526.6366 (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)													389.5993 (232)
Total delivered energy for all uses													5917.3589 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3526.6366	3.4800	122.7270 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1926.1230	3.4800	67.0291 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	389.5993	13.1900	51.3881 (250)
Additional standing charges			120.0000 (251)
Total energy cost			371.0367 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.1186 (257)
SAP value		84.3950
SAP rating (Section 12)		84 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3526.6366	0.2160	761.7535 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1926.1230	0.2160	416.0426 (264)
Space and water heating			1177.7961 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	389.5993	0.5190	202.2020 (268)
Total kg/year			1418.9231 (272)
CO2 emissions per m2			15.0500 (273)
EI value			86.3514
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	$3.48 / 0.8873 = 3.922$, stars = 4
Water heating environmental impact	$0.216 / 0.8873 = 0.2434$, stars = 4

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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	47.1540 (1b)	x 2.3850 (2b)	= 112.4623 (1b) - (3b)
First floor	47.1540 (1c)	x 2.6830 (2c)	= 126.5142 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.3080		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 238.9765 (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				2 * 10 =	20.0000 (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) =				20.0000 / (5) =	0.0837 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3337 (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) =		0.3087 (21)							
Wind speed	Jan 5.7000	Feb 5.2000	Mar 4.9000	Apr 4.5000	May 4.6000	Jun 4.2000	Jul 4.3000	Aug 4.2000	Sep 4.5000	Oct 4.9000	Nov 4.9000	Dec 5.2000 (22)
Wind factor	1.4250	1.3000	1.2250	1.1250	1.1500	1.0500	1.0750	1.0500	1.1250	1.2250	1.2250	1.3000 (22a)
Adj infilt rate												
Effective ac	0.4398	0.4013	0.3781	0.3472	0.3550	0.3241	0.3318	0.3241	0.3472	0.3781	0.3781	0.4013 (22b)
	0.5967	0.5805	0.5715	0.5603	0.5630	0.5525	0.5551	0.5525	0.5603	0.5715	0.5715	0.5805 (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
Solid Door			2.1200	1.0900	2.3108		(26)
Windows (Uw = 1.40)			19.2600	1.3258	25.5341		(27)
Flr - Ground			47.1540	0.1586	7.4773	75.6000	3564.8424 (28a)
Brick	99.1610	21.3830	77.7780	0.2500	19.4445	51.1900	3981.4558 (29a)
RF - Ins Joist	47.1540		47.1540	0.1000	4.7154	7.4000	348.9396 (30)
Total net area of external elements Aum(A, m2)			193.4660				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	59.4821	(33)
Party Wall			43.5850	0.0000	0.0000	7.4000	322.5290 (32)
Stud			28.2861			7.4000	209.3171 (32c)
Stud			102.7589			7.4000	760.4159 (32c)
Block			56.2145			54.0300	3037.2667 (32c)
Internal Floor			47.1540			7.4000	348.9396 (32d)
Internal Ceiling			47.1540			7.4000	348.9396 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 12922.6458 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							137.0260 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0867 (36)
Total fabric heat loss							(33) + (36) = 69.5688 (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	47.0596	45.7800	45.0686	44.1857	44.3994	43.5729	43.7725	43.5729	44.1857	45.0686	45.0686	45.7800 (38)
Average = Sum(39)m / 12 =	116.6284	115.3488	114.6374	113.7545	113.9682	113.1417	113.3413	113.1417	113.7545	114.6374	114.6374	115.3488 (39)
HLP	1.2367	1.2231	1.2156	1.2062	1.2085	1.1997	1.2018	1.1997	1.2062	1.2156	1.2156	1.2231 (40)
HLP (average)												1.2126 (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												2.6802 (42)
Average daily hot water use (litres/day)												97.8552 (43)
Daily hot water use	107.6407	103.7265	99.8123	95.8981	91.9839	88.0697	88.0697	91.9839	95.8981	99.8123	103.7265	107.6407 (44)
Energy conte	159.6281	139.6117	144.0668	125.6009	120.5171	103.9971	96.3686	110.5844	111.9051	130.4146	142.3577	154.5913 (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 =	1539.6432 (45)
Distribution loss (46)m = 0.15 x (45)m														
	23.9442	20.9418	21.6100	18.8401	18.0776	15.5996	14.4553	16.5877	16.7858	19.5622	21.3537	23.1887	23.1887	(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	14.6958	13.2599	14.6483	14.1196	14.5495	14.0331	14.4715	14.5221	14.0802	14.6074	14.1854	14.6807	14.6807	(61)
Total heat required for water heating calculated for each month	174.3239	152.8716	158.7151	139.7206	135.0666	118.0301	110.8401	125.1064	125.9853	145.0220	156.5431	169.2719	169.2719	(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	174.3239	152.8716	158.7151	139.7206	135.0666	118.0301	110.8401	125.1064	125.9853	145.0220	156.5431	169.2719	169.2719	(64)
Total per year (kWh/year) = Sum(64)m =													1711.4968 (64)	
Heat gains from water heating, kWh/month	56.7503	49.7359	51.5643	45.2922	43.7093	38.0873	35.6604	40.3998	40.7285	47.0147	50.8803	55.0718	55.0718	(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	160.8131	160.8131	160.8131	160.8131	160.8131	160.8131	160.8131	160.8131	160.8131	160.8131	160.8131	160.8131	160.8131 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.1518	48.9853	39.8376	30.1596	22.5447	19.0331	20.5660	26.7324	35.8802	45.5582	53.1731	56.6846	56.6846 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	368.3344	372.1566	362.5249	342.0201	316.1365	291.8095	275.5576	271.7355	281.3672	301.8720	327.7556	352.0825	352.0825 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.7615	53.7615	53.7615	53.7615	53.7615	53.7615	53.7615	53.7615	53.7615	53.7615	53.7615	53.7615	53.7615 (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)	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087 (71)
Water heating gains (Table 5)	76.2773	74.0117	69.3068	62.9059	58.7491	52.8990	47.9307	54.3008	56.5674	63.1918	70.6671	74.0212	74.0212 (72)
Total internal gains	610.1294	605.5196	582.0352	545.4514	507.7961	474.1076	454.4202	463.1347	484.1807	520.9879	561.9617	593.1543	593.1543 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W					
North	6.1200	13.4530	0.7300	0.7200	0.7700	29.9889 (74)						
East	6.6320	25.1540	0.7300	0.7200	0.7700	60.7631 (76)						
South	6.5100	56.4170	0.7300	0.7200	0.7700	133.7764 (78)						
Solar gains	224.5284	341.9146	500.5835	691.8407	785.6480	861.9276	806.2956	718.9486	590.5985	414.2932	270.4012	187.3722 (83)
Total gains	834.6578	947.4342	1082.6187	1237.2922	1293.4441	1336.0352	1260.7158	1182.0832	1074.7791	935.2811	832.3629	780.5265 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	30.7783	31.1197	31.3129	31.5559	31.4967	31.7268	31.6709	31.7268	31.5559	31.3129	31.3129	31.1197	31.1197 (86)
alpha	3.0519	3.0746	3.0875	3.1037	3.0998	3.1151	3.1114	3.1151	3.1037	3.0875	3.0875	3.0746	3.0746 (86)
util living area	0.9476	0.9268	0.8776	0.7770	0.6334	0.4555	0.3418	0.3363	0.5609	0.7911	0.9106	0.9536 (86)	
MIT	19.4447	19.6365	20.0214	20.4710	20.7895	20.9445	20.9830	20.9851	20.8958	20.5561	19.9906	19.4335 (87)	
Th 2	19.8908	19.9016	19.9076	19.9150	19.9132	19.9202	19.9185	19.9202	19.9150	19.9076	19.9076	19.9016 (88)	
util rest of house	0.9376	0.9136	0.8560	0.7397	0.5741	0.3782	0.2507	0.2390	0.4767	0.7434	0.8910	0.9446 (89)	
MIT 2	18.5186	18.7114	19.0840	19.5039	19.7747	19.8935	19.9134	19.9163	19.8611	19.5863	19.0640	18.5167 (90)	
Living area fraction	18.6853	18.8779	19.2527	19.6780	19.9574	20.0827	20.1059	20.1087	20.0473	19.7609	19.2308	18.6817 (92)	
Temperature adjustment	18.5353	18.7279	19.1027	19.5280	19.8074	19.9327	19.9559	19.9587	19.8973	19.6109	19.0808	-0.1500 (93)	
adjusted MIT	18.5353	18.7279	19.1027	19.5280	19.8074	19.9327	19.9559	19.9587	19.8973	19.6109	19.0808	18.5317 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9220	0.8961	0.8372	0.7248	0.5679	0.3791	0.2540	0.2426	0.4752	0.7285	0.8727	0.9299 (94)	
Ext temp.	769.5627	848.9942	906.3969	896.7533	734.5295	506.5080	320.1840	286.7521	510.7762	681.3577	726.3869	725.8233 (95)	
Heat loss rate W	5.4000	5.6000	7.1000	9.5000	12.6000	15.3000	17.1000	17.4000	15.1000	12.0000	8.6000	5.6000 (96)	
Month fracti	1531.9475	1514.2908	1375.9582	1140.7316	821.4089	524.1525	323.6970	289.4911	545.7181	872.4910	1201.4877	1491.6559 (97)	
Space heating kWh	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 per m2	567.2143	447.0793	349.3536	175.6644	64.6383	0.0000	0.0000	0.0000	0.0000	142.2031	342.0726	569.7795 (98)	
(98) / (4) =													28.1843 (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													2937.0221 (211)
Space heating requirement	567.2143	447.0793	349.3536	175.6644	64.6383	0.0000	0.0000	0.0000	0.0000	142.2031	342.0726	569.7795	(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)	626.7561	494.0103	386.0261	194.1043	71.4235	0.0000	0.0000	0.0000	0.0000	157.1305	377.9807	629.5906	(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	174.3239	152.8716	158.7151	139.7206	135.0666	118.0301	110.8401	125.1064	125.9853	145.0220	156.5431	169.2719	(64)
Efficiency of water heater (217)m	89.7268	89.6626	89.4754	89.0539	88.3107	87.3000	87.3000	87.3000	87.3000	88.8555	89.4704	89.7465	(216)
Fuel for water heating, kWh/month	194.2829	170.4966	177.3840	156.8944	152.9448	135.2006	126.9646	143.3063	144.3131	163.2110	174.9664	188.6111	(219)
Water heating fuel used													1928.5759 (219)
Annual totals kWh/year													
Space heating fuel - main system													2937.0221 (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)													389.5993 (232)
Total delivered energy for all uses													5330.1973 (238)

10a. Fuel costs - using BEDF prices (510)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2937.0221	4.2600	125.1171 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1928.5759	4.2600	82.1573 (247)
Pumps and fans for heating	75.0000	22.5500	16.9125 (249)
Energy for lighting	389.5993	22.5500	87.8546 (250)
Additional standing charges			96.0000 (251)
Total energy cost			408.0416 (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	2937.0221	0.2160	634.3968 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1928.5759	0.2160	416.5724 (264)
Space and water heating			1050.9692 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	389.5993	0.5190	202.2020 (268)
Total kg/year			1292.0962 (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	2937.0221	1.2200	3583.1670 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1928.5759	1.2200	2352.8626 (264)
Space and water heating			5936.0296 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	389.5993	3.0700	1196.0698 (268)
Primary energy kWh/year			7362.3494 (272)
Primary energy kWh/m2/year			78.0671 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 84
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	+ 1.2	-£ 32	-193 kg (14.9%)
U Solar photovoltaic panels	+ 9.6	-£ 453	-1042 kg (94.7%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£32	2.04 kg/m ²	B 86 B 88
Solar photovoltaic panels	£453	11.04 kg/m ²	A 95 A 97
Total Savings	£484	13.09 kg/m ²	

Potential energy efficiency rating: A 95
 Potential environmental impact rating: A 97

Fuel prices for cost data on this page from database revision number 510 TEST (21 Dec 2022)
 Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£105	£116	-£11
Mains gas	£303	£260	£43
Space heating	£238	£238	£0
Water heating	£82	£50	£32
Lighting	£88	£88	£0
Generated (PV)	-£0	-£453	£453
Total cost of fuels	£408	-£77	£485
Total cost of uses	£408	-£77	£485
Delivered energy	57 kWh/m ²	25 kWh/m ²	31 kWh/m ²
Carbon dioxide emissions	1.3 tonnes	0.1 tonnes	1.2 tonnes
CO2 emissions per m ²	14 kg/m ²	1 kg/m ²	13 kg/m ²
Primary energy	78 kWh/m ²	1 kWh/m ²	77 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	47.1540 (1b)	2.3850 (2b)	112.4623 (1b) - (3b)
First floor	47.1540 (1c)	2.6830 (2c)	126.5142 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.3080		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 238.9765 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ 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				2 * 10 =	20.0000 (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) =				20.0000 / (5) =	0.0837 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3337 (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) =	0.3087 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3935	0.3858	0.3781	0.3395	0.3318	0.2932	0.2932	0.2855	0.3087	0.3318	0.3472	0.3627 (22b)
Effective ac	0.5774	0.5744	0.5715	0.5576	0.5551	0.5430	0.5430	0.5408	0.5476	0.5551	0.5603	0.5658 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1200	1.0900	2.3108		(26)
Windows (Uw = 1.40)			19.2600	1.3258	25.5341		(27)
Flr - Ground			47.1540	0.1586	7.4773	75.6000	3564.8424 (28a)
Brick	99.1610	21.3830	77.7780	0.2500	19.4445	51.1900	3981.4558 (29a)
RF - Ins Joist	47.1540		47.1540	0.1000	4.7154	7.4000	348.9396 (30)
Total net area of external elements Aum(A, m ²)			193.4660				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	59.4821	(33)
Party Wall			43.5850	0.0000	0.0000	7.4000	322.5290 (32)
Stud			28.2861			7.4000	209.3171 (32c)
Stud			102.7589			7.4000	760.4159 (32c)
Block			56.2145			54.0300	3037.2667 (32c)
Internal Floor			47.1540			7.4000	348.9396 (32d)
Internal Ceiling			47.1540			7.4000	348.9396 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 12922.6458 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							137.0260 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0867 (36)
Total fabric heat loss							(33) + (36) = 69.5688 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	45.5381	45.3010	45.0686	43.9768	43.7725	42.8216	42.8216	42.6455	43.1878	43.7725	44.1857	44.6177 (38)
Average = Sum(39)m / 12 =	115.1070	114.8698	114.6374	113.5456	113.3413	112.3904	112.3904	112.2143	112.7567	113.3413	113.7545	114.1866 (39)
HLP	1.2205	1.2180	1.2156	1.2040	1.2018	1.1917	1.1917	1.1899	1.1956	1.2018	1.2062	1.2108 (40)
HLP (average)												1.2040 (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												2.6802 (42)
Average daily hot water use (litres/day)												97.8552 (43)
Daily hot water use	107.6407	103.7265	99.8123	95.8981	91.9839	88.0697	88.0697	91.9839	95.8981	99.8123	103.7265	107.6407 (44)
Energy conte	159.6281	139.6117	144.0668	125.6009	120.5171	103.9971	96.3686	110.5844	111.9051	130.4146	142.3577	154.5913 (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 =	1539.6432 (45)
Distribution loss (46)m = 0.15 x (45)m													
	23.9442	20.9418	21.6100	18.8401	18.0776	15.5996	14.4553	16.5877	16.7858	19.5622	21.3537	23.1887	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.6958	13.2599	14.6483	14.1196	14.5495	14.0331	14.4715	14.5221	14.0802	14.6074	14.1854	14.6807	(61)
Total heat required for water heating calculated for each month	174.3239	152.8716	158.7151	139.7206	135.0666	118.0301	110.8401	125.1064	125.9853	145.0220	156.5431	169.2719	(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												1.1779 (H8)	
Utilisation factor												0.5721 (H9)	
Collector performance factor												0.8793 (H10)	
Dedicated solar storage volume												75.0000 (H11)	
Effective solar volume												75.0000 (H13)	
Daily hot water demand												97.8552 (H14)	
Volume ratio Veff/V												0.7664 (H15)	
Solar storage volume factor												0.9468 (H16)	
Solar input												-863.8349 (H17)	
Solar input	-25.0495	-41.8004	-71.1909	-95.4098	-117.8707	-115.8857	-114.3542	-99.9119	-78.2510	-53.4362	-29.7123	-20.9621	(63)
												Solar input (sum of months) = Sum(63)m =	-863.8349 (63)
Output from w/h	149.2744	111.0712	87.5242	44.3108	17.1958	2.1444	0.0000	25.1945	47.7343	91.5858	126.8308	148.3098	(64)
												Total per year (kWh/year) = Sum(64)m =	851.1760 (64)
Heat gains from water heating, kWh/month	56.7503	49.7359	51.5643	45.2922	43.7093	38.0873	35.6604	40.3998	40.7285	47.0147	50.8803	55.0718	(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	160.8131	160.8131	160.8131	160.8131	160.8131	160.8131	160.8131	160.8131	160.8131	160.8131	160.8131	160.8131	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.1518	48.9853	39.8376	30.1596	22.5447	19.0331	20.5660	26.7324	35.8802	45.5582	53.1731	56.6846	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	368.3344	372.1566	362.5249	342.0201	316.1365	291.8095	275.5576	271.7355	281.3672	301.8720	327.7556	352.0825	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.7615	53.7615	53.7615	53.7615	53.7615	53.7615	53.7615	53.7615	53.7615	53.7615	53.7615	53.7615	(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)	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	(71)
Water heating gains (Table 5)	76.2773	74.0117	69.3068	62.9059	58.7491	52.8990	47.9307	54.3008	56.5674	63.1918	70.6671	74.0212	(72)
Total internal gains	610.1294	605.5196	582.0352	545.4514	507.7961	474.1076	454.4202	463.1347	484.1807	520.9879	561.9617	593.1543	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b g	Specific data or Table 6c FF	Access factor Table 6d	Gains W							
North	6.1200	10.6334	0.7300	0.7200	0.7700	23.7035 (74)							
East	6.6320	19.6403	0.7300	0.7200	0.7700	47.4439 (76)							
South	6.5100	46.7521	0.7300	0.7200	0.7700	110.8589 (78)							
Solar gains	182.0062	319.6671	461.0917	607.9434	712.1278	720.0919	688.8324	609.4991	511.9043	359.8769	219.8038	154.5682	(83)
Total gains	792.1356	925.1867	1043.1268	1153.3949	1219.9239	1194.1995	1143.2526	1072.6338	996.0850	880.8648	781.7655	747.7225	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, T _{hl} (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	31.1851	31.2495	31.3129	31.6139	31.6709	31.9389	31.9389	31.9890	31.8351	31.6709	31.5559	31.4365	
alpha	3.0790	3.0833	3.0875	3.1076	3.1114	3.1293	3.1293	3.1326	3.1223	3.1114	3.1037	3.0958	
util living area	0.9606	0.9372	0.8962	0.8182	0.6990	0.5464	0.4141	0.4547	0.6573	0.8538	0.9399	0.9663	(86)
MIT	19.2359	19.5069	19.8935	20.3435	20.6925	20.8978	20.9678	20.9564	20.8115	20.3485	19.7091	19.1786	(87)
Th 2	19.9036	19.9056	19.9076	19.9168	19.9185	19.9266	19.9266	19.9281	19.9235	19.9185	19.9150	19.9114	(88)
util rest of house	0.9534	0.9262	0.8779	0.7863	0.6472	0.4707	0.3203	0.3587	0.5847	0.8205	0.9273	0.9601	(89)
MIT 2	18.3226	18.5880	18.9625	19.3919	19.7018	19.8707	19.9148	19.9110	19.8099	19.4095	18.7975	18.2723	(90)
Living area fraction												fLA = Living area / (4) =	0.1800 (91)
MIT	18.4870	18.7534	19.1301	19.5632	19.8801	20.0556	20.1044	20.0991	19.9902	19.5785	18.9616	18.4354	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.3370	18.6034	18.9801	19.4132	19.7301	19.9056	19.9544	19.9491	19.8402	19.4285	18.8116	18.2854	(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	0.9399	0.9096	0.8591	0.7694	0.6373	0.4692	0.3228	0.3606	0.5785	0.8027	0.9110	0.9478	(94)
Useful gains	744.5635	841.5504	896.2016	887.4101	777.4592	560.2716	369.0665	386.8352	576.2449	707.0363	712.2023	708.6687	(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	1615.7526	1574.1087	1430.6879	1193.7281	910.1401	596.2956	376.9980	398.2645	647.2475	1000.6346	1332.2431	1608.3654	(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	648.1647	492.2792	397.6578	220.5490	98.7146	0.0000	0.0000	0.0000	0.0000	218.4371	446.4294	669.3744	(98)
Space heating per m2													(98) / (4) = 33.8424 (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													3526.6366 (211)
Space heating requirement	648.1647	492.2792	397.6578	220.5490	98.7146	0.0000	0.0000	0.0000	0.0000	218.4371	446.4294	669.3744	(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)	716.2041	543.9549	439.4009	243.7005	109.0769	0.0000	0.0000	0.0000	0.0000	241.3670	493.2921	739.6402	(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	149.2744	111.0712	87.5242	44.3108	17.1958	2.1444	0.0000	25.1945	47.7343	91.5858	126.8308	148.3098	(64)
Efficiency of water heater (217)m	89.8833	89.8934	89.9055	89.9484	90.0105	87.3000	87.3000	87.3000	87.3000	89.5305	89.7720	89.9023	(216)
Fuel for water heating, kWh/month	166.0758	123.5588	97.3514	49.2625	19.1042	2.4564	0.0000	28.8597	54.6785	102.2956	141.2811	164.9678	(219)
Water heating fuel used													949.8917 (219)
Annual totals kWh/year													
Space heating fuel - main system													3526.6366 (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)													389.5993 (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													3263.8882 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3526.6366	3.4800	122.7270	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	949.8917	3.4800	33.0562	(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	389.5993	13.1900	51.3881	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit		-1727.2394	13.1900	-227.8229 (252)
Total energy cost			115.8360	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)		0.3492 (257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	95.1282
SAP rating (Section 12)		95 (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	3526.6366	0.2160	761.7535 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	949.8917	0.2160	205.1766 (264)
Space and water heating			966.9301 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	389.5993	0.5190	202.2020 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			337.5699 (272)
CO2 emissions per m2			3.5800 (273)
EI value			96.7529
EI rating			97 (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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	47.1540 (1b)	x 2.3850 (2b)	= 112.4623 (1b) - (3b)
First floor	47.1540 (1c)	x 2.6830 (2c)	= 126.5142 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.3080		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 238.9765 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ 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				2 * 10 =	20.0000 (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) =				20.0000 / (5) =	0.0837 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3337 (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) =		0.3087 (21)							
Wind speed	Jan 5.7000	Feb 5.2000	Mar 4.9000	Apr 4.5000	May 4.6000	Jun 4.2000	Jul 4.3000	Aug 4.2000	Sep 4.5000	Oct 4.9000	Nov 4.9000	Dec 5.2000 (22)
Wind factor	1.4250	1.3000	1.2250	1.1250	1.1500	1.0500	1.0750	1.0500	1.1250	1.2250	1.2250	1.3000 (22a)
Adj infilt rate	0.4398	0.4013	0.3781	0.3472	0.3550	0.3241	0.3318	0.3241	0.3472	0.3781	0.3781	0.4013 (22b)
Effective ac	0.5967	0.5805	0.5715	0.5603	0.5630	0.5525	0.5551	0.5525	0.5603	0.5715	0.5715	0.5805 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1200	1.0900	2.3108		(26)
Windows (Uw = 1.40)			19.2600	1.3258	25.5341		(27)
Flr - Ground			47.1540	0.1586	7.4773	75.6000	3564.8424 (28a)
Brick	99.1610	21.3830	77.7780	0.2500	19.4445	51.1900	3981.4558 (29a)
RF - Ins Joist	47.1540		47.1540	0.1000	4.7154	7.4000	348.9396 (30)
Total net area of external elements Aum(A, m ²)			193.4660				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	59.4821	(33)
Party Wall			43.5850	0.0000	0.0000	7.4000	322.5290 (32)
Stud			28.2861			7.4000	209.3171 (32c)
Stud			102.7589			7.4000	760.4159 (32c)
Block			56.2145			54.0300	3037.2667 (32c)
Internal Floor			47.1540			7.4000	348.9396 (32d)
Internal Ceiling			47.1540			7.4000	348.9396 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 12922.6458 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							137.0260 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0867 (36)
Total fabric heat loss							(33) + (36) = 69.5688 (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	47.0596	45.7800	45.0686	44.1857	44.3994	43.5729	43.7725	43.5729	44.1857	45.0686	45.0686	45.7800 (38)
Average = Sum(39)m / 12 =	116.6284	115.3488	114.6374	113.7545	113.9682	113.1417	113.3413	113.1417	113.7545	114.6374	114.6374	115.3488 (39)
HLP	1.2367	1.2231	1.2156	1.2062	1.2085	1.1997	1.2018	1.1997	1.2062	1.2156	1.2156	1.2231 (40)
HLP (average)												1.2126 (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												2.6802 (42)
Average daily hot water use (litres/day)												97.8552 (43)
Daily hot water use	107.6407	103.7265	99.8123	95.8981	91.9839	88.0697	88.0697	91.9839	95.8981	99.8123	103.7265	107.6407 (44)
Energy conte	159.6281	139.6117	144.0668	125.6009	120.5171	103.9971	96.3686	110.5844	111.9051	130.4146	142.3577	154.5913 (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 =	1539.6432 (45)
Distribution loss (46)m = 0.15 x (45)m													
	23.9442	20.9418	21.6100	18.8401	18.0776	15.5996	14.4553	16.5877	16.7858	19.5622	21.3537	23.1887	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.6958	13.2599	14.6483	14.1196	14.5495	14.0331	14.4715	14.5221	14.0802	14.6074	14.1854	14.6807	(61)
Total heat required for water heating calculated for each month	174.3239	152.8716	158.7151	139.7206	135.0666	118.0301	110.8401	125.1064	125.9853	145.0220	156.5431	169.2719	(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												1254.2188 (H5)	
Overshading factor												0.8000 (H6)	
Solar energy available												2107.0876 (H7)	
Adjustment factor for showers												1.0000 (H7a)	
Solar-to-load ratio												1.3686 (H8)	
Utilisation factor												0.5184 (H9)	
Collector performance factor												0.8793 (H10)	
Dedicated solar storage volume												75.0000 (H11)	
Effective solar volume												75.0000 (H13)	
Daily hot water demand												97.8552 (H14)	
Volume ratio Veff/V												0.7664 (H15)	
Solar storage volume factor												0.9468 (H16)	
Solar input	-28.4920	-41.1992	-70.9881	-99.1518	-118.2199	-125.8883	-121.5662	-107.4033	-82.7418	-56.6366	-33.7005	-23.4275	(63)
Solar input (sum of months) = Sum(63)m =												-909.4151 (63)	
Output from w/h	145.8319	111.6725	87.7270	40.5687	16.8467	0.0000	0.0000	17.7032	43.2435	88.3854	122.8426	145.8445	(64)
Total per year (kWh/year) = Sum(64)m =												820.6659 (64)	
Heat gains from water heating, kWh/month	56.7503	49.7359	51.5643	45.2922	43.7093	38.0873	35.6604	40.3998	40.7285	47.0147	50.8803	55.0718	(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	160.8131	160.8131	160.8131	160.8131	160.8131	160.8131	160.8131	160.8131	160.8131	160.8131	160.8131	160.8131	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.1518	48.9853	39.8376	30.1596	22.5447	19.0331	20.5660	26.7324	35.8802	45.5582	53.1731	56.6846	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	368.3344	372.1566	362.5249	342.0201	316.1365	291.8095	275.5576	271.7355	281.3672	301.8720	327.7556	352.0825	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.7615	53.7615	53.7615	53.7615	53.7615	53.7615	53.7615	53.7615	53.7615	53.7615	53.7615	53.7615	(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)	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	-107.2087	(71)
Water heating gains (Table 5)	76.2773	74.0117	69.3068	62.9059	58.7491	52.8990	47.9307	54.3008	56.5674	63.1918	70.6671	74.0212	(72)
Total internal gains	610.1294	605.5196	582.0352	545.4514	507.7961	474.1076	454.4202	463.1347	484.1807	520.9879	561.9617	593.1543	(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	6.1200	13.4530	0.7300	0.7200	0.7700	29.9889 (74)							
East	6.6320	25.1540	0.7300	0.7200	0.7700	60.7631 (76)							
South	6.5100	56.4170	0.7300	0.7200	0.7700	133.7764 (78)							
Solar gains	224.5284	341.9146	500.5835	691.8407	785.6480	861.9276	806.2956	718.9486	590.5985	414.2932	270.4012	187.3722	(83)
Total gains	834.6578	947.4342	1082.6187	1237.2922	1293.4441	1336.0352	1260.7158	1182.0832	1074.7791	935.2811	832.3629	780.5265	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, T _{hl} (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	30.7783	31.1197	31.3129	31.5559	31.4967	31.7268	31.6709	31.7268	31.5559	31.3129	31.3129	31.1197	
alpha	3.0519	3.0746	3.0875	3.1037	3.0998	3.1151	3.1114	3.1151	3.1037	3.0875	3.0875	3.0746	
util living area	0.9476	0.9268	0.8776	0.7770	0.6334	0.4555	0.3418	0.3363	0.5609	0.7911	0.9106	0.9536	(86)
MIT	19.4447	19.6365	20.0214	20.4710	20.7895	20.9445	20.9830	20.9851	20.8958	20.5561	19.9906	19.4335	(87)
Th 2	19.8908	19.9016	19.9076	19.9150	19.9132	19.9202	19.9185	19.9202	19.9150	19.9076	19.9076	19.9016	(88)
util rest of house	0.9376	0.9136	0.8560	0.7397	0.5741	0.3782	0.2507	0.2390	0.4767	0.7434	0.8910	0.9446	(89)
MIT 2	18.5186	18.7114	19.0840	19.5039	19.7747	19.8935	19.9134	19.9163	19.8611	19.5863	19.0640	18.5167	(90)
Living area fraction												fLA = Living area / (4) =	
MIT	18.6853	18.8779	19.2527	19.6780	19.9574	20.0827	20.1059	20.1087	20.0473	19.7609	19.2308	18.6817	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.5353	18.7279	19.1027	19.5280	19.8074	19.9327	19.9559	19.9587	19.8973	19.6109	19.0808	18.5317	(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	0.9220	0.8961	0.8372	0.7248	0.5679	0.3791	0.2540	0.2426	0.4752	0.7285	0.8727	0.9299	(94)
Useful gains	769.5627	848.9942	906.3969	896.7533	734.5295	506.5080	320.1840	286.7521	510.7762	681.3577	726.3869	725.8233	(95)
Ext temp.	5.4000	5.6000	7.1000	9.5000	12.6000	15.3000	17.1000	17.4000	15.1000	12.0000	8.6000	5.6000	(96)
Heat loss rate W	1531.9475	1514.2908	1375.9582	1140.7316	821.4089	524.1525	323.6970	289.4911	545.7181	872.4910	1201.4877	1491.6559	(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	567.2143	447.0793	349.3536	175.6644	64.6383	0.0000	0.0000	0.0000	0.0000	142.2031	342.0726	569.7795	(98)
Space heating													
Space heating per m2													(98) / (4) = 28.1843 (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													2937.0221 (211)
Space heating requirement	567.2143	447.0793	349.3536	175.6644	64.6383	0.0000	0.0000	0.0000	0.0000	142.2031	342.0726	569.7795	(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)	626.7561	494.0103	386.0261	194.1043	71.4235	0.0000	0.0000	0.0000	0.0000	157.1305	377.9807	629.5906	(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	145.8319	111.6725	87.7270	40.5687	16.8467	0.0000	0.0000	17.7032	43.2435	88.3854	122.8426	145.8445	(64)
Efficiency of water heater (217)m	89.8266	89.8418	89.8390	89.8819	89.8193	87.3000	87.3000	87.3000	87.3000	89.2461	89.6319	89.8289	(216)
Fuel for water heating, kWh/month	162.3483	124.2990	97.6491	45.1356	18.7562	0.0000	0.0000	20.2785	49.5344	99.0356	137.0523	162.3580	(219)
Water heating fuel used													916.4469 (219)
Annual totals kWh/year													
Space heating fuel - main system													2937.0221 (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)													389.5993 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1254 * 0.80) =										-2006.7501			-2006.7501 (233)
Total delivered energy for all uses													2361.3182 (238)

10a. Fuel costs - using BEDF prices (£/10)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2937.0221	4.2600	125.1171	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	916.4469	4.2600	39.0406	(247)
Pumps and fans for heating	75.0000	22.5500	16.9125	(249)
Pump for solar water heating	50.0000	22.5500	11.2750	(249)
Energy for lighting	389.5993	22.5500	87.8546	(250)
Additional standing charges			96.0000	(251)
Energy saving/generation technologies				
PV Unit	-2006.7501	22.5500	-452.5221	(252)
Total energy cost			-76.3222	(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	2937.0221	0.2160	634.3968	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	916.4469	0.2160	197.9525	(264)
Space and water heating			832.3493	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	389.5993	0.5190	202.2020	(268)
Energy saving/generation technologies				
PV Unit	-2006.7501	0.5190	-1041.5033	(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 57.9230 (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	2937.0221	1.2200	3583.1670 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	916.4469	1.2200	1118.0652 (264)
Space and water heating			4701.2322 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	389.5993	3.0700	1196.0698 (268)
Energy saving/generation technologies			
PV Unit	-2006.7501	3.0700	-6160.7228 (269)
Primary energy kWh/year			120.3292 (272)
Primary energy kWh/m2/year			1.2759 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	South East England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	137.0 (calculated from construction elements)
Night ventilation	Yes
Ventilation rate during hot weather (ach)	4.61 (Calculated rate)

Overheating Calculation

Summer ventilation heat loss coefficient	363.55 (P1)
Transmission heat loss coefficient	69.57 (37)
Summer heat loss coefficient	433.12 (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	6.1200	86.6589	0.7300	0.7200	0.7650	191.9215
East	6.6320	124.7972	0.7300	0.7200	0.7650	299.5082
South	6.5100	118.3991	0.7300	0.7200	0.7650	278.9257

total: 770.3555

Solar gains	Jun 815	Jul 770	Aug 686	(P3)
Internal gains	471	451	460	
Total summer gains	1286	1222	1146	(P5)

Summer gain/loss ratio	2.97	2.82	2.65	(P6)
Summer external temperature	15.40	17.40	17.50	
Thermal mass temperature increment (TMP = 137.0)	1.04	1.04	1.04	
Threshold temperature	19.41	21.26	21.19	(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)

Property Reference	631 - PRJ012992		Issued on Date	01/02/2023	
Assessment Reference	631	Prop Type Ref	Daisy		
Property	Lancing Phase 2, BN15				
SAP Rating	84 B	DER	16.52	TER	17.39
Environmental	86 B	% DER<TER	5.01		
CO₂ Emissions (t/year)	1.29	DFEE	45.42	TFEE	51.73
General Requirements Compliance	Pass	% DFEE<TFEE	12.20		
Assessor Details	Chris Nicholls, , Tel: ,		Assessor ID	T850-0001	
Client					

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)	17.39	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	16.52	kgCO ₂ /m ²	Pass
	-0.87 (-5.0%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.73	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	45.42	kWh/m ² /yr	
	-6.3 (-12.2%)	kWh/m ² /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	0.16 (max. 0.25)	0.16 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.37 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (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 30 Combi boiler Efficiency: 89.6% SEDBUK2009 Minimum: 88.0%	Pass
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BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (South East England)

Slight

Pass

Based on:

Overshading

Average

Windows facing North

6.12 m², No overhang

Windows facing East

6.63 m², No overhang

Windows facing South

6.51 m², No overhang

Air change rate

4.61 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/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.00 (design value)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.10

W/m²K

Door U-value

1.09

W/m²K