

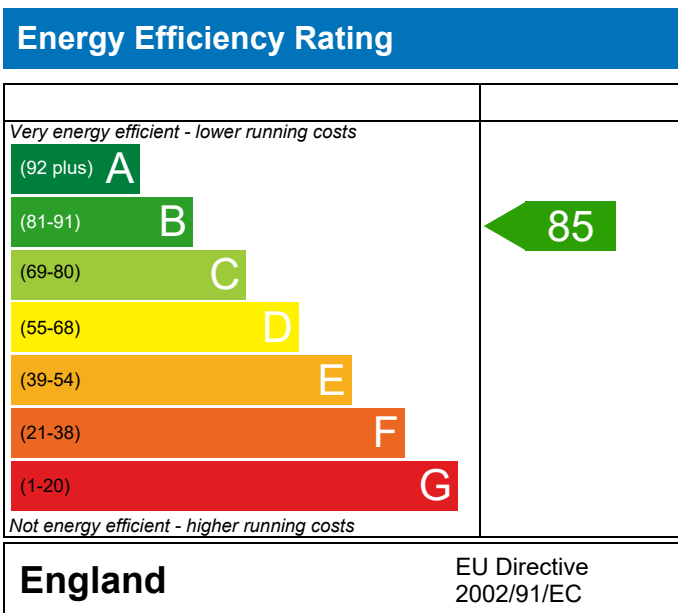
PREDICTED ENERGY ASSESSMENT

Land North of Grange Road,
SO31

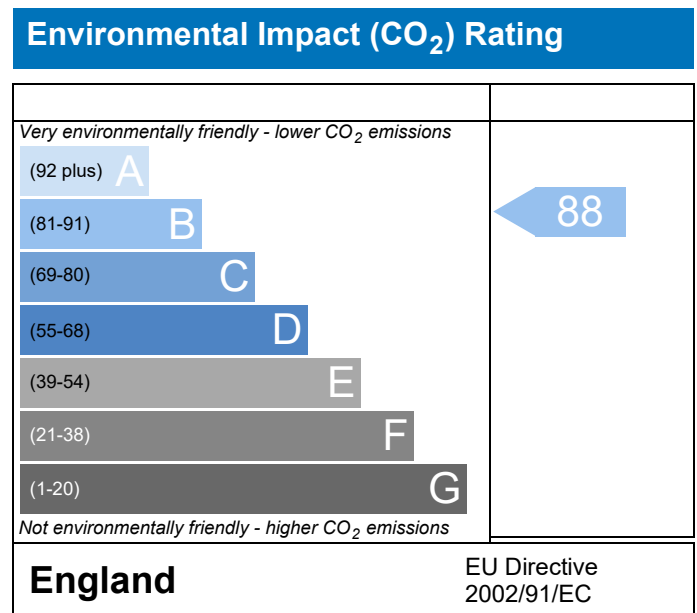
Dwelling type: House, Semi-Detached
Date of assessment: 27/01/2023
Produced by: Scott Binstead
Total floor area: 94.3 m²

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	052 - PRJ013014			Issued on Date	27/01/2023
Assessment Reference	052	Prop Type Ref	3B		
Property	Land North of Grange Road, SO31				
SAP Rating	85 B	DER	14.38	TER	17.42
Environmental	88 B	% DER<TER	17.47		
CO ₂ Emissions (t/year)	1.13	DFEE	43.90	TFEE	49.99
General Requirements Compliance	Pass	% DFEE<TFEE	12.18		
Assessor Details	Chris Nicholls, , Tel: ,			Assessor ID	U903-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Semi-Detached House, total floor area 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) 17.42 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.38 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 50.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 43.9 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	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.08 (max. 0.20)	0.08 (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: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading:

Average

Windows facing East:

3.55 m², No overhang

Windows facing West:

7.72 m², No overhang

Air change rate:

4.65 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 0.08 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 (m2)	Storey height (m)	Volume (m3)
Ground floor	47.1500 (1b)	2.3700 (2b)	111.7455 (1b) - (3b)
First floor	47.1500 (1c)	2.6200 (2c)	123.5330 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.3000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 235.2785 (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) =	0.1275 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3775 (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) =	0.3492 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4452	0.4365	0.4278	0.3841	0.3754	0.3317	0.3317	0.3230	0.3492	0.3754	0.3928	0.4103 (22b)
	0.5991	0.5953	0.5915	0.5738	0.5705	0.5550	0.5550	0.5522	0.5610	0.5705	0.5772	0.5842 (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			2.0900	1.2000	2.5080		(26)
Windows (Uw = 1.40)			11.2600	1.3258	14.9413		(27)
Flr - Ground			47.1480	0.1917	9.0370	75.6000	3564.3888 (28a)
Wl - Brick (Timber Frame)	97.1030	13.3520	83.7510	0.2500	20.9378	7.4000	619.7574 (29a)
RF - Ins Joist	47.1480		47.1480	0.0800	3.7718	7.4000	348.8952 (30)
Total net area of external elements Aum(A, m2)			191.4070				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	51.1959	(33)
Party Wall			46.2040	0.0000	0.0000	7.4000	341.9096 (32)
Stud			76.8070			7.4000	568.3715 (32c)
Internal Floor			47.1480			7.4000	348.8952 (32d)
Internal Ceiling			47.1480			7.4000	348.8952 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 6141.1129 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K = 65.1231 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) = 8.4925 (36)
 Total fabric heat loss (33) + (36) = 59.6884 (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	46.5162	46.2174	45.9245	44.5488	44.2914	43.0931	43.0931	42.8712	43.5547	44.2914	44.8121	45.3565 (38)
Average = Sum(39)m / 12 =	106.2046	105.9058	105.6129	104.2372	103.9798	102.7816	102.7816	102.5597	103.2431	103.9798	104.5005	105.0449 (39)
												104.2359 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1262	1.1231	1.1200	1.1054	1.1026	1.0899	1.0899	1.0876	1.0948	1.1026	1.1082	1.1139 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy = 2.6801 (42)
 Average daily hot water use (litres/day) = 97.8530 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	107.6383	103.7242	99.8100	95.8959	91.9818	88.0677	88.0677	91.9818	95.8959	99.8100	103.7242	107.6383 (44)
Energy content (annual)	159.6245	139.6086	144.0635	125.5981	120.5144	103.9947	96.3664	110.5819	111.9025	130.4116	142.3545	154.5878 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1539.6084 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:	23.9437	20.9413	21.6095	18.8397	18.0772	15.5992	14.4550	16.5873	16.7854	19.5617	21.3532	23.1882 (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	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	174.3202	152.8685	158.7118	139.7177	135.0638	118.0278	110.8379	125.1039	125.9828	145.0190	156.5399	169.2684 (62)
WWHRS	-58.4332	-51.4138	-52.4744	-43.1740	-40.0878	-33.0703	-27.9882	-33.8874	-34.8761	-43.1140	-49.9420	-56.4784 eq. (G10)
Total of WWHRS savings	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-524.9396
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	115.8870	101.4547	106.2374	96.5437	94.9760	84.9575	82.8497	91.2165	91.1067	101.9051	106.5978	112.7900 (64)
Heat gains from water heating, kWh/month	56.7491	49.7348	51.5632	45.2913	43.7084	38.0865	35.6597	40.3990	40.7277	47.0137	50.8792	55.0706 (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	134.0063	134.0063	134.0063	134.0063	134.0063	134.0063	134.0063	134.0063	134.0063	134.0063	134.0063	134.0063 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.2922	21.5761	17.5469	13.2841	9.9300	8.3834	9.0585	11.7746	15.8038	20.0666	23.4207	24.9674 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	246.7701	249.3308	242.8780	229.1405	211.7995	195.5014	184.6132	182.0525	188.5054	202.2428	219.5839	235.8820 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4006	36.4006	36.4006	36.4006	36.4006	36.4006	36.4006	36.4006	36.4006	36.4006	36.4006	36.4006 (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)	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050 (71)
Water heating gains (Table 5)	76.2756	74.0102	69.3054	62.9045	58.7478	52.8979	47.9297	54.2997	56.5662	63.1905	70.6656	74.0196 (72)
Total internal gains	413.5399	411.1190	395.9321	371.5311	346.6792	322.9845	307.8033	314.3287	327.0773	351.7018	379.8720	401.0709 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W						
East	3.5460	19.6403	0.5000	0.7200	0.7700	17.3749 (76)						
West	7.7170	19.6403	0.5000	0.7200	0.7700	37.8122 (80)						
Solar gains	55.1870	107.9576	177.7907	259.2972	317.7784	325.3028	309.7015	266.0290	206.7780	128.1007	68.8118	45.3831 (83)
Total gains	468.7269	519.0766	573.7228	630.8283	664.4577	648.2873	617.5048	580.3577	533.8553	479.8025	448.6838	446.4540 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	16.0621	16.1074	16.1520	16.3652	16.4057	16.5970	16.5970	16.6329	16.5228	16.4057	16.3240	16.2394
tau	2.0708	2.0738	2.0768	2.0910	2.0937	2.1065	2.1065	2.1089	2.1015	2.0937	2.0883	2.0826
util living area	0.9524	0.9394	0.9144	0.8670	0.7923	0.6830	0.5683	0.6059	0.7689	0.8896	0.9389	0.9567 (86)
MIT	17.7845	18.0462	18.5540	19.2531	19.9214	20.4706	20.7506	20.7039	20.2582	19.3974	18.4813	17.7414 (87)
Th 2	19.9795	19.9820	19.9846	19.9964	19.9987	20.0091	20.0091	20.0110	20.0051	19.9987	19.9942	19.9895 (88)
util rest of house	0.9469	0.9322	0.9038	0.8488	0.7600	0.6247	0.4776	0.5191	0.7213	0.8709	0.9306	0.9516 (89)
MIT 2	15.6742	16.0515	16.7825	17.7842	18.7224	19.4674	19.8099	19.7629	19.2011	18.0038	16.6870	15.6143 (90)
Living area fraction	16.0101	16.3690	17.0644	18.0180	18.9132	19.6271	19.9597	19.9127	19.3694	18.2256	16.9726	15.9529 (92)
Temperature adjustment	15.8601	16.2190	16.9144	17.8680	18.7632	19.4771	19.8097	19.7627	19.2194	18.0756	16.8226	15.8029 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	427.1105	462.9126	491.6017	502.7122	471.7450	381.0814	282.0471	286.6334	359.9151	393.5361	399.2644	409.8611 (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	1227.7365	1198.7449	1099.8997	934.7994	734.4338	501.2737	329.8938	344.8746	528.5397	777.3133	1016.0182	1218.8247 (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	595.6657	494.4793	452.5737	311.1028	195.4405	0.0000	0.0000	0.0000	0.0000	285.5302	444.0628	601.8689 (98)
Space heating												3380.7239 (98)
Space heating per m2												(98) / (4) = 35.8507 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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													3735.6065 (211)
Space heating requirement	595.6657	494.4793	452.5737	311.1028	195.4405	0.0000	0.0000	0.0000	0.0000	285.5302	444.0628	601.8689	(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)	658.1942	546.3860	500.0814	343.7600	215.9563	0.0000	0.0000	0.0000	0.0000	315.5030	490.6771	665.0485	(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	115.8870	101.4547	106.2374	96.5437	94.9760	84.9575	82.8497	91.2165	91.1067	101.9051	106.5978	112.7900	(64)
Efficiency of water heater (217)m	89.9629	89.9387	89.8737	89.7211	89.4280	87.3000	87.3000	87.3000	87.3000	89.6358	89.8624	87.3000	(216)
Fuel for water heating, kWh/month	128.8164	112.8042	118.2074	107.6042	106.2039	97.3167	94.9023	104.4863	104.3605	113.6879	118.6235	125.3509	(219)
Water heating fuel used													1332.3642 (219)
Annual totals kWh/year													
Space heating fuel - main system													3735.6065 (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)													429.0080 (232)
Total delivered energy for all uses													5571.9787 (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	3735.6065	0.2160	806.8910	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1332.3642	0.2160	287.7907	(264)
Space and water heating			1094.6817	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	429.0080	0.5190	222.6552	(268)
Total CO2, kg/year			1356.2618	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.3800	(273)

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

DER			14.3800	ZC1
Total Floor Area		TFA	94.3000	
Assumed number of occupants		N	2.6801	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			15.5070	ZC2
CO2 emissions from cooking, equation (L16)			1.9440	ZC3
Total CO2 emissions			31.8310	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			31.8310	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	47.1500 (1b)	x 2.3700 (2b)	= 111.7455 (1b) - (3b)
First floor	47.1500 (1c)	x 2.6200 (2c)	= 123.5330 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 235.2785 (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) =	0.1275 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3775 (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) =		0.3492 (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	0.4452	0.4365	0.4278	0.3841	0.3754	0.3317	0.3317	0.3230	0.3492	0.3754	0.3928	0.4103 (22b)
Effective ac	0.5991	0.5953	0.5915	0.5738	0.5705	0.5550	0.5550	0.5522	0.5610	0.5705	0.5772	0.5842 (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			2.0900	1.0000	2.0900		(26)					
TER Opening Type (Uw = 1.40)			11.2600	1.3258	14.9413		(27)					
Flr - Ground			47.1480	0.1300	6.1292		(28a)					
Wl - Brick (Timber Frame)	97.1030	13.3520	83.7510	0.1800	15.0752		(29a)					
RF - Ins Joist	47.1480		47.1480	0.1300	6.1292		(30)					
Total net area of external elements Aum(A, m ²)			191.4070				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	44.3649	(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)							9.5268 (36)					
Total fabric heat loss							(33) + (36) = 53.8917 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 46.5162	Feb 46.2174	Mar 45.9245	Apr 44.5488	May 44.2914	Jun 43.0931	Jul 43.0931	Aug 42.8712	Sep 43.5547	Oct 44.2914	Nov 44.8121	Dec 45.3565 (38)
Heat transfer coeff	100.4080	100.1091	99.8162	98.4405	98.1831	96.9849	96.9849	96.7630	97.4464	98.1831	98.7038	99.2482 (39)
Average = Sum(39)m / 12 =												98.4393 (39)
HLP	Jan 1.0648	Feb 1.0616	Mar 1.0585	Apr 1.0439	May 1.0412	Jun 1.0285	Jul 1.0285	Aug 1.0261	Sep 1.0334	Oct 1.0412	Nov 1.0467	Dec 1.0525 (40)
HLP (average)												1.0439 (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												2.6801 (42)
Average daily hot water use (litres/day)												97.8530 (43)
Daily hot water use	107.6383	103.7242	99.8100	95.8959	91.9818	88.0677	88.0677	91.9818	95.8959	99.8100	103.7242	107.6383 (44)
Energy conte	159.6245	139.6086	144.0635	125.5981	120.5144	103.9947	96.3664	110.5819	111.9025	130.4116	142.3545	154.5878 (45)
Energy content (annual)												Total = Sum(45)m = 1539.6084 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	23.9437	20.9413	21.6095	18.8397	18.0772	15.5992	14.4550	16.5873	16.7854	19.5617	21.3532	23.1882 (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												

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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 (57)
Total heat required for water heating calculated for each month	50.9589	46.0274	50.8621	47.2911	46.8729	43.4306	44.8783	46.8729	47.2911	50.8621	49.3151	50.9589 (61)
Solar input	210.5834	185.6360	194.9256	172.8892	167.3873	147.4254	141.2447	157.4548	159.1937	181.2737	191.6696	205.5467 (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	210.5834	185.6360	194.9256	172.8892	167.3873	147.4254	141.2447	157.4548	159.1937	181.2737	191.6696	205.5467 (64)
	65.8149	57.9267	60.6167	53.5841	51.7893	45.4359	43.2614	48.4867	49.0304	56.0774	59.6616	64.1402 (65)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Total per year (kWh/year) = Sum(64)m = 2115.2300 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	134.0063	134.0063	134.0063	134.0063	134.0063	134.0063	134.0063	134.0063	134.0063	134.0063	134.0063	134.0063 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.4443	21.7112	17.6567	13.3673	9.9922	8.4358	9.1152	11.8483	15.9028	20.1922	23.5673	25.1237 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	246.7701	249.3308	242.8780	229.1405	211.7995	195.5014	184.6132	182.0525	188.5054	202.2428	219.5839	235.8820 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4006	36.4006	36.4006	36.4006	36.4006	36.4006	36.4006	36.4006	36.4006	36.4006	36.4006	36.4006 (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)	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050 (71)
Water heating gains (Table 5)	88.4608	86.2004	81.4740	74.4224	69.6092	63.1054	58.1471	65.1703	68.0978	75.3728	82.8634	86.2099 (72)
Total internal gains	425.8772	423.4444	408.2106	383.1321	357.6028	333.2445	318.0774	325.2730	338.7078	364.0098	392.2165	413.4175 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b g	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
East	3.5460	19.6403	0.6300	0.7000	0.7700	21.2842 (76)						
West	7.7170	19.6403	0.6300	0.7000	0.7700	46.3199 (80)						
Solar gains	67.6041	132.2480	217.7937	317.6391	389.2786	398.4959	379.3843	325.8855	253.3030	156.9234	84.2944	55.5943 (83)
Total gains	493.4813	555.6924	626.0042	700.7712	746.8814	731.7404	697.4617	651.1585	592.0108	520.9332	476.5109	469.0118 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)												21.0000 (85)
tau	65.2200	65.4147	65.6067	66.5235	66.6979	67.5220	67.5220	67.6768	67.2022	66.6979	66.3461	65.9822
alpha	5.3480	5.3610	5.3738	5.4349	5.4465	5.5015	5.5015	5.5118	5.4801	5.4465	5.4231	5.3988
util living area	0.9990	0.9978	0.9937	0.9762	0.9161	0.7690	0.5952	0.6546	0.8941	0.9873	0.9979	0.9992 (86)
MIT	19.8024	19.9298	20.1641	20.4851	20.7674	20.9410	20.9882	20.9808	20.8544	20.4851	20.0901	19.7846 (87)
Th 2	20.0297	20.0323	20.0349	20.0469	20.0492	20.0597	20.0597	20.0616	20.0556	20.0492	20.0446	20.0398 (88)
util rest of house	0.9986	0.9971	0.9913	0.9665	0.8814	0.6852	0.4766	0.5353	0.8372	0.9806	0.9970	0.9990 (89)
MIT 2	18.4197	18.6078	18.9514	19.4222	19.8089	20.0177	20.0550	20.0530	19.9293	19.4287	18.8514	18.4010 (90)
Living area fraction										fLA = Living area / (4) =		0.1592 (91)
MIT	18.6398	18.8183	19.1444	19.5914	19.9614	20.1647	20.2035	20.2007	20.0766	19.5969	19.0486	18.6212 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6398	18.8183	19.1444	19.5914	19.9614	20.1647	20.2035	20.2007	20.0766	19.5969	19.0486	18.6212 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9979	0.9956	0.9882	0.9605	0.8775	0.6955	0.4954	0.5540	0.8387	0.9761	0.9956	0.9984 (94)
Useful gains	492.4234	553.2666	618.6323	673.0710	655.3993	508.8992	345.5495	360.7310	496.5041	508.4769	474.4207	468.2477 (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	1439.8320	1393.3457	1262.1172	1052.4661	811.1332	539.6898	349.4889	367.7679	582.3947	883.3398	1179.3701	1431.2812 (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	704.8720	564.5332	478.7527	273.1645	115.8660	0.0000	0.0000	0.0000	0.0000	278.8980	507.5636	716.4969 (98)
Space heating per m2												3640.1470 (98)
												38.6018 (99)

(98) / (4) = 38.6018 (99)

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3897.3737 (211)
Space heating requirement	704.8720	564.5332	478.7527	273.1645	115.8660	0.0000	0.0000	0.0000	0.0000	278.8980	507.5636	716.4969	(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)	754.6810	604.4253	512.5832	292.4673	124.0536	0.0000	0.0000	0.0000	0.0000	298.6060	543.4300	767.1273	(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	210.5834	185.6360	194.9256	172.8892	167.3873	147.4254	141.2447	157.4548	159.1937	181.2737	191.6696	205.5467	(64)
Efficiency of water heater (217)m	87.8580	87.6712	87.2256	86.1977	84.1456	80.3000	80.3000	80.3000	80.3000	86.1324	87.3871	87.9344	(216)
Fuel for water heating, kWh/month	239.6860	211.7410	223.4731	200.5728	198.9257	183.5932	175.8963	196.0832	198.2487	210.4595	219.3339	233.7500	(219)
Water heating fuel used													2491.7634 (219)
Annual totals kWh/year													
Space heating fuel - main system													3897.3737 (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)													431.6941 (232)
Total delivered energy for all uses													6895.8312 (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	3897.3737	0.2160	841.8327 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2491.7634	0.2160	538.2209 (264)
Space and water heating			1380.0536 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	431.6941	0.5190	224.0492 (268)
Total CO2, kg/m2/year			1643.0279 (272)
Emissions per m2 for space and water heating			14.6347 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3759 (272b)
Emissions per m2 for pumps and fans			0.4128 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.6347 * 1.00) + 2.3759 + 0.4128, rounded to 2 d.p.			17.4200 (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	47.1500 (1b)	2.3700 (2b)	111.7455 (1b) - (3b)
First floor	47.1500 (1c)	2.6200 (2c)	123.5330 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.3000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 235.2785 (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) =	0.1275 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3775 (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) =	0.3492 (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	0.4452	0.4365	0.4278	0.3841	0.3754	0.3317	0.3317	0.3230	0.3492	0.3754	0.3928	0.4103 (22b)
Effective ac	0.5991	0.5953	0.5915	0.5738	0.5705	0.5550	0.5550	0.5522	0.5610	0.5705	0.5772	0.5842 (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			2.0900	1.2000	2.5080		(26)
Windows (Uw = 1.40)			11.2600	1.3258	14.9413		(27)
Flr - Ground			47.1480	0.1917	9.0370	75.6000	3564.3888 (28a)
Wl - Brick (Timber Frame)	97.1030	13.3520	83.7510	0.2500	20.9378	7.4000	619.7574 (29a)
RF - Ins Joist	47.1480		47.1480	0.0800	3.7718	7.4000	348.8952 (30)
Total net area of external elements Aum(A, m2)			191.4070				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 51.1959		(33)
Party Wall			46.2040	0.0000	0.0000	7.4000	341.9096 (32)
Stud			76.8070			7.4000	568.3715 (32c)
Internal Floor			47.1480			7.4000	348.8952 (32d)
Internal Ceiling			47.1480			7.4000	348.8952 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 6141.1129 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K = 65.1231 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) = 8.4925 (36)
 Total fabric heat loss (33) + (36) = 59.6884 (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	46.5162	46.2174	45.9245	44.5488	44.2914	43.0931	43.0931	42.8712	43.5547	44.2914	44.8121	45.3565 (38)
Average = Sum(39)m / 12 =	106.2046	105.9058	105.6129	104.2372	103.9798	102.7816	102.7816	102.5597	103.2431	103.9798	104.5005	105.0449 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1262	1.1231	1.1200	1.1054	1.1026	1.0899	1.0899	1.0876	1.0948	1.1026	1.1082	1.1139 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy = 2.6801 (42)
 Average daily hot water use (litres/day) = 97.8530 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	107.6383	103.7242	99.8100	95.8959	91.9818	88.0677	88.0677	91.9818	95.8959	99.8100	103.7242	107.6383 (44)
Energy content (annual)	159.6245	139.6086	144.0635	125.5981	120.5144	103.9947	96.3664	110.5819	111.9025	130.4116	142.3545	154.5878 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1539.6084 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Water 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	(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	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)
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	(59)
Heat gains from water heating, kWh/month	33.9202	29.6668	30.6135	26.6896	25.6093	22.0989	20.4779	23.4986	23.7793	27.7125	30.2503	32.8499	32.8499	(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	134.0063	134.0063	134.0063	134.0063	134.0063	134.0063	134.0063	134.0063	134.0063	134.0063	134.0063	134.0063	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.2922	21.5761	17.5469	13.2841	9.9300	8.3834	9.0585	11.7746	15.8038	20.0666	23.4207	24.9674	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	246.7701	249.3308	242.8780	229.1405	211.7995	195.5014	184.6132	182.0525	188.5054	202.2428	219.5839	235.8820	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4006	36.4006	36.4006	36.4006	36.4006	36.4006	36.4006	36.4006	36.4006	36.4006	36.4006	36.4006	(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)	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	(71)
Water heating gains (Table 5)	45.5917	44.1471	41.1472	37.0689	34.4211	30.6929	27.5240	31.5842	33.0268	37.2479	42.0143	44.1531	(72)
Total internal gains	379.8559	378.2559	364.7739	342.6954	319.3525	297.7795	284.3976	288.6132	300.5379	322.7593	348.2208	368.2043	(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							
East	3.5460	19.6403	0.5000	0.7200	0.7700	17.3749 (76)							
West	7.7170	19.6403	0.5000	0.7200	0.7700	37.8122 (80)							
Solar gains	55.1870	107.9576	177.7907	259.2972	317.7784	325.3028	309.7015	266.0290	206.7780	128.1007	68.8118	45.3831	(83)
Total gains	435.0429	486.2135	542.5646	601.9926	637.1309	623.0823	594.0991	554.6422	507.3159	450.8600	417.0325	413.5875	(84)

7. Mean internal temperature (heating season)

Utilisation during heating periods in the living area from Table 9, Thl (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)	16.0621	16.1074	16.1520	16.3652	16.4057	16.5970	16.5970	16.6329	16.5228	16.4057	16.3240	16.2394	21.0000 (85)
tau	2.0708	2.0738	2.0768	2.0910	2.0937	2.1065	2.1065	2.1089	2.1015	2.0937	2.0883	2.0826	
alpha	0.9583	0.9459	0.9220	0.8761	0.8036	0.6963	0.5822	0.6221	0.7834	0.8999	0.9462	0.9623	(86)
util living area	17.7130	17.9789	18.4947	19.2054	19.8859	20.4485	20.7381	20.6876	20.2261	19.3458	18.4161	17.6704	(87)
MIT	19.9795	19.9820	19.9846	19.9964	19.9987	20.0091	20.0091	20.0110	20.0051	19.9987	19.9942	19.9895	(88)
Th 2	0.9534	0.9394	0.9121	0.8588	0.7722	0.6387	0.4911	0.5353	0.7374	0.8827	0.9387	0.9578	(89)
util rest of house	16.9498	17.2149	17.7268	18.4323	19.0906	19.6201	19.8647	19.8300	19.4263	18.5803	17.6593	16.9140	(90)
Living area fraction	17.0713	17.3365	17.8490	18.5553	19.2172	19.7519	20.0037	19.9665	19.5536	18.7021	17.7798	17.0344	(91)
MIT	17.0713	17.3365	17.8490	18.5553	19.2172	19.7519	20.0037	19.9665	19.5536	18.7021	17.7798	17.0344	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.0713	17.3365	17.8490	18.5553	19.2172	19.7519	20.0037	19.9665	19.5536	18.7021	17.7798	17.0344	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9335	0.9162	0.8844	0.8276	0.7429	0.6215	0.4905	0.5309	0.7121	0.8532	0.9158	0.9392	(94)
Useful gains	406.1138	445.4749	479.8339	498.2010	473.3157	387.2695	291.4242	294.4579	361.2835	384.6861	381.9167	388.4571	(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	1356.3711	1317.0960	1198.6024	1006.4425	781.6380	529.5224	349.8377	365.7788	563.0446	842.4557	1116.0441	1348.1870	(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	706.9914	585.7294	534.7638	365.9339	229.3917	0.0000	0.0000	0.0000	0.0000	340.5806	528.5717	714.0390	(98)
Space heating												4006.0015	(98)
Space heating per m2												42.4815	(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	966.1467	760.5835	779.4535	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6258	0.6930	0.6657	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	604.6208	527.0807	518.8540	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	831.0318	795.0645	751.0472	0.0000	0.0000	0.0000	0.0000	(103)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	163.0159	199.3800	172.7517	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling Cooled fraction													535.1476 (104)
Intermittency factor (Table 10b)													$fC = \text{cooled area} / (4) =$
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	40.7540	49.8450	43.1879	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													133.7869 (107)
Space cooling per m2													1.4187 (108)
Energy for space heating													42.4815 (99)
Energy for space cooling													1.4187 (108)
Total													43.9002 (109)
Dwelling Fabric Energy Efficiency (DFEE)													43.9 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	47.1500 (1b)	2.3700 (2b)	111.7455 (1b) - (3b)
First floor	47.1500 (1c)	2.6200 (2c)	123.5330 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.3000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 235.2785 (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) =	0.1275 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3775 (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) =	0.3492 (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	0.4452	0.4365	0.4278	0.3841	0.3754	0.3317	0.3317	0.3230	0.3492	0.3754	0.3928	0.4103 (22b)
Effective ac	0.5991	0.5953	0.5915	0.5738	0.5705	0.5550	0.5550	0.5522	0.5610	0.5705	0.5772	0.5842 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.0900	1.0000	2.0900		(26)					
TER Opening Type (Uw = 1.40)			11.2600	1.3258	14.9413		(27)					
Flr - Ground			47.1480	0.1300	6.1292		(28a)					
Wl - Brick (Timber Frame)	97.1030	13.3520	83.7510	0.1800	15.0752		(29a)					
RF - Ins Joist	47.1480		47.1480	0.1300	6.1292		(30)					
Total net area of external elements Aum(A, m2)			191.4070				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 44.3649		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.5268 (36)					
Total fabric heat loss							(33) + (36) = 53.8917 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 46.5162	Feb 46.2174	Mar 45.9245	Apr 44.5488	May 44.2914	Jun 43.0931	Jul 43.0931	Aug 42.8712	Sep 43.5547	Oct 44.2914	Nov 44.8121	Dec 45.3565 (38)
Heat transfer coeff	100.4080	100.1091	99.8162	98.4405	98.1831	96.9849	96.9849	96.7630	97.4464	98.1831	98.7038	99.2482 (39)
Average = Sum(39)m / 12 =												98.4393 (39)
HLP	Jan 1.0648	Feb 1.0616	Mar 1.0585	Apr 1.0439	May 1.0412	Jun 1.0285	Jul 1.0285	Aug 1.0261	Sep 1.0334	Oct 1.0412	Nov 1.0467	Dec 1.0525 (40)
HLP (average)												1.0439 (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												2.6801 (42)
Average daily hot water use (litres/day)												97.8530 (43)
Daily hot water use	107.6383	103.7242	99.8100	95.8959	91.9818	88.0677	88.0677	91.9818	95.8959	99.8100	103.7242	107.6383 (44)
Energy conte	159.6245	139.6086	144.0635	125.5981	120.5144	103.9947	96.3664	110.5819	111.9025	130.4116	142.3545	154.5878 (45)
Energy content (annual)												Total = Sum(45)m = 1539.6084 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	0.0000	0.0000	0.0000	0.0000	(59)
	33.9202	29.6668	30.6135	26.6896	25.6093	22.0989	20.4779	23.4986	23.7793	27.7125	30.2503	32.8499	(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	134.0063	134.0063	134.0063	134.0063	134.0063	134.0063	134.0063	134.0063	134.0063	134.0063	134.0063	134.0063	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.4443	21.7112	17.6567	13.3673	9.9922	8.4358	9.1152	11.8483	15.9028	20.1922	23.5673	25.1237	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	246.7701	249.3308	242.8780	229.1405	211.7995	195.5014	184.6132	182.0525	188.5054	202.2428	219.5839	235.8820	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4006	36.4006	36.4006	36.4006	36.4006	36.4006	36.4006	36.4006	36.4006	36.4006	36.4006	36.4006	(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)	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	(71)
Water heating gains (Table 5)	45.5917	44.1471	41.1472	37.0689	34.4211	30.6929	27.5240	31.5842	33.0268	37.2479	42.0143	44.1531	(72)
Total internal gains	380.0080	378.3910	364.8838	342.7786	319.4147	297.8320	284.4543	288.6869	300.6369	322.8849	348.3674	368.3607	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W						
East	3.5460	19.6403	0.6300		0.7000	0.7700	21.2842 (76)						
West	7.7170	19.6403	0.6300		0.7000	0.7700	46.3199 (80)						
Solar gains	67.6041	132.2480	217.7937	317.6391	389.2786	398.4959	379.3843	325.8855	253.3030	156.9234	84.2944	55.5943	(83)
Total gains	447.6121	510.6390	582.6774	660.4176	708.6933	696.3279	663.8387	614.5724	553.9399	479.8083	432.6618	423.9550	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)	65.2200	65.4147	65.6067	66.5235	66.6979	67.5220	67.5220	67.6768	67.2022	66.6979	66.3461	65.9822	(85)
tau	5.3480	5.3610	5.3738	5.4349	5.4465	5.5015	5.5015	5.5118	5.4801	5.4465	5.4231	5.3988	
alpha	0.9994	0.9986	0.9955	0.9815	0.9300	0.7937	0.6214	0.6858	0.9148	0.9913	0.9987	0.9995	(86)
util living area	19.7562	19.8847	20.1216	20.4486	20.7419	20.9307	20.9855	20.9759	20.8315	20.4457	20.0460	19.7391	(87)
MIT	20.0297	20.0323	20.0349	20.0469	20.0492	20.0597	20.0597	20.0616	20.0556	20.0492	20.0446	20.0398	(88)
util rest of house	0.9992	0.9980	0.9938	0.9738	0.8993	0.7119	0.4995	0.5645	0.8647	0.9865	0.9981	0.9994	(89)
MIT 2	18.8844	19.0148	19.2530	19.5856	19.8638	20.0252	20.0557	20.0541	19.9525	19.5874	19.1861	18.8754	(90)
Living area fraction	19.0232	19.1532	19.3913	19.7230	20.0036	20.1694	20.2037	20.2008	20.0924	19.7241	19.3229	19.0129	(91)
MIT	19.0232	19.1532	19.3913	19.7230	20.0036	20.1694	20.2037	20.2008	20.0924	19.7241	19.3229	19.0129	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0232	19.1532	19.3913	19.7230	20.0036	20.1694	20.2037	20.2008	20.0924	19.7241	19.3229	19.0129	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9988	0.9974	0.9922	0.9704	0.8975	0.7225	0.5191	0.5837	0.8671	0.9842	0.9975	0.9991	(94)
Ext temp.	447.0878	509.3089	578.1339	640.8564	636.0604	503.0775	344.5731	358.7428	480.3086	472.2414	431.5937	423.5885	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1478.3220	1426.8804	1286.7598	1065.4223	815.2711	540.1440	349.5021	367.7772	583.9360	895.8286	1206.4509	1470.1545	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	767.2383	616.6081	527.2177	305.6875	133.3327	0.0000	0.0000	0.0000	0.0000	315.1489	557.8972	778.6452	(98)
Space heating per m2												4001.7755	(98)
												42.4366	(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	911.6579	717.6882	735.3988	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8485	0.9171	0.8890	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	773.5586	658.1997	653.8026	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	916.7134	876.6538	821.1937	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	103.0714	162.5298	124.5390	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												390.1403	(104)
Cooled fraction												1.0000	(105)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Intermittency factor (Table 10b)	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	25.7679	40.6325	31.1348	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												97.5351 (107)
Space cooling per m2												1.0343 (108)
Energy for space heating												42.4366 (99)
Energy for space cooling												1.0343 (108)
Total												43.4709 (109)
Target Fabric Energy Efficiency (TFEE)												50.0 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	47.1500 (1b)	2.3700 (2b)	111.7455 (1b) - (3b)
First floor	47.1500 (1c)	2.6200 (2c)	123.5330 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.3000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 235.2785 (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) =	0.1275 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3775 (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) =	0.3492 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.9000	4.6000	4.5000	4.2000	4.2000	4.1000	4.1000	4.0000	4.0000	4.3000	4.3000	4.4000 (22)
Wind factor	1.2250	1.1500	1.1250	1.0500	1.0500	1.0250	1.0250	1.0000	1.0000	1.0750	1.0750	1.1000 (22a)
Adj infiltr rate	0.4278	0.4016	0.3928	0.3667	0.3667	0.3579	0.3579	0.3492	0.3492	0.3754	0.3754	0.3841 (22b)
Effective ac	0.5915	0.5806	0.5772	0.5672	0.5672	0.5641	0.5641	0.5610	0.5610	0.5705	0.5705	0.5738 (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			2.0900	1.2000	2.5080		(26)
Windows (Uw = 1.40)			11.2600	1.3258	14.9413		(27)
Flr - Ground			47.1480	0.1917	9.0370	75.6000	3564.3888 (28a)
Wl - Brick (Timber Frame)	97.1030	13.3520	83.7510	0.2500	20.9378	7.4000	619.7574 (29a)
RF - Ins Joist	47.1480		47.1480	0.0800	3.7718	7.4000	348.8952 (30)
Total net area of external elements Aum(A, m2)			191.4070				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 51.1959		(33)
Party Wall			46.2040	0.0000	0.0000	7.4000	341.9096 (32)
Stud			76.8070			7.4000	568.3715 (32c)
Internal Floor			47.1480			7.4000	348.8952 (32d)
Internal Ceiling			47.1480			7.4000	348.8952 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 6141.1129 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.4925 (36)
 Total fabric heat loss (33) + (36) = 59.6884 (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	45.9245	45.0813	44.8121	44.0399	44.0399	43.7943	43.7943	43.5547	43.5547	44.2914	44.2914	44.5488 (38)
Average = Sum(39)m / 12 =	105.6129	104.7697	104.5005	103.7283	103.7283	103.4827	103.4827	103.2431	103.2431	103.9798	103.9798	104.2372 (39)
												103.9990 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1200	1.1110	1.1082	1.1000	1.1000	1.0974	1.0974	1.0948	1.0948	1.1026	1.1026	1.1054 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6801 (42)
 Average daily hot water use (litres/day) 97.8530 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	107.6383	103.7242	99.8100	95.8959	91.9818	88.0677	88.0677	91.9818	95.8959	99.8100	103.7242	107.6383 (44)
Energy content (annual)	159.6245	139.6086	144.0635	125.5981	120.5144	103.9947	96.3664	110.5819	111.9025	130.4116	142.3545	154.5878 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1539.6084 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Water storage loss:	23.9437	20.9413	21.6095	18.8397	18.0772	15.5992	14.4550	16.5873	16.7854	19.5617	21.3532	23.1882 (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	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	174.3202	152.8685	158.7118	139.7177	135.0638	118.0278	110.8379	125.1039	125.9828	145.0190	156.5399	169.2684 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	174.3202	152.8685	158.7118	139.7177	135.0638	118.0278	110.8379	125.1039	125.9828	145.0190	156.5399	169.2684 (64)
RHI water heating demand	56.7491	49.7348	51.5632	45.2913	43.7084	38.0865	35.6597	40.3990	40.7277	47.0137	50.8792	55.0706 (65)
Heat gains from water heating, kWh/month												1711 (64)
												1711 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	160.8075	160.8075	160.8075	160.8075	160.8075	160.8075	160.8075	160.8075	160.8075	160.8075	160.8075	160.8075 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	60.7305	53.9403	43.8672	33.2103	24.8251	20.9584	22.6463	29.4365	39.5096	50.1665	58.5517	62.4184 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	368.3136	372.1356	362.5044	342.0008	316.1186	291.7931	275.5421	271.7202	281.3513	301.8550	327.7371	352.0627 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.7609	53.7609	53.7609	53.7609	53.7609	53.7609	53.7609	53.7609	53.7609	53.7609	53.7609	53.7609 (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)	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050 (71)
Water heating gains (Table 5)	76.2756	74.0102	69.3054	62.9045	58.7478	52.8979	47.9297	54.2997	56.5662	63.1905	70.6656	74.0196 (72)
Total internal gains	615.6832	610.4495	586.0404	548.4790	510.0550	476.0128	456.4815	465.8197	487.7905	525.5753	567.3178	598.8641 (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						
East	3.5460	25.1733	0.5000	0.7200	0.7700	22.2697 (76)						
West	7.7170	25.1733	0.5000	0.7200	0.7700	48.4645 (80)						
Solar gains	70.7342	117.7069	196.7212	288.2213	332.3757	375.4147	345.5394	309.6231	240.7960	152.4839	87.9085	57.1762 (83)
Total gains	686.4174	728.1563	782.7616	836.7003	842.4307	851.4275	802.0209	775.4428	728.5865	678.0592	655.2262	656.0403 (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	16.1520	16.2820	16.3240	16.4455	16.4455	16.4845	16.4845	16.5228	16.5228	16.4057	16.4057	16.3652
alpha	2.0768	2.0855	2.0883	2.0964	2.0964	2.0990	2.0990	2.1015	2.1015	2.0937	2.0937	2.0910
util living area	0.8953	0.8798	0.8414	0.7719	0.6676	0.5081	0.3819	0.3822	0.5902	0.7679	0.8607	0.9008 (86)
MIT	18.5672	18.7548	19.2140	19.8116	20.3700	20.7665	20.9137	20.9165	20.6614	20.0600	19.2749	18.5706 (87)
Th 2	19.9846	19.9918	19.9942	20.0008	20.0008	20.0030	20.0030	20.0051	20.0051	19.9987	19.9987	19.9964 (88)
util rest of house	0.8835	0.8663	0.8228	0.7433	0.6205	0.4330	0.2804	0.2774	0.5188	0.7310	0.8422	0.8895 (89)
MIT 2	16.7946	17.0633	17.7156	18.5545	19.3115	19.8032	19.9550	19.9602	19.6930	18.9115	17.8140	16.8045 (90)
Living area fraction	17.0767	17.3326	17.9541	18.7546	19.4800	19.9565	20.1076	20.1125	19.8472	19.0943	18.0465	17.0857 (92)
Temperature adjustment	16.9267	17.1826	17.8041	18.6046	19.3300	19.8065	19.9576	19.9625	19.6972	18.9443	17.8965	-0.1500
adjusted MIT												16.9357 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8337	0.8153	0.7705	0.6948	0.5841	0.4168	0.2754	0.2726	0.4937	0.6831	0.7901	0.8409 (94)
Ext temp.	572.2982	593.6814	603.0990	581.3168	492.0628	354.8870	220.9073	211.3952	359.7125	463.1676	517.7116	551.6355 (95)
Heat loss rate W	5.7000	6.1000	7.7000	10.1000	13.1000	15.9000	17.7000	17.8000	15.5000	12.3000	8.8000	5.8000 (96)
Month fracti	1185.6879	1161.1187	1055.8868	882.1696	646.2228	404.2581	233.6193	223.2581	433.3303	690.8759	945.8527	1160.7492 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
RHI space heating demand	456.3619	381.3179	336.8742	216.6140	114.6950	0.0000	0.0000	0.0000	0.0000	169.4150	308.2616	453.1806 (98)
												2437.7201 (98)
												2437 (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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	47.1500 (1b)	2.3700 (2b)	111.7455 (1b) - (3b)
First floor	47.1500 (1c)	2.6200 (2c)	123.5330 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.3000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 235.2785 (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) =	0.1275 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3775 (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) =	0.3492 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4452	0.4365	0.4278	0.3841	0.3754	0.3317	0.3317	0.3230	0.3492	0.3754	0.3928	0.4103 (22b)
	0.5991	0.5953	0.5915	0.5738	0.5705	0.5550	0.5550	0.5522	0.5610	0.5705	0.5772	0.5842 (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			2.0900	1.2000	2.5080		(26)
Windows (Uw = 1.40)			11.2600	1.3258	14.9413		(27)
Flr - Ground			47.1480	0.1917	9.0370	75.6000	3564.3888 (28a)
Wl - Brick (Timber Frame)	97.1030	13.3520	83.7510	0.2500	20.9378	7.4000	619.7574 (29a)
RF - Ins Joist	47.1480		47.1480	0.0800	3.7718	7.4000	348.8952 (30)
Total net area of external elements Aum(A, m ²)			191.4070				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 51.1959		(33)
Party Wall			46.2040	0.0000	0.0000	7.4000	341.9096 (32)
Stud			76.8070			7.4000	568.3715 (32c)
Internal Floor			47.1480			7.4000	348.8952 (32d)
Internal Ceiling			47.1480			7.4000	348.8952 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 6141.1129 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 65.1231 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.4925 (36)
 Total fabric heat loss (33) + (36) = 59.6884 (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	46.5162	46.2174	45.9245	44.5488	44.2914	43.0931	43.0931	42.8712	43.5547	44.2914	44.8121	45.3565 (38)
Average = Sum(39)m / 12 =	106.2046	105.9058	105.6129	104.2372	103.9798	102.7816	102.7816	102.5597	103.2431	103.9798	104.5005	105.0449 (39)
												104.2359 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1262	1.1231	1.1200	1.1054	1.1026	1.0899	1.0899	1.0876	1.0948	1.1026	1.1082	1.1139 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6801 (42)
 Average daily hot water use (litres/day) 97.8530 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	107.6383	103.7242	99.8100	95.8959	91.9818	88.0677	88.0677	91.9818	95.8959	99.8100	103.7242	107.6383 (44)
Energy content (annual)	159.6245	139.6086	144.0635	125.5981	120.5144	103.9947	96.3664	110.5819	111.9025	130.4116	142.3545	154.5878 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1539.6084 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water storage loss:	23.9437	20.9413	21.6095	18.8397	18.0772	15.5992	14.4550	16.5873	16.7854	19.5617	21.3532	23.1882 (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	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	174.3202	152.8685	158.7118	139.7177	135.0638	118.0278	110.8379	125.1039	125.9828	145.0190	156.5399	169.2684 (62)
WWHRS	-58.4332	-51.4138	-52.4744	-43.1740	-40.0878	-33.0703	-27.9882	-33.8874	-34.8761	-43.1140	-49.9420	-56.4784 eq. (G10)
Total of WWHRS savings												-524.9396
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	115.8870	101.4547	106.2374	96.5437	94.9760	84.9575	82.8497	91.2165	91.1067	101.9051	106.5978	112.7900 (64)
Heat gains from water heating, kWh/month	56.7491	49.7348	51.5632	45.2913	43.7084	38.0865	35.6597	40.3990	40.7277	47.0137	50.8792	55.0706 (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	160.8075	160.8075	160.8075	160.8075	160.8075	160.8075	160.8075	160.8075	160.8075	160.8075	160.8075	160.8075 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	60.7305	53.9403	43.8672	33.2103	24.8251	20.9584	22.6463	29.4365	39.5096	50.1665	58.5517	62.4184 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	368.3136	372.1356	362.5044	342.0008	316.1186	291.7931	275.5421	271.7202	281.3513	301.8550	327.7371	352.0627 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.7609	53.7609	53.7609	53.7609	53.7609	53.7609	53.7609	53.7609	53.7609	53.7609	53.7609	53.7609 (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)	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050 (71)
Water heating gains (Table 5)	76.2756	74.0102	69.3054	62.9045	58.7478	52.8979	47.9297	54.2997	56.5662	63.1905	70.6656	74.0196 (72)
Total internal gains	615.6832	610.4495	586.0404	548.4790	510.0550	476.0128	456.4815	465.8197	487.7905	525.5753	567.3178	598.8641 (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						
East	3.5460	19.6403	0.5000	0.7200	0.7700	17.3749 (76)						
West	7.7170	19.6403	0.5000	0.7200	0.7700	37.8122 (80)						
Solar gains	55.1870	107.9576	177.7907	259.2972	317.7784	325.3028	309.7015	266.0290	206.7780	128.1007	68.8118	45.3831 (83)
Total gains	670.8703	718.4070	763.8311	807.7762	827.8334	801.3156	766.1830	731.8488	694.5685	653.6761	636.1295	644.2472 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	16.0621	16.1074	16.1520	16.3652	16.4057	16.5970	16.5970	16.6329	16.5228	16.4057	16.3240	16.2394
tau	2.0708	2.0738	2.0768	2.0910	2.0937	2.1065	2.1065	2.1089	2.1015	2.0937	2.0883	2.0826
util living area	0.9125	0.8964	0.8660	0.8106	0.7276	0.6092	0.4914	0.5228	0.6861	0.8253	0.8913	0.9185 (86)
MIT	18.1861	18.4254	18.8866	19.5169	20.1072	20.5823	20.8134	20.7801	20.4206	19.6732	18.8371	18.1424 (87)
Th 2	19.9795	19.9820	19.9846	19.9964	19.9987	20.0091	20.0091	20.0110	20.0051	19.9987	19.9942	19.9895 (88)
util rest of house	0.9032	0.8852	0.8509	0.7876	0.6907	0.5489	0.4050	0.4385	0.6325	0.7996	0.8779	0.9098 (89)
MIT 2	16.2456	16.5882	17.2473	18.1429	18.9605	19.5924	19.8651	19.8333	19.3952	18.3775	17.1881	16.1862 (90)
Living area fraction	16.5545	16.8807	17.5082	18.3616	19.1430	19.7500	20.0160	19.9840	19.5584	18.5838	17.4506	16.4976 (92)
MIT	16.4045	16.7307	17.3582	18.2116	18.9930	19.6000	19.8660	19.8340	19.4084	18.4338	17.3006	16.3476 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	574.3438	600.3375	610.1219	594.6695	535.3236	417.2848	299.7601	308.6365	413.0276	488.7187	526.6098	556.7612 (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	1285.5487	1252.9366	1146.7660	970.6194	758.3291	513.9030	335.6882	352.1939	548.0568	814.5517	1065.9681	1276.0379 (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	529.1364	438.5466	399.2632	270.6839	165.9161	0.0000	0.0000	0.0000	0.0000	242.4198	388.3380	535.1419 (98)
Space heating												2969.4459 (98)
Space heating per m2												(98) / (4) = 31.4894 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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													3281.1557 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	529.1364	438.5466	399.2632	270.6839	165.9161	0.0000	0.0000	0.0000	0.0000	242.4198	388.3380	535.1419	(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)	584.6812	484.5819	441.1748	299.0983	183.3327	0.0000	0.0000	0.0000	0.0000	267.8672	429.1027	591.3170	(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	115.8870	101.4547	106.2374	96.5437	94.9760	84.9575	82.8497	91.2165	91.1067	101.9051	106.5978	112.7900	(64)
Efficiency of water heater (217)m	89.9079	89.8810	89.8082	89.6362	89.3083	87.3000	87.3000	87.3000	87.3000	89.5288	89.7911	87.3000	(216)
Fuel for water heating, kWh/month	128.8953	112.8767	118.2937	107.7061	106.3463	97.3167	94.9023	104.4863	104.3605	113.8239	118.7176	125.4251	(219)
Water heating fuel used													1333.1503 (219)
Annual totals kWh/year													
Space heating fuel - main system													3281.1557 (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)													429.0080 (232)
Total delivered energy for all uses													5118.3140 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost f/year
Space heating - main system 1	3281.1557	3.4800	114.1842 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1333.1503	3.4800	46.3936 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	429.0080	13.1900	56.5862 (250)
Additional standing charges			120.0000 (251)
Total energy cost			347.0565 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.0464 (257)
SAP value		85.4027
SAP rating (Section 12)		85 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3281.1557	0.2160	708.7296 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1333.1503	0.2160	287.9605 (264)
Space and water heating			996.6901 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	429.0080	0.5190	222.6552 (268)
Total kg/year			1258.2703 (272)
CO2 emissions per m2			13.3400 (273)
EI value			87.8960
EI rating			88 (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	$3.48 / 0.8892 = 3.914$, stars = 5
Water heating environmental impact	$0.216 / 0.8892 = 0.2429$, stars = 5

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	47.1500 (1b)	2.3700 (2b)	111.7455 (1b) - (3b)
First floor	47.1500 (1c)	2.6200 (2c)	123.5330 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.3000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 235.2785 (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) =	0.1275 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3775 (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) =	0.3492 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.9000	4.6000	4.5000	4.2000	4.2000	4.1000	4.1000	4.0000	4.0000	4.3000	4.3000	4.4000 (22)
Wind factor	1.2250	1.1500	1.1250	1.0500	1.0500	1.0250	1.0250	1.0000	1.0000	1.0750	1.0750	1.1000 (22a)
Adj infilt rate												
Effective ac	0.4278	0.4016	0.3928	0.3667	0.3667	0.3579	0.3579	0.3492	0.3492	0.3754	0.3754	0.3841 (22b)
	0.5915	0.5806	0.5772	0.5672	0.5672	0.5641	0.5641	0.5610	0.5610	0.5705	0.5705	0.5738 (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			2.0900	1.2000	2.5080		(26)
Windows (Uw = 1.40)			11.2600	1.3258	14.9413		(27)
Flr - Ground			47.1480	0.1917	9.0370	75.6000	3564.3888 (28a)
Wl - Brick (Timber Frame)	97.1030	13.3520	83.7510	0.2500	20.9378	7.4000	619.7574 (29a)
RF - Ins Joist	47.1480		47.1480	0.0800	3.7718	7.4000	348.8952 (30)
Total net area of external elements Aum(A, m2)			191.4070				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	51.1959	(33)
Party Wall			46.2040	0.0000	0.0000	7.4000	341.9096 (32)
Stud			76.8070			7.4000	568.3715 (32c)
Internal Floor			47.1480			7.4000	348.8952 (32d)
Internal Ceiling			47.1480			7.4000	348.8952 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 6141.1129 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.4925 (36)
 Total fabric heat loss (33) + (36) = 59.6884 (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	45.9245	45.0813	44.8121	44.0399	44.0399	43.7943	43.7943	43.5547	43.5547	44.2914	44.2914	44.5488 (38)
Average = Sum(39)m / 12 =	105.6129	104.7697	104.5005	103.7283	103.7283	103.4827	103.4827	103.2431	103.2431	103.9798	103.9798	104.2372 (39)
												103.9990 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1200	1.1110	1.1082	1.1000	1.1000	1.0974	1.0974	1.0948	1.0948	1.1026	1.1026	1.1054 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6801 (42)
 Average daily hot water use (litres/day) 97.8530 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	107.6383	103.7242	99.8100	95.8959	91.9818	88.0677	88.0677	91.9818	95.8959	99.8100	103.7242	107.6383 (44)
Energy content (annual)	159.6245	139.6086	144.0635	125.5981	120.5144	103.9947	96.3664	110.5819	111.9025	130.4116	142.3545	154.5878 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1539.6084 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Water storage loss:	23.9437	20.9413	21.6095	18.8397	18.0772	15.5992	14.4550	16.5873	16.7854	19.5617	21.3532	23.1882 (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	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	174.3202	152.8685	158.7118	139.7177	135.0638	118.0278	110.8379	125.1039	125.9828	145.0190	156.5399	169.2684 (62)
WWHRS	-58.4332	-51.4138	-52.4744	-43.1740	-40.0878	-33.0703	-27.9882	-33.8874	-34.8761	-43.1140	-49.9420	-56.4784 eq. (G10)
Total of WWHRS savings	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-524.9396
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	115.8870	101.4547	106.2374	96.5437	94.9760	84.9575	82.8497	91.2165	91.1067	101.9051	106.5978	112.7900 (64)
Heat gains from water heating, kWh/month	56.7491	49.7348	51.5632	45.2913	43.7084	38.0865	35.6597	40.3990	40.7277	47.0137	50.8792	55.0706 (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	160.8075	160.8075	160.8075	160.8075	160.8075	160.8075	160.8075	160.8075	160.8075	160.8075	160.8075	160.8075 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	60.7305	53.9403	43.8672	33.2103	24.8251	20.9584	22.6463	29.4365	39.5096	50.1665	58.5517	62.4184 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	368.3136	372.1356	362.5044	342.0008	316.1186	291.7931	275.5421	271.7202	281.3513	301.8550	327.7371	352.0627 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.7609	53.7609	53.7609	53.7609	53.7609	53.7609	53.7609	53.7609	53.7609	53.7609	53.7609	53.7609 (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)	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050 (71)
Water heating gains (Table 5)	76.2756	74.0102	69.3054	62.9045	58.7478	52.8979	47.9297	54.2997	56.5662	63.1905	70.6656	74.0196 (72)
Total internal gains	615.6832	610.4495	586.0404	548.4790	510.0550	476.0128	456.4815	465.8197	487.7905	525.5753	567.3178	598.8641 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W						
East	3.5460	25.1733	0.5000	0.7200	0.7700	22.2697 (76)						
West	7.7170	25.1733	0.5000	0.7200	0.7700	48.4645 (80)						
Solar gains	70.7342	117.7069	196.7212	288.2213	332.3757	375.4147	345.5394	309.6231	240.7960	152.4839	87.9085	57.1762 (83)
Total gains	686.4174	728.1563	782.7616	836.7003	842.4307	851.4275	802.0209	775.4428	728.5865	678.0592	655.2262	656.0403 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	0.8953	0.8798	0.8414	0.7719	0.6676	0.5081	0.3819	0.3822	0.5902	0.7679	0.8607	0.9008 (86)
MIT	18.5672	18.7548	19.2140	19.8116	20.3700	20.7665	20.9137	20.9165	20.6614	20.0600	19.2749	18.5706 (87)
Th 2	19.9846	19.9918	19.9942	20.0008	20.0008	20.0030	20.0030	20.0051	20.0051	19.9987	19.9987	19.9964 (88)
util rest of house	0.8835	0.8663	0.8228	0.7433	0.6205	0.4330	0.2804	0.2774	0.5188	0.7310	0.8422	0.8895 (89)
MIT 2	16.7946	17.0633	17.7156	18.5545	19.3115	19.8032	19.9550	19.9602	19.6930	18.9115	17.8140	16.8045 (90)
Living area fraction	17.0767	17.3326	17.9541	18.7546	19.4800	19.9565	20.1076	20.1125	19.8472	19.0943	18.0465	17.0857 (92)
Temperature adjustment	16.9267	17.1826	17.8041	18.6046	19.3300	19.8065	19.9576	19.9625	19.6972	18.9443	17.8965	16.9357 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	572.2982	593.6814	603.0990	581.3168	492.0628	354.8870	220.9073	211.3952	359.7125	463.1676	517.7116	551.6355 (95)
Ext temp.	5.7000	6.1000	7.7000	10.1000	13.1000	15.9000	17.7000	17.8000	15.5000	12.3000	8.8000	5.8000 (96)
Heat loss rate W	1185.6879	1161.1187	1055.8868	882.1696	646.2228	404.2581	233.6193	223.2581	433.3303	690.8759	945.8527	1160.7492 (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	456.3619	381.3179	336.8742	216.6140	114.6950	0.0000	0.0000	0.0000	0.0000	169.4150	308.2616	453.1806 (98)
Space heating per m2												2436.7201 (98)
												(98) / (4) = 25.8401 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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													2692.5084 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	456.3619	381.3179	336.8742	216.6140	114.6950	0.0000	0.0000	0.0000	0.0000	169.4150	308.2616	453.1806	(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)	504.2673	421.3457	372.2366	239.3525	126.7349	0.0000	0.0000	0.0000	0.0000	187.1988	340.6206	500.7520	(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	115.8870	101.4547	106.2374	96.5437	94.9760	84.9575	82.8497	91.2165	91.1067	101.9051	106.5978	112.7900	(64)
Efficiency of water heater (217)m	89.8332	89.8082	89.7116	89.4887	89.0219	87.3000	87.3000	87.3000	87.3000	89.2710	89.6556	87.3000	(216)
Fuel for water heating, kWh/month	129.0025	112.9682	118.4210	107.8836	106.6884	97.3167	94.9023	104.4863	104.3605	114.1525	118.8971	125.5403	(219)
Water heating fuel used													1334.6193 (219)
Annual totals kWh/year													
Space heating fuel - main system													2692.5084 (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)													429.0080 (232)
Total delivered energy for all uses													4531.1358 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2692.5084	3.6300	97.7381 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1334.6193	3.6300	48.4467 (247)
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)
Energy for lighting	429.0080	19.4400	83.3992 (250)
Additional standing charges			95.0000 (251)
Total energy cost			339.1639 (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	2692.5084	0.2160	581.5818 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1334.6193	0.2160	288.2778 (264)
Space and water heating			869.8596 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	429.0080	0.5190	222.6552 (268)
Total kg/year			1131.4398 (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	2692.5084	1.2200	3284.8603 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1334.6193	1.2200	1628.2356 (264)
Space and water heating			4913.0959 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	429.0080	3.0700	1317.0546 (268)
Primary energy kWh/year			6460.4005 (272)
Primary energy kWh/m2/year			68.5090 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 85
 Current environmental impact rating: B 88

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	SAP increase too small
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Recommended
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 9.6	-£ 378	-1010 kg (89.3%)

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.8	-£ 17	-134 kg (11.9%)
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Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
Solar photovoltaic panels	£378	10.71 kg/m ²	A 95	A 97
Total Savings	£378	10.71 kg/m²		
Potential energy efficiency rating:			A 95	
Potential environmental impact rating:				A 97

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

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

	Current	Potential	Saving
Electricity	£98	£98	£0
Mains gas	£241	£241	£0
Space heating	£207	£207	£0
Water heating	£48	£48	£0
Lighting	£83	£83	£0
Generated (PV)	-£0	-£378	£378
Total cost of fuels	£339	-£39	£378
Total cost of uses	£338	-£40	£378
Delivered energy	48 kWh/m ²	27 kWh/m ²	21 kWh/m ²
Carbon dioxide emissions	1.1 tonnes	0.1 tonnes	1.0 tonnes
CO2 emissions per m ²	12 kg/m ²	1 kg/m ²	11 kg/m ²
Primary energy	69 kWh/m ²	5 kWh/m ²	63 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	47.1500 (1b)	2.3700 (2b)	111.7455 (1b) - (3b)
First floor	47.1500 (1c)	2.6200 (2c)	123.5330 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.3000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 235.2785 (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) =	0.1275 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3775 (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) =	0.3492 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4452	0.4365	0.4278	0.3841	0.3754	0.3317	0.3317	0.3230	0.3492	0.3754	0.3928	0.4103 (22b)
	0.5991	0.5953	0.5915	0.5738	0.5705	0.5550	0.5550	0.5522	0.5610	0.5705	0.5772	0.5842 (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			2.0900	1.2000	2.5080		(26)
Windows (Uw = 1.40)			11.2600	1.3258	14.9413		(27)
Flr - Ground			47.1480	0.1917	9.0370	75.6000	3564.3888 (28a)
Wl - Brick (Timber Frame)	97.1030	13.3520	83.7510	0.2500	20.9378	7.4000	619.7574 (29a)
RF - Ins Joist	47.1480		47.1480	0.0800	3.7718	7.4000	348.8952 (30)
Total net area of external elements Aum(A, m2)			191.4070				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	51.1959	(33)
Party Wall			46.2040	0.0000	0.0000	7.4000	341.9096 (32)
Stud			76.8070			7.4000	568.3715 (32c)
Internal Floor			47.1480			7.4000	348.8952 (32d)
Internal Ceiling			47.1480			7.4000	348.8952 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 6141.1129 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K = 65.1231 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) = 8.4925 (36)
 Total fabric heat loss (33) + (36) = 59.6884 (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	46.5162	46.2174	45.9245	44.5488	44.2914	43.0931	43.0931	42.8712	43.5547	44.2914	44.8121	45.3565 (38)
Average = Sum(39)m / 12 =	106.2046	105.9058	105.6129	104.2372	103.9798	102.7816	102.7816	102.5597	103.2431	103.9798	104.5005	105.0449 (39)
												104.2359 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1262	1.1231	1.1200	1.1054	1.1026	1.0899	1.0899	1.0876	1.0948	1.1026	1.1082	1.1139 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy = 2.6801 (42)
 Average daily hot water use (litres/day) = 97.8530 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	107.6383	103.7242	99.8100	95.8959	91.9818	88.0677	88.0677	91.9818	95.8959	99.8100	103.7242	107.6383 (44)
Energy content (annual)	159.6245	139.6086	144.0635	125.5981	120.5144	103.9947	96.3664	110.5819	111.9025	130.4116	142.3545	154.5878 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1539.6084 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Water storage loss:	23.9437	20.9413	21.6095	18.8397	18.0772	15.5992	14.4550	16.5873	16.7854	19.5617	21.3532	23.1882 (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	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	174.3202	152.8685	158.7118	139.7177	135.0638	118.0278	110.8379	125.1039	125.9828	145.0190	156.5399	169.2684 (62)
WWHRS	-58.4332	-51.4138	-52.4744	-43.1740	-40.0878	-33.0703	-27.9882	-33.8874	-34.8761	-43.1140	-49.9420	-56.4784 eq. (G10)
Total of WWHRS savings	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-524.9396
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	115.8870	101.4547	106.2374	96.5437	94.9760	84.9575	82.8497	91.2165	91.1067	101.9051	106.5978	112.7900 (64)
Heat gains from water heating, kWh/month	56.7491	49.7348	51.5632	45.2913	43.7084	38.0865	35.6597	40.3990	40.7277	47.0137	50.8792	55.0706 (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	160.8075	160.8075	160.8075	160.8075	160.8075	160.8075	160.8075	160.8075	160.8075	160.8075	160.8075	160.8075 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	60.7305	53.9403	43.8672	33.2103	24.8251	20.9584	22.6463	29.4365	39.5096	50.1665	58.5517	62.4184 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	368.3136	372.1356	362.5044	342.0008	316.1186	291.7931	275.5421	271.7202	281.3513	301.8550	327.7371	352.0627 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.7609	53.7609	53.7609	53.7609	53.7609	53.7609	53.7609	53.7609	53.7609	53.7609	53.7609	53.7609 (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)	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050 (71)
Water heating gains (Table 5)	76.2756	74.0102	69.3054	62.9045	58.7478	52.8979	47.9297	54.2997	56.5662	63.1905	70.6656	74.0196 (72)
Total internal gains	615.6832	610.4495	586.0404	548.4790	510.0550	476.0128	456.4815	465.8197	487.7905	525.5753	567.3178	598.8641 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W					
East	3.5460	19.6403	0.5000	0.7200	0.7700	17.3749 (76)						
West	7.7170	19.6403	0.5000	0.7200	0.7700	37.8122 (80)						
Solar gains	55.1870	107.9576	177.7907	259.2972	317.7784	325.3028	309.7015	266.0290	206.7780	128.1007	68.8118	45.3831 (83)
Total gains	670.8703	718.4070	763.8311	807.7762	827.8334	801.3156	766.1830	731.8488	694.5685	653.6761	636.1295	644.2472 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	16.0621	16.1074	16.1520	16.3652	16.4057	16.5970	16.5970	16.6329	16.5228	16.4057	16.3240	16.2394
tau	2.0708	2.0738	2.0768	2.0910	2.0937	2.1065	2.1065	2.1089	2.1015	2.0937	2.0883	2.0826
util living area	0.9125	0.8964	0.8660	0.8106	0.7276	0.6092	0.4914	0.5228	0.6861	0.8253	0.8913	0.9185 (86)
MIT	18.1861	18.4254	18.8866	19.5169	20.1072	20.5823	20.8134	20.7801	20.4206	19.6732	18.8371	18.1424 (87)
Th 2	19.9795	19.9820	19.9846	19.9964	19.9987	20.0091	20.0091	20.0110	20.0051	19.9987	19.9942	19.9895 (88)
util rest of house	0.9032	0.8852	0.8509	0.7876	0.6907	0.5489	0.4050	0.4385	0.6325	0.7996	0.8779	0.9098 (89)
MIT 2	16.2456	16.5882	17.2473	18.1429	18.9605	19.5924	19.8651	19.8333	19.3952	18.3775	17.1881	16.1862 (90)
Living area fraction	16.5545	16.8807	17.5082	18.3616	19.1430	19.7500	20.0160	19.9840	19.5584	18.5838	17.4506	16.4976 (92)
Temperature adjustment	16.4045	16.7307	17.3582	18.2116	18.9930	19.6000	19.8660	19.8340	19.4084	18.4338	17.3006	16.3476 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	574.3438	600.3375	610.1219	594.6695	535.3236	417.2848	299.7601	308.6365	413.0276	488.7187	526.6098	556.7612 (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	1285.5487	1252.9366	1146.7660	970.6194	758.3291	513.9030	335.6882	352.1939	548.0568	814.5517	1065.9681	1276.0379 (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	529.1364	438.5466	399.2632	270.6839	165.9161	0.0000	0.0000	0.0000	0.0000	242.4198	388.3380	535.1419 (98)
Space heating												2969.4459 (98)
Space heating per m2												(98) / (4) = 31.4894 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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													3281.1557 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	529.1364	438.5466	399.2632	270.6839	165.9161	0.0000	0.0000	0.0000	0.0000	242.4198	388.3380	535.1419	(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)	584.6812	484.5819	441.1748	299.0983	183.3327	0.0000	0.0000	0.0000	0.0000	267.8672	429.1027	591.3170	(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	115.8870	101.4547	106.2374	96.5437	94.9760	84.9575	82.8497	91.2165	91.1067	101.9051	106.5978	112.7900	(64)
Efficiency of water heater (217)m	89.9079	89.8810	89.8082	89.6362	89.3083	87.3000	87.3000	87.3000	87.3000	89.5288	89.7911	87.3000	(216)
Fuel for water heating, kWh/month	128.8953	112.8767	118.2937	107.7061	106.3463	97.3167	94.9023	104.4863	104.3605	113.8239	118.7176	125.4251	(219)
Water heating fuel used													1333.1503 (219)
Annual totals kWh/year													
Space heating fuel - main system													3281.1557 (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)													429.0080 (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													3391.0746 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3281.1557	3.4800	114.1842 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1333.1503	3.4800	46.3936 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	429.0080	13.1900	56.5862 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			119.2336 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.3595 (257)
SAP value		94.9850
SAP rating (Section 12)		95 (258)
SAP band		A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3281.1557	0.2160	708.7296 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1333.1503	0.2160	287.9605 (264)
Space and water heating			996.6901 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	429.0080	0.5190	222.6552 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			361.8330 (272)
CO2 emissions per m2			3.8400 (273)
EI value			96.5193
EI rating			97 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	47.1500 (1b)	2.3700 (2b)	111.7455 (1b) - (3b)
First floor	47.1500 (1c)	2.6200 (2c)	123.5330 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.3000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 235.2785 (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) =	0.1275 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3775 (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) =	0.3492 (21)							
Wind speed	Jan 4.9000	Feb 4.6000	Mar 4.5000	Apr 4.2000	May 4.2000	Jun 4.1000	Jul 4.1000	Aug 4.0000	Sep 4.0000	Oct 4.3000	Nov 4.3000	Dec 4.4000 (22)
Wind factor	1.2250	1.1500	1.1250	1.0500	1.0500	1.0250	1.0250	1.0000	1.0000	1.0750	1.0750	1.1000 (22a)
Adj infilt rate	0.4278	0.4016	0.3928	0.3667	0.3667	0.3579	0.3579	0.3492	0.3492	0.3754	0.3754	0.3841 (22b)
Effective ac	0.5915	0.5806	0.5772	0.5672	0.5672	0.5641	0.5641	0.5610	0.5610	0.5705	0.5705	0.5738 (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			2.0900	1.2000	2.5080		(26)					
Windows (Uw = 1.40)			11.2600	1.3258	14.9413		(27)					
Flr - Ground			47.1480	0.1917	9.0370	75.6000	3564.3888 (28a)					
Wl - Brick (Timber Frame)	97.1030	13.3520	83.7510	0.2500	20.9378	7.4000	619.7574 (29a)					
RF - Ins Joist	47.1480		47.1480	0.0800	3.7718	7.4000	348.8952 (30)					
Total net area of external elements Aum(A, m2)			191.4070				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	51.1959	(33)					
Party Wall			46.2040	0.0000	0.0000	7.4000	341.9096 (32)					
Stud			76.8070			7.4000	568.3715 (32c)					
Internal Floor			47.1480			7.4000	348.8952 (32d)					
Internal Ceiling			47.1480			7.4000	348.8952 (32e)					
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 6141.1129 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							65.1231 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.4925 (36)					
Total fabric heat loss							(33) + (36) = 59.6884 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 45.9245	Feb 45.0813	Mar 44.8121	Apr 44.0399	May 44.0399	Jun 43.7943	Jul 43.7943	Aug 43.5547	Sep 43.5547	Oct 44.2914	Nov 44.2914	Dec 44.5488 (38)
Heat transfer coeff	105.6129	104.7697	104.5005	103.7283	103.7283	103.4827	103.4827	103.2431	103.2431	103.9798	103.9798	104.2372 (39)
Average = Sum(39)m / 12 =												103.9990 (39)
HLP	Jan 1.1200	Feb 1.1110	Mar 1.1082	Apr 1.1000	May 1.1000	Jun 1.0974	Jul 1.0974	Aug 1.0948	Sep 1.0948	Oct 1.1026	Nov 1.1026	Dec 1.1054 (40)
HLP (average)												1.1029 (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												2.6801 (42)
Average daily hot water use (litres/day)												97.8530 (43)
Daily hot water use	107.6383	103.7242	99.8100	95.8959	91.9818	88.0677	88.0677	91.9818	95.8959	99.8100	103.7242	107.6383 (44)
Energy conte	159.6245	139.6086	144.0635	125.5981	120.5144	103.9947	96.3664	110.5819	111.9025	130.4116	142.3545	154.5878 (45)
Energy content (annual)												Total = Sum(45)m = 1539.6084 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Water storage loss:	23.9437	20.9413	21.6095	18.8397	18.0772	15.5992	14.4550	16.5873	16.7854	19.5617	21.3532	23.1882 (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	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	174.3202	152.8685	158.7118	139.7177	135.0638	118.0278	110.8379	125.1039	125.9828	145.0190	156.5399	169.2684 (62)
WWHRS	-58.4332	-51.4138	-52.4744	-43.1740	-40.0878	-33.0703	-27.9882	-33.8874	-34.8761	-43.1140	-49.9420	-56.4784 eq. (G10)
Total of WWHRS savings	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-524.9396
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	115.8870	101.4547	106.2374	96.5437	94.9760	84.9575	82.8497	91.2165	91.1067	101.9051	106.5978	112.7900 (64)
Heat gains from water heating, kWh/month	56.7491	49.7348	51.5632	45.2913	43.7084	38.0865	35.6597	40.3990	40.7277	47.0137	50.8792	55.0706 (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	160.8075	160.8075	160.8075	160.8075	160.8075	160.8075	160.8075	160.8075	160.8075	160.8075	160.8075	160.8075 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	60.7305	53.9403	43.8672	33.2103	24.8251	20.9584	22.6463	29.4365	39.5096	50.1665	58.5517	62.4184 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	368.3136	372.1356	362.5044	342.0008	316.1186	291.7931	275.5421	271.7202	281.3513	301.8550	327.7371	352.0627 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.7609	53.7609	53.7609	53.7609	53.7609	53.7609	53.7609	53.7609	53.7609	53.7609	53.7609	53.7609 (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)	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050	-107.2050 (71)
Water heating gains (Table 5)	76.2756	74.0102	69.3054	62.9045	58.7478	52.8979	47.9297	54.2997	56.5662	63.1905	70.6656	74.0196 (72)
Total internal gains	615.6832	610.4495	586.0404	548.4790	510.0550	476.0128	456.4815	465.8197	487.7905	525.5753	567.3178	598.8641 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W						
East	3.5460	25.1733	0.5000	0.7200	0.7700	22.2697 (76)						
West	7.7170	25.1733	0.5000	0.7200	0.7700	48.4645 (80)						
Solar gains	70.7342	117.7069	196.7212	288.2213	332.3757	375.4147	345.5394	309.6231	240.7960	152.4839	87.9085	57.1762 (83)
Total gains	686.4174	728.1563	782.7616	836.7003	842.4307	851.4275	802.0209	775.4428	728.5865	678.0592	655.2262	656.0403 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	0.8953	0.8798	0.8414	0.7719	0.6676	0.5081	0.3819	0.3822	0.5902	0.7679	0.8607	0.9008 (86)
MIT	18.5672	18.7548	19.2140	19.8116	20.3700	20.7665	20.9137	20.9165	20.6614	20.0600	19.2749	18.5706 (87)
Th 2	19.9846	19.9918	19.9942	20.0008	20.0008	20.0030	20.0030	20.0051	20.0051	19.9987	19.9987	19.9964 (88)
util rest of house	0.8835	0.8663	0.8228	0.7433	0.6205	0.4330	0.2804	0.2774	0.5188	0.7310	0.8422	0.8895 (89)
MIT 2	16.7946	17.0633	17.7156	18.5545	19.3115	19.8032	19.9550	19.9602	19.6930	18.9115	17.8140	16.8045 (90)
Living area fraction	17.0767	17.3326	17.9541	18.7546	19.4800	19.9565	20.1076	20.1125	19.8472	19.0943	18.0465	17.0857 (92)
Temperature adjustment	16.9267	17.1826	17.8041	18.6046	19.3300	19.8065	19.9576	19.9625	19.6972	18.9443	17.8965	16.9357 (93)
adjusted MIT												

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	572.2982	593.6814	603.0990	581.3168	492.0628	354.8870	220.9073	211.3952	359.7125	463.1676	517.7116	551.6355 (95)
Ext temp.	5.7000	6.1000	7.7000	10.1000	13.1000	15.9000	17.7000	17.8000	15.5000	12.3000	8.8000	5.8000 (96)
Heat loss rate W	1185.6879	1161.1187	1055.8868	882.1696	646.2228	404.2581	233.6193	223.2581	433.3303	690.8759	945.8527	1160.7492 (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	456.3619	381.3179	336.8742	216.6140	114.6950	0.0000	0.0000	0.0000	0.0000	169.4150	308.2616	453.1806 (98)
Space heating												2436.7201 (98)
Space heating per m2												(98) / (4) = 25.8401 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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													2692.5084 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	456.3619	381.3179	336.8742	216.6140	114.6950	0.0000	0.0000	0.0000	0.0000	169.4150	308.2616	453.1806	(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)	504.2673	421.3457	372.2366	239.3525	126.7349	0.0000	0.0000	0.0000	0.0000	187.1988	340.6206	500.7520	(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	115.8870	101.4547	106.2374	96.5437	94.9760	84.9575	82.8497	91.2165	91.1067	101.9051	106.5978	112.7900	(64)
Efficiency of water heater (217)m	89.8332	89.8082	89.7116	89.4887	89.0219	87.3000	87.3000	87.3000	87.3000	89.2710	89.6556	87.3000	(216)
Fuel for water heating, kWh/month	129.0025	112.9682	118.4210	107.8836	106.6884	97.3167	94.9023	104.4863	104.3605	114.1525	118.8971	125.5403	(219)
Water heating fuel used													1334.6193 (219)
Annual totals kWh/year													
Space heating fuel - main system													2692.5084 (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)													429.0080 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1217 * 0.80) =													-1946.4459 (233)
Total delivered energy for all uses													2584.6899 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2692.5084	3.6300	97.7381 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1334.6193	3.6300	48.4467 (247)
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)
Energy for lighting	429.0080	19.4400	83.3992 (250)
Additional standing charges			95.0000 (251)
Energy saving/generation technologies			
PV Unit	-1946.4459	19.4400	-378.3891 (252)
Total energy cost			-39.2252 (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	2692.5084	0.2160	581.5818 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1334.6193	0.2160	288.2778 (264)
Space and water heating			869.8596 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	429.0080	0.5190	222.6552 (268)
Energy saving/generation technologies			
PV Unit	-1946.4459	0.5190	-1010.2054 (269)
Total kg/year			121.2343 (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	2692.5084	1.2200	3284.8603 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1334.6193	1.2200	1628.2356 (264)
Space and water heating			4913.0959 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	429.0080	3.0700	1317.0546 (268)
Energy saving/generation technologies			
PV Unit	-1946.4459	3.0700	-5975.5890 (269)
Primary energy kWh/year			484.8115 (272)
Primary energy kWh/m2/year			5.1412 (273)

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 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	Southern England
Front of dwelling faces	East
Overshading	Average or unknown
Thermal mass parameter	65.1 (calculated from construction elements)
Night ventilation	Yes
Ventilation rate during hot weather (ach)	4.65 (Calculated rate)

Overheating Calculation

Summer ventilation heat loss coefficient	361.03 (P1)
Transmission heat loss coefficient	59.69 (37)
Summer heat loss coefficient	420.72 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
East	0.850	0.90	1.000	0.765 (P8)
West	0.850	0.90	1.000	0.765 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	3.5460	125.2818	0.5000	0.7200	0.7650	110.1116
West	7.7170	125.2818	0.5000	0.7200	0.7650	239.6309
total:						349.7425

	Jun	Jul	Aug	
Solar gains	376	350	308	(P3)
Internal gains	473	453	463	
Total summer gains	849	803	770	(P5)
Summer gain/loss ratio	2.02	1.91	1.83	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 65.1)	1.54	1.54	1.54	
Threshold temperature	18.96	20.75	20.68	(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	052 - PRJ013014		Issued on Date	27/01/2023	
Assessment Reference	052	Prop Type Ref	3B		
Property	Land North of Grange Road, SO31				
SAP Rating	85 B	DER	14.38	TER	17.42
Environmental	88 B	% DER<TER	17.47		
CO₂ Emissions (t/year)	1.13	DFEE	43.90	TFEE	49.99
General Requirements Compliance	Pass	% DFEE<TFEE	12.18		
Assessor Details	Chris Nicholls, , Tel: ,			Assessor ID	U903-0001
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)	17.42	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.38	kgCO ₂ /m ²	Pass
	-3.04 (-17.5%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.99	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	43.90	kWh/m ² /yr	
	-6.1 (-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	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.08 (max. 0.20)	0.08 (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

Time and temperature zone control

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Slight

Pass

Based on:

Overshading

Average

Windows facing East

3.55 m², No overhang

Windows facing West

7.72 m², No overhang

Air change rate

4.65 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

0.08

W/m²K